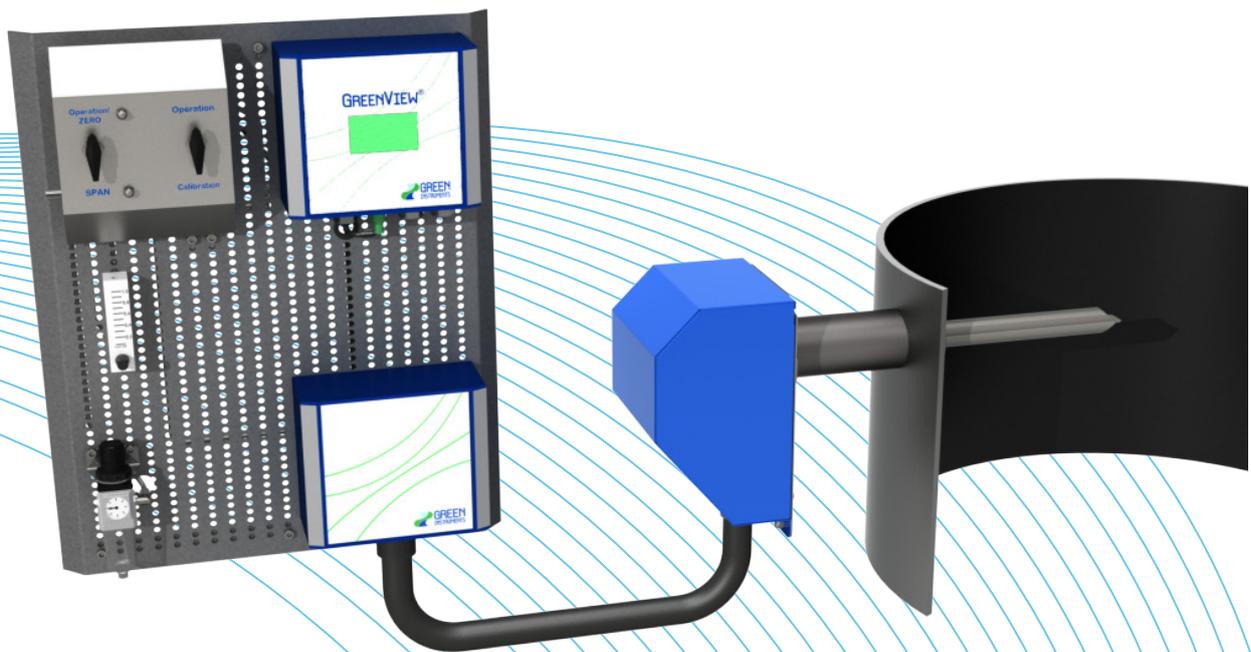


G4130 NOX/O₂ ANALYZING SYSTEM WITH DIFFUSION PROBE MANUAL

PART NUMBER: 02156





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1 Introduction

1.1 About this Manual

This manual contains data and instructions for the installation, operation, and maintenance of the gas sampling board with the sampling probe of the G4130 NO_x/O₂ Analyzing System.

The G4100 NO_x/O₂ Analyzing System consists of two parts:

 G41 NO_x/O₂ Analyzer

 G4130 NO_x/O₂ gas analyzing board with the diffusion probe

The instructions for installation, operation, and maintenance of the analyzer are provided in a separate manual – the G41 NO_x/O₂ Analyzer manual.

For the installation, operation, and maintenance of the G4130 NO_x/O₂ Analyzing System, both manuals must be read carefully in their entirety.

The manual has been made in general terms and do not take into consideration a specific installation. As such, the instruction manual is designed for the standard sampling system fitted with the G41 NO_x/O₂ Analyzer.

The manual does not describe all possible situations but only the most common and known situations, and cannot replace the necessary instruction and education 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 A/S for instructions.

This manual does not claim to cover all details or variations in equipment or to provide for every possible contingency that may arise during installation, operation, or maintenance.

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.

Green Instruments A/S reserves the copyright of the manual. Without prior written permission of Green Instruments A/S, the manual may not be copied and given to unauthorized people.

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 right side of the blue analyzer box.

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:



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2 System Specifications

Gas Connection	
Span NO _x gas connection	For 6/4 mm tubing – max. 1 bar
Air supply filter regulator	1/8" BSP connection – max. 8 bar
Air supply quality	Instrument air quality according to ISO 8573-1, class 3
Analyzer	
See details in the G41 NO _x /O ₂ Analyzer manual	
Analyzing Board	
Analyzing board dimension	600 × 500 × 140 mm (H × W × D)
Weight	Approx. 10.0 kg without packaging
Approval & Certificate	Lloyd's Register Type Approval Certificate 
Diffusion Probe	
Sensor technology	Heated zirconia type sensor
Measurement range	NO _x : 0...1500 ppm O ₂ : 0.0...21 %
Sample temperature	0...500 °C
Probe insert length	Approx. 208...338 mm for duct diameters 235...2800 mm
Mounting type	Welding socket size OD: 70.0 mm L: 190 mm; or thread size: 1½" BSP
Connection for calibration gas and back-flushing	6/4 mm tubing
Calibration air flow	Approx. 0.5...1 l/m
Diffusion probe dimension – short	285 x 180 x 475 mm (H x W x D)
Diffusion probe dimension – long	285 x 180 x 600 mm (H x W x D)
Weight including house	Approx. 6.0 kg without packaging

Umbilical cord	
Cord length	3.0 m
Tubing	In 28 mm nylon conduit
Optional Equipment	
Remote display with alarm relays Recording and visualization Extension kit for umbilical cord	
Specifications are subject to changes without notice.	

