

N-Gen nitrogen generator, High Performance and Single tube

User manual

Type	:	User manual
Date	:	March 2021
Version / Revision	:	Version 2.0, Revision 00
Status	:	Approved
Company	:	PRESSCON
Location	:	Honselersdijk

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Introduction

The N-Gen nitrogen generator is a system that provides a supply of nitrogen in a pressure vessel. It is applicable for various purposes and in various industries where it is desired to generate nitrogen on site. The N-Gen nitrogen generator is a system that consists only of a nitrogen generator unit. However, to be fully functional the N-Gen nitrogen generator needs a compressed air supply and a start/stop signal.

The N-Gen nitrogen generator works on the basis of a start / stop signal that is supplied externally. This can be in the form of a pressure switch or a digital output signal from another PLC. As soon as the N-Gen receives the signal, it immediately starts producing nitrogen. As soon as the signal drops out, the N-Gen will first complete the production cycle, after which the generator will stop. The nitrogen supplied by the N-Gen nitrogen generator is in fact an air mixture with a nitrogen concentration that deviates from 95.0 vol.%N₂ to 99.9999 vol.%N₂. Nitrogen is an inert gas and at a high concentration it has the property of preventing corrosion in a steel tank or pipe. It can also be used for fire and explosion prevention and for research in hospitals. Furthermore, there are many other possible applications for nitrogen.

Important to know

The N-Gen nitrogen generator can be delivered in a range of capacities and in 2 versions. The N-Gen nitrogen generator can be built as a High Performance (H.P.) generator or as a Single Tube generator. The difference is in the number of PSA tubes that are used to make nitrogen. The High Performance version uses 2 PSA tubes and the Single tube version uses only 1 PSA tube. The Single Tube generator is a simplified version of the High Performance generator, but the function of both systems remains the same. However, for the Single Tube version it is always necessary to use a nitrogen pressure vessel. It is important to know that the Single Tube version of the N-Gen has a maximum capacity of 2.5 m³/h with a maximum purity of 99%.

The N-Gen nitrogen generator has a capacity that varies from systems that supply 2.0 m³/h nitrogen to systems that can supply 16.0 m³/h of nitrogen at 8 bar compressed air and 99% purity. In addition, by combining several N-Gen generators, a capacity of over 3,000.0 m³/h can be reached, depending on the customer's requirements.

The N-Gen nitrogen generator is designed on flow and the corresponding purity. The higher the purity the lower the flow that comes from the generator. An N-Gen 16.0 for example has a capacity of 16.0 m³/h nitrogen at a purity of 99% and 8 bar compressed air. However, if the purity is increased to 99.99%, the generator only has a capacity of 4.0 m³/h nitrogen, if the purity is decreased to 95% the capacity becomes 27.0 m³/h nitrogen. The pressure of the compressed air is also important. In the example above, the flow of 16.0 m³/h of nitrogen is achieved with an air pressure of 8 bar. If the air pressure is lowered to 6 bar, the generator will no longer deliver 16.0 m³/h nitrogen. The flow will be lower. When the capacity of the N-Gen nitrogen generator increases, the dimensions of the system also increases, however, the rest of the appearance remains the same.




1 Precautions and safety instructions

1.1 General safety standards

When working with the N-Gen nitrogen generator, there are a number of safety risks that have to be considered. These risks include topics such as dangerous voltages, high pressure and danger of suffocation when breathing in a high concentration of nitrogen. These are further explained in this chapter. It is highly recommended to observe the safety risks before carrying out any work on the system. The safety risks in this chapter are divided among the different components of the system. For more information on the composition of the components, see chapter 2.





1.1.1 Working with the N-Gen nitrogen generator

The N-Gen nitrogen generator is commonly located in the technical room of the facility. When operating or when working on the nitrogen generator, the following hazards should be considered.

Symbol	Description	Applies to
	HIGH PRESSURE, Relief pressure from components before work is conducted.	The external components of the nitrogen generator which are: <ul style="list-style-type: none"> • Valves; • Hoses; • PSA vessels.
	DANGEROUS VOLTAGE, Forbidden to work on the system if the power is on.	All components that are connected to the control cabinet. Applied voltages are: <ul style="list-style-type: none"> • 24V AC; • 25V DC; • 230V AC;
	DANGER OF INHALATION, danger of asphyxiation if breathing high concentration of nitrogen. Avoid the specified area to avoid health hazards.	The nitrogen output connection. The mixture produced by the nitrogen generator consists of 95% or more nitrogen. Inhalation directly from the output connection may cause intoxication. The nitrogen quickly mixes with the ambient air so that at a distance of >0.5m from the nitrogen output connection it no longer poses a health risk.

1.1.2 Working with the compressor

In order to work safely and responsibly with the compressor, it is recommended to read the maintenance manual of the respective device carefully. Please also observe the hazard symbols and safety precautions. In addition to the symbols described in this manual, the manufacturer may have used different symbols. When working on the compressor, the following hazards, which generally apply to the compressors, must be taken into account.












Symbol	Description	Applies to
	HIGH PRESSURE, Relief pressure from components before work is conducted.	The external and internal components of the compressor which are: <ul style="list-style-type: none"> • Compressed air HP vessel; • Tubing, filters, oil barrel; • Compressor block.
	OVERPRESSURE VALVE, Be aware of the sudden relief of overpressure.	The compressed air HP vessel which has an overpressure valve of 10 Bar. The overpressure valve can relief its pressure suddenly.
	DANGEROUS VOLTAGE, Forbidden to work on the system if the power is on.	All internal components of the compressor. Applied voltages are: <ul style="list-style-type: none"> • 230V AC; • 380V AC.
	MOVING PARTS AND ROTATING FAN, Risk of getting stuck or injuries to limbs. Turn the machine off completely before working on it.	All internal components of the compressor which consist out of some rotating and moving parts.



For the precautions and safety instructions of the compressor, PRESSCON also refers to the enclosed instructions of the compressor manufacturer. These can be found with the compressor or in the control panel of the nitrogen generator.

1.2 Description of general hazard symbols

In addition to the identified risks for the nitrogen generator and the compressor, the following symbols can also be applied. When a hazard symbol is encountered, please observe its meaning carefully before further commencing the work.

Symbol	Description	Symbol	Description
	1. OVERPRESSURE VALVE, Be aware of the sudden relief of overpressure.		7. HIGH PRESSURE, Relief pressure from components before work is conducted.
	2. DANGEROUS VOLTAGE, Forbidden to work on the system if the power is on.		8. HOT PARTS, Do not touch parts with bare hands. Use heat-resistant clothing.
	3. DANGEROUS TO INHALE GAS, Avoid the specified area or wear appropriate breathing equipment.		9. MOVING PARTS, Risk of getting stuck or injuries to limbs. Turn the machine off completely before working on it.
	4. NOISE, Wear ear protection to prevent hearing damage.		10. ROTATING FAN, Risk of getting stuck or injuries to limbs. Turn the machine off completely before working on it.
	5. MACHINE WITH AUTOMATIC START, Machine stops and starts automatically when it is operating normally. Turn off the machine completely before working on it.		11. ATTENTION, Special situation occurs, follow additional instructions.
	6. READ THE OPERATING AND MAINTENANCE INSTRUCTIONS, It is advised that the maintenance instructions are read before continuing work.		

2 System components

The N-Gen nitrogen generator consists of a nitrogen generator and a compressor. This chapter describes these components by providing an illustration and numbering the most important parts. The compressor is not described because different brands can be used that come with their own manual.

2.1 N-Gen nitrogen generator High Performance (H.P.) multi-f