3 System Installation

Read this chapter in its entirety before installing the system.

3.1 Control at Delivery

When you receive the G4130 NO_x/O₂ Analyzing System, please inspect and confirm that the received items are 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 G4130 NO_x/O₂ Analyzing System are achieved by paying attention to the following points:

-  Make sure to install the probe in a suitable location where it will extract the gas that is going to be tested.
-  The probe shall be fitted at least 10 pipe diameters after the outlet of the engine, the turbocharger, or the last after-treatment device – choose whichever is further downstream. However, the probe shall also be placed at least 0.5 m or 3 pipe diameters upstream from the exit of the exhaust gas system – choose what provides the greatest length. See Figure 3-1 and Figure 3-2 for the installation layout of the probe. If you find it difficult estimating where to install the probe, please contact Green Instruments A/S for more instructions.
-  As a standard scope of supply, the analyzing board can be installed up to 3 m from the probe. If necessary, the umbilical cord can be extended.

-  The analyzing board shall be placed and installed where the ambient temperature is below 55 °C at any time.
-  The system shall be installed in a clean place away from dust, oil mist, and moisture. The elements of the system shall be installed at viewing level so that it is easy accessible in connection with operation and service.

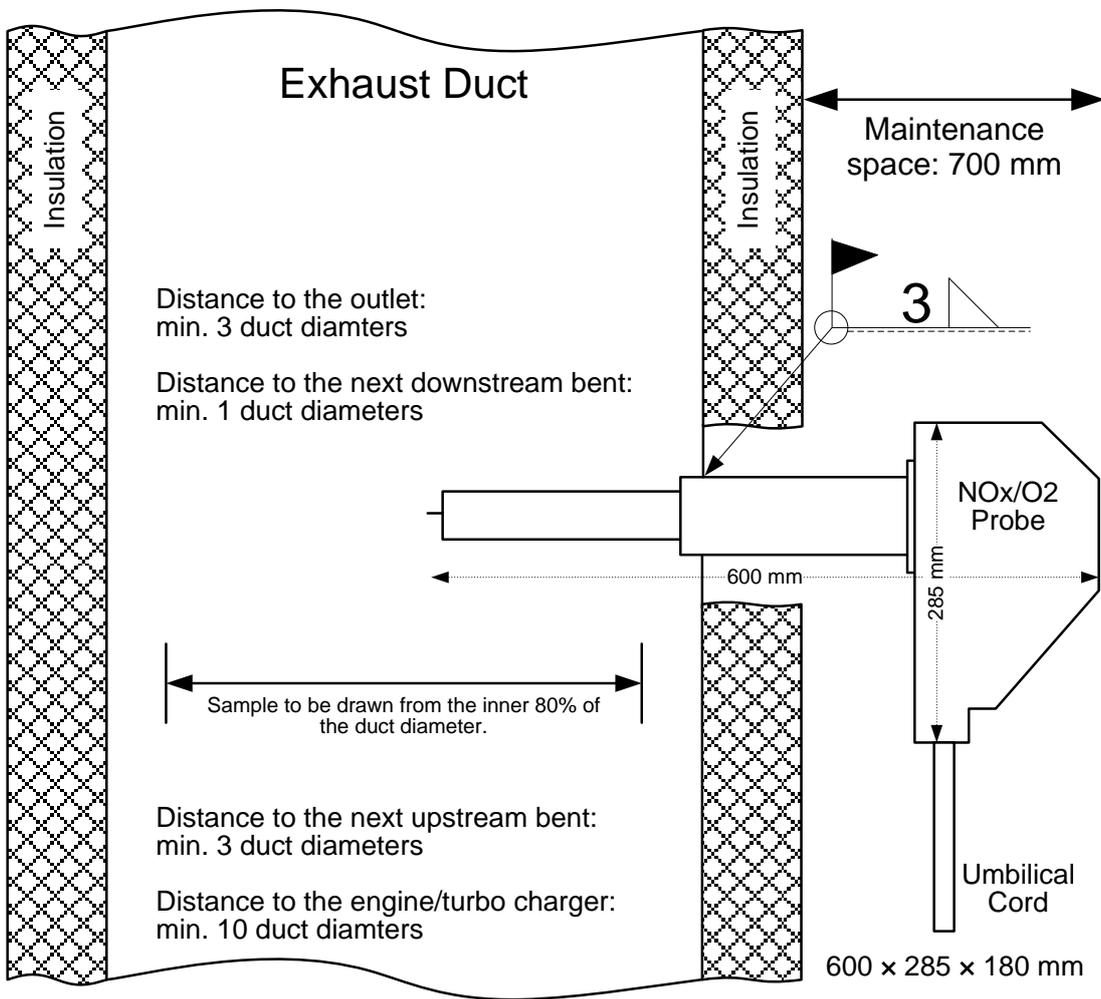


Figure 3-1: Installation layout of the diffusion probe – welding type

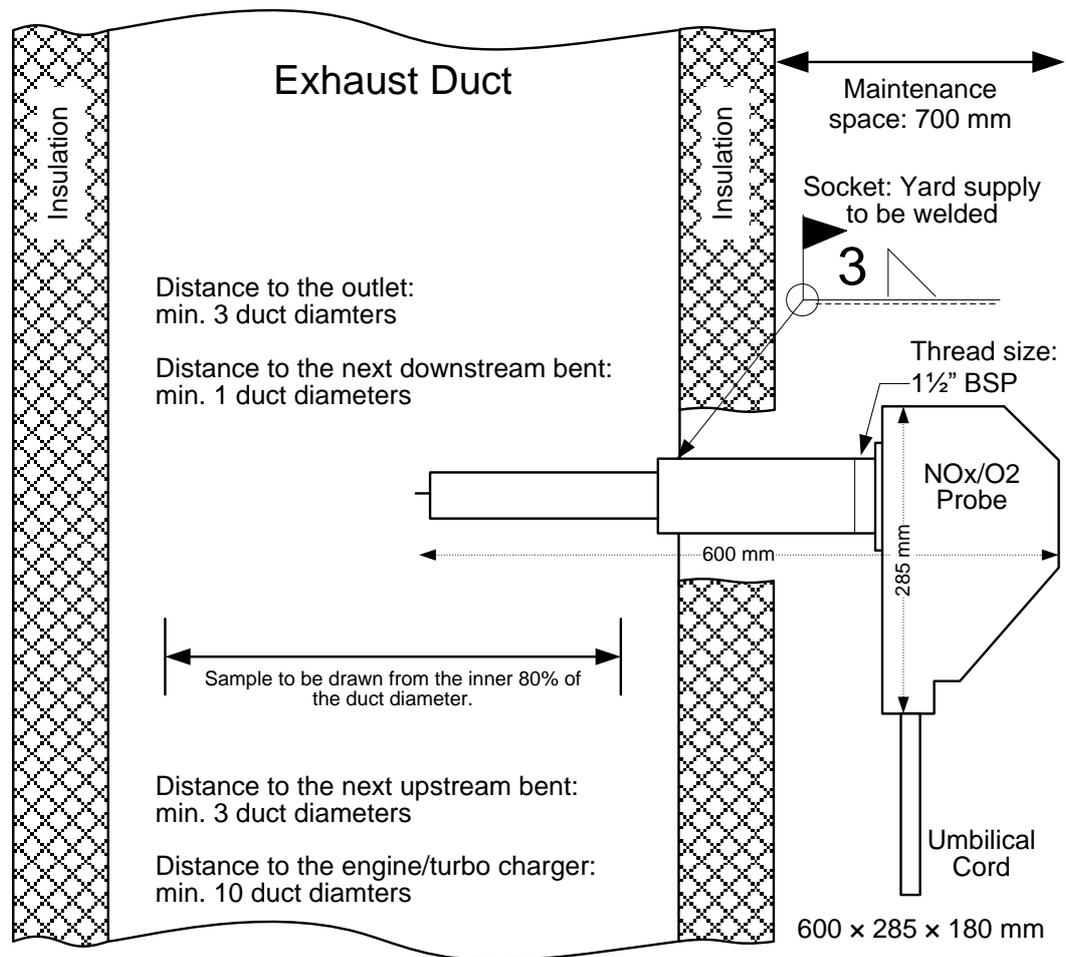


Figure 3-2: Installation layout of the diffusion probe – thread type

3.3 Safety Aspects



Warning

Make sure to follow the operating instructions!
Read the manual before operating and servicing the system.

Hot sensor/probe!

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

Installation and operation!

It should be pointed out that installation and operation of the G4130 NO_x/O₂ Analyzing System and associated equipment must be carried out by skilled, trained,

and certified personnel, and that Green Instruments A/S does not take any responsibility for 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!

Please do not dispose the G4130 NO_x/O₂ Analyzing System with regular refuse. Disposal should be in accordance with the requirements of the current statutory regulations.



3.4 Diffusion Probe

The sample gas flow is diffused through the sample filter element into the sensor area. The gas, which passes the probe, must represent the gas to be tested and extracted from a location with laminar flow. Holes and leaks in the gas ducting system before and after the probe may influence the accuracy of the measurement.

The probe shall be placed so that it is protected against mechanical damage. The flue gas temperature cannot exceed the given temperature limit of the diffusion probe.

For mounting of the diffusion probe, there are two mounting types:

 Probe with welding socket (see Figure 3-3 and Figure 3-4)

 Probe with thread (see Figure 3-5 and Figure 3-6)

When mounting the probe on the stack, make sure that the back plate of the probe is mounted with the sampling hose connection facing down and the probe protection house mounted in a vertical position of the stack. Please see Figure 3-1 and Figure 3-2 for the installation of the probes.

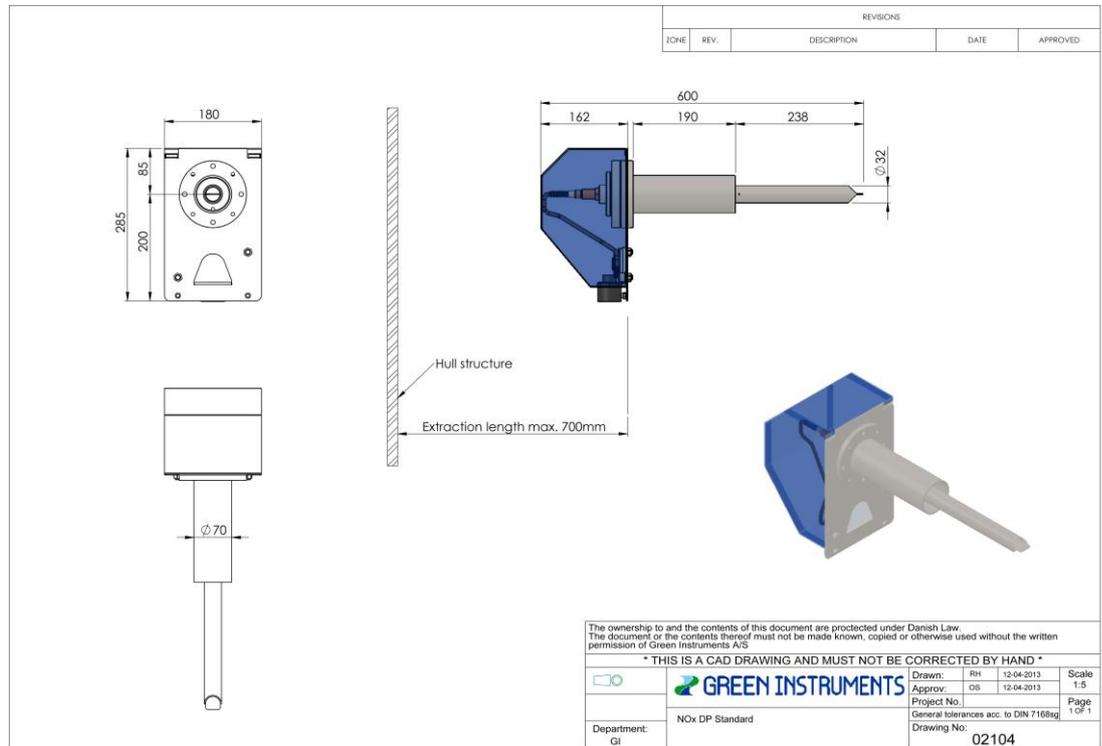


Figure 3-3: Diffusion probe standard – welding type

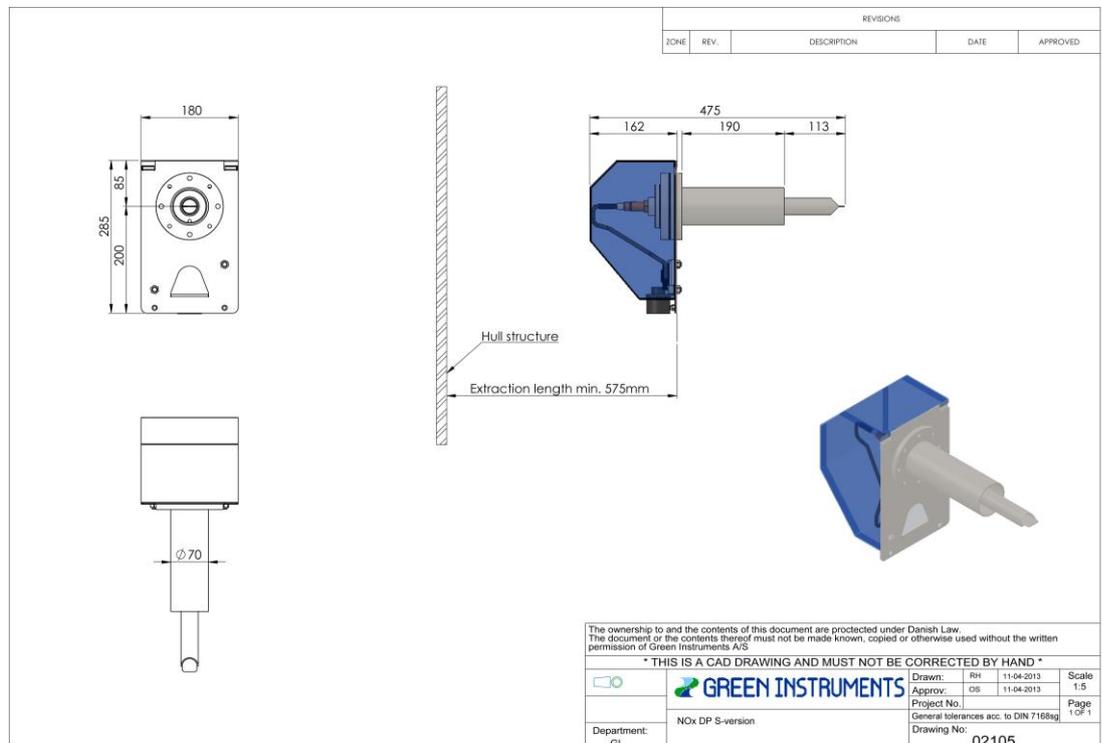


Figure 3-4: Diffusion probe short – welding type

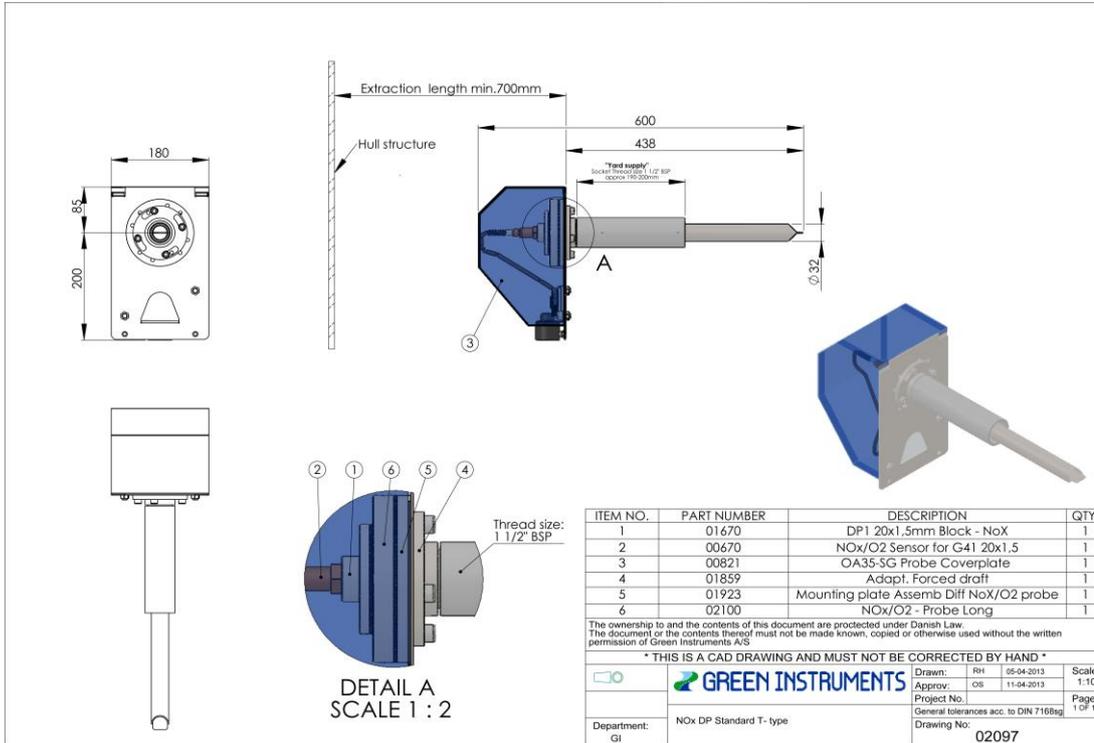


Figure 3-5: Diffusion probe standard – Thread type

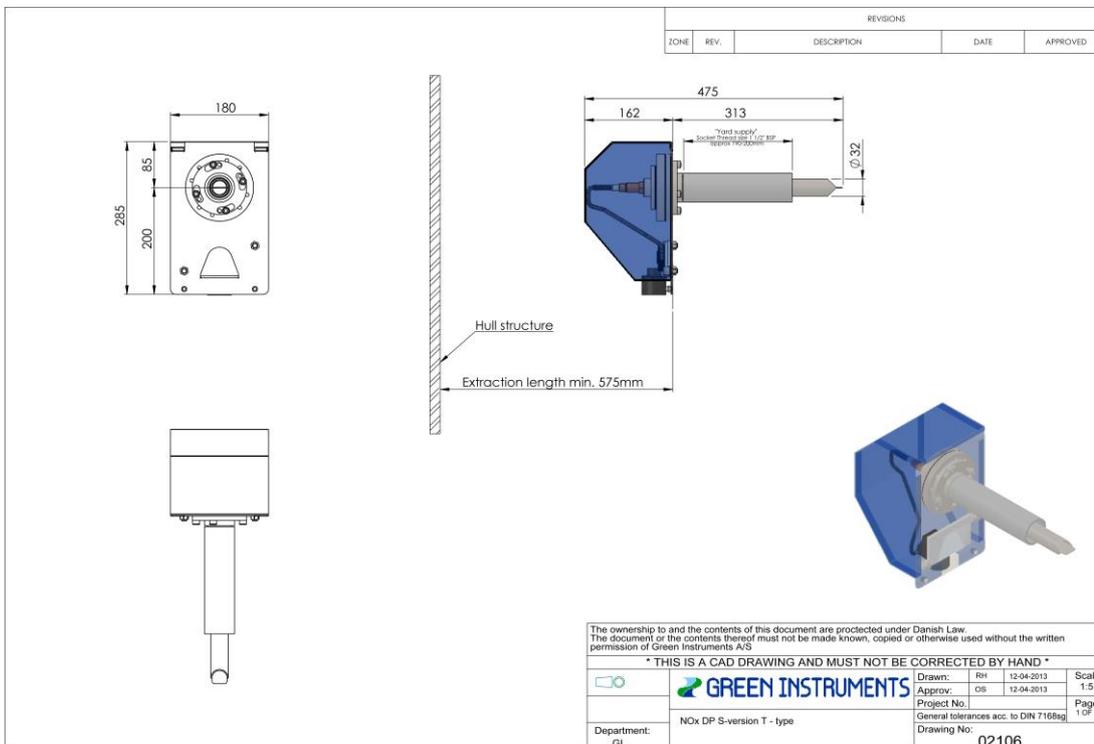


Figure 3-6: Diffusion probe short – Thread type

3.5 Analyzing Board

3.5.1 Mounting Panel

The analyzing board is designed for mounting with the G41 NO_x Analyzer (see Figure 3-7). The board has two angle iron mounting brackets. The brackets are made of ordinary mild steel and can be welded or bolted directly to a chosen location structure as required.

The two mounting brackets are mounted horizontal and parallel with a distance of 577 mm.

When the analyzing board and the probe are installed in appropriate locations, the instrument air and power can be connected as described below.

The figure below shows the piping and connection of the system.

3.5.2 Air Supply Connection

For back-flushing and zero calibration, the instrument air is connected directly to the air supply filter regulator. The filter regulator has a filter and a drain. The air supply connection to the filter regulator is a 1/8" BSP female connection. The maximum pressure for the air supply inlet is 8 bar (see Figure 3-8).

3.5.3 Span NO_x Gas Connection

For span calibration, span NO_x gas with a certain percent of NO_x and without the content of O₂ is connected to the span NO_x gas port. The connection is arranged on the left upper corner of the analyzing board. The connection is for 6/4 mm tubing. The pressure of the Span NO_x gas must not exceed 1 bar. The gas flow should be approximately 0.5...1 l/m. To see the layout of the analyzing board see Figure 3-8.

3.5.4 Analyzer and Electrical Connections

The G41 NO_x/O₂ Analyzer is mounted on the right upper corner of the analyzing board. For the layout of the analyzing board, see Figure 3-7.

The instructions for electrical connections are described in the G41 NO_x/O₂ Analyzer manual. Note that the analyzer includes two cable glands for 11-44 mm diameter cable.

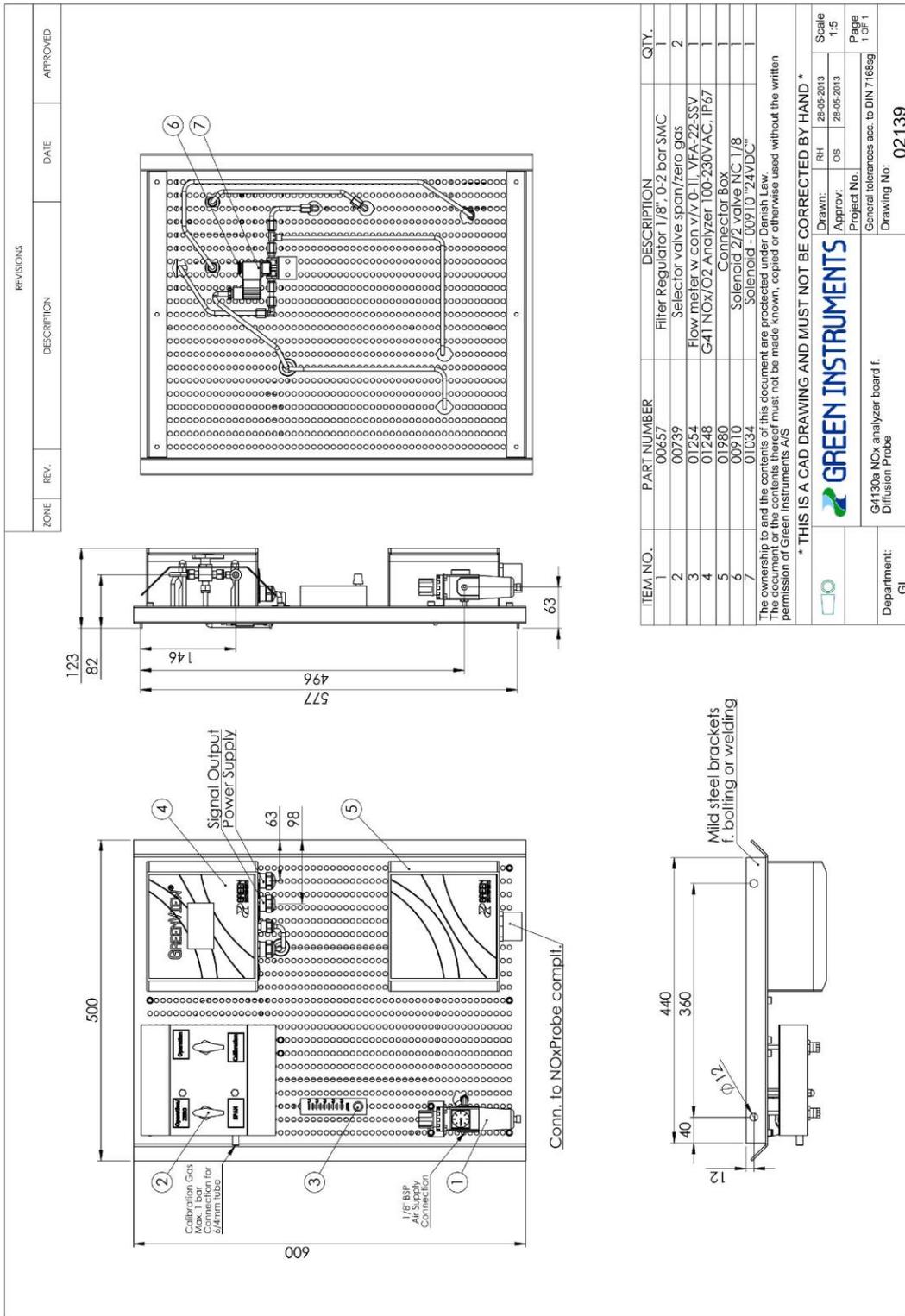


Figure 3-7: Analyzing board dimensions

4 Commissioning

4.1 Installation and Set-up Pre-checks

After completing the installation and before starting the system for the first time, please check the following:

-  Check and confirm that all electrical connections are carried out according to the manuals and the technical drawings.
-  Check that the air supply is connected to the air supply filter regulator without leaking and in accordance with good installation practice.
-  Check that the probe is installed in accordance with the instructions i.e. in a suitable location representing the gas to be tested, without leaking and in accordance with good installation practice.
-  Check the settings of the analyzer's input and output signal. Please see the analyzer manual for the settings.
-  Re-check all connections to make sure there is no air leaking. ***A leaking connection will result in loss of air and may result in poor calibration***

4.2 Start of Systems

Using the G41 NO_x/O₂ Analyzer manual, follow the instructions for commissioning of the analyzer and start the system. For calibration, follow the instructions in the section 5.1 of this manual and section 6 of the analyzer manual.

5 System Operation

5.1 Calibration Mode

In the calibration mode (both Zero and Span), the selector valve must stay at the Calibration position.

For zero calibration

-  Turn the selector valve to Zero position.
-  Check that the instrument air (zero NO_x gas) is connected to the air supply filter regulator.
-  The pressure of the zero NO_x gas must not exceed 8 bar and should be reduced to 0.3...1 bar at the air supply filter regulator station. The flow of zero NO_x gas should be approximately 0.5...1 l/min, which can be adjusted at the calibration flow meter.

For span calibration

-  Turn the selector valve to Span position.
-  Check that the span NO_x gas is connected to the span NO_x gas connection.
-  The pressure of the span NO_x gas should be approximately 1 bar. The flow of the calibration gases should be approximately 0.5...1 l/min, which can be adjusted at the calibration flow meter, or at the fixed flow valve of the test gas bottle.

After calibration, remember to turn both selector valves back to the Operation position.

5.2 Measurement Mode

In the measurement mode, both selector valves must point to the **Operation** position.

The instrument air for back-flushing is regulated by the solenoid valve which is controlled by the analyzer. For back-flushing, the solenoid valve will be opened automatically to allow the probe back-flushing with high air flow. To set the back-flushing interval, see the instruction in the analyzer manual.

6 Routine Maintenance

6.1 Calibration

The system must be calibrated regularly and always after each start-up of the analyzer. The frequency of calibration depends on each specific application, but we recommend the calibration before making any measuring report or at least once a month.

6.2 Air Flow System

Routine inspection and maintenance of the air flow system and connections is required to make sure no gas is leaking from the system. It is important that air flow and pressure are stable. Failure to periodically inspect and maintain the air flow system and connections may lead to imprecise analyzer readings and thus a malfunction of the system.

Make sure that the instrument air that is supplied at the air supply filter regulator is maximum 8 bar and has a temperature of maximum 60 °C. Always prevent ultraviolet rays from reaching the air supply filter regulator.

Before cleaning and servicing the air flow system, depressurize the air supply filter regulator. When cleaning do not use an adhesion of organic solvents to the air supply filter regulator.

The flow meter and the control valve do not require any special maintenance. Dirt and oil on the surface of the flow meters are to be removed carefully using neutral detergent and a clean dry rag.

6.3 Sensor

Warning

The analyzer must be turned off and the air supply must be disconnected before you start changing the sensor.

If you remove the sensor while there is exhaust gas in the stack, there is a risk that hot exhaust gas will come out of the sensor house.

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



To change the sensor, please go through the following steps:

- Turn off the analyzer and disconnect the air supply.
- Unscrew the nuts and remove the blue cover plate of the probe.
- To disconnect the sensor electronic control unit (ECU) press the small button on the plug at the end of the cable to the ECU and pull out the plug.
- To dismount the ECU, loosen the two nuts on the back of the mounting plate.
- Use a spanner to loosen the sensor. Then insert a new sensor into the sensor house.
- Mount the ECU back on the mounting plate and reconnect the cable to the ECU.
- Close the blue cover plate of the probe

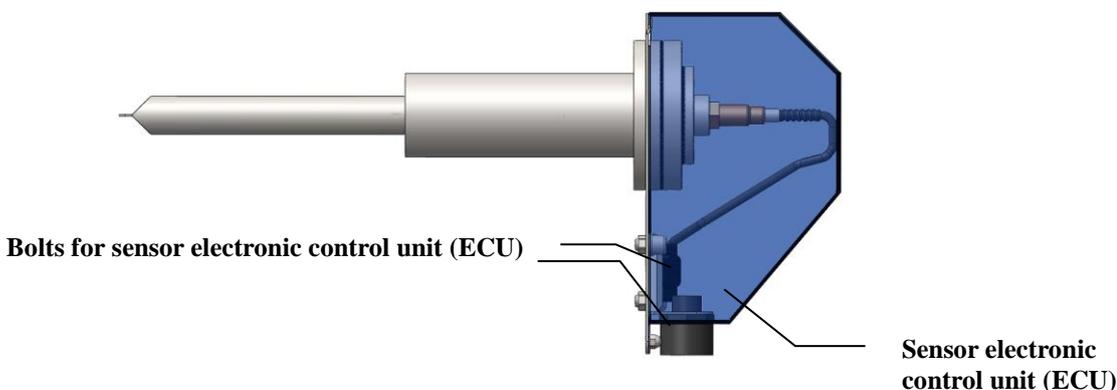


Figure 6-1: Diffusion probe

6.4 Diffusion Probe

The probe filter element is normally cleaned by back-flushing. The period between back-flushings depends on the actual flue gas condition and how dirty the filter gets.

Regular back-flushing will normally keep the filter clean. However, a slow response to NO_x/O₂ changes in the flue gases indicates that the probe filter may be contaminated. In that case, manual cleaning of the probe is required.



Warning

The analyzer must be turned off and the air supply must be disconnected before you start working with the probe.

If you remove the probe while there is exhaust gas in the stack, there is a risk that hot exhaust gas will come out of probe hole.

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

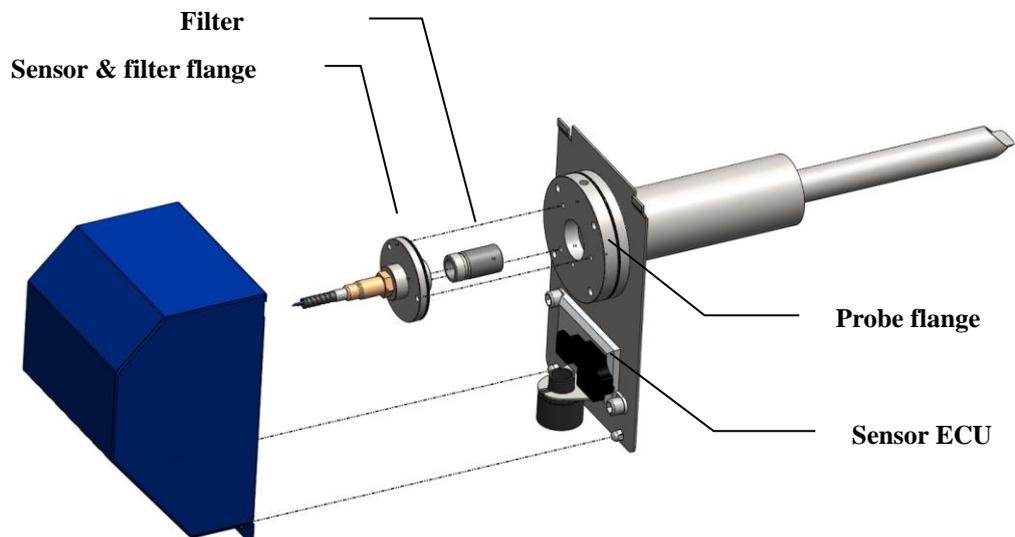


Figure 6-2: Maintenance of the diffusion probe – changing the filter

To clean the probe filter, please go through the following steps:

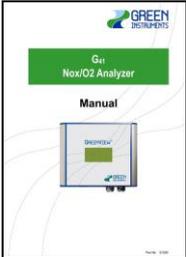
-  Turn off the analyzer and disconnect the air supply.
-  Unscrew the nuts and remove the blue cover plate of the probe.
-  Unbolt the 3 bolts at the sensor and filter flange.
-  Take the sensor and filter flange out and unscrew the threaded filter
-  Clean or change the filter.
-  Re-screw the filter to the sensor and filter flange and remount the flange to the probe.
-  Close the blue cover plate of the probe.

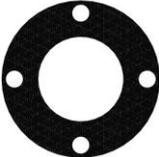
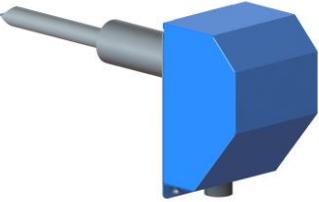
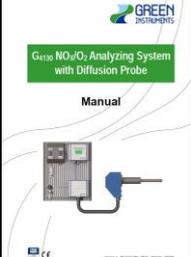
7 Parts List

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.	Consumable Parts - Part Description	The specific appearance of the spare parts is subject change without notice; the function however will not change
00670	NO _x /O ₂ sensor	
00657	Filter regulator 0–2 bar	
00739	Selector valve	
01034	Solenoid 24 VDC	
01047	Cable glands – M20	

Parts List

Part No.	Consumable Parts - Part Description	The specific appearance of the spare parts is subject change without notice; the function however will not change
01061	Back flush valve	
01251	Fuse for analyzer 2 AT (pkg of 10)	
01248	G41 NO _x /O ₂ Analyzer 100-230 VAC	
01250	Manual G41 NO _x /O ₂ Analyzer - Software version 2.04	
01819	Manual G41 NO _x /O ₂ Analyzer - Software version 2.05	
01254	Flow meter for calibration 1 l/m	
01332	Span test gas bottle 1200 ppm NO _x in N ₂ – 112DA container	
01950	Span test gas bottle 400 ppm NO _x in N ₂ – 112 DA container	
01673	Span test gas bottle 1500 ppm NO _x in N ₂ – 112DA container	
01333	Gas flow regulator SS 0.5 l/m – 1200 PSI Fit cylinder: 103 L - Valve inlet: C-10	

Part No.	Consumable Parts - Part Description	The specific appearance of the spare parts is subject change without notice; the function however will not change
02199	Umbilical cord complete with sensor cable and air hoses - 3 m	
02200	Additional meters for # 02199 Umbilical Cord (per additional meter)	
01905	Probe filter	
01913	Gasket for DP sensor & filter flange OD82	
02035	Flange gasket for DP thread Type OD100	
02064	Gasket for DP1 Flange OD125	
02104	Probe - long type for welding socket L=600	
02105	Probe - short type for welding socket L=475	
02097	Long type probe for thread socket 1½" BSP	
02106	Short type probe for thread socket 1½" BSP	
02156	This manual	

Part No.	Consumable Parts - Part Description	The specific appearance of the spare parts is subject change without notice; the function however will not change
33592	Signal amplifier (4-20 mA) (optional)	
	Other optional equipment – e.g. flow alarm, remote digital display, visualization, recording and data logging, monitoring of gas temperature, pressure, and load – can be supplied.	

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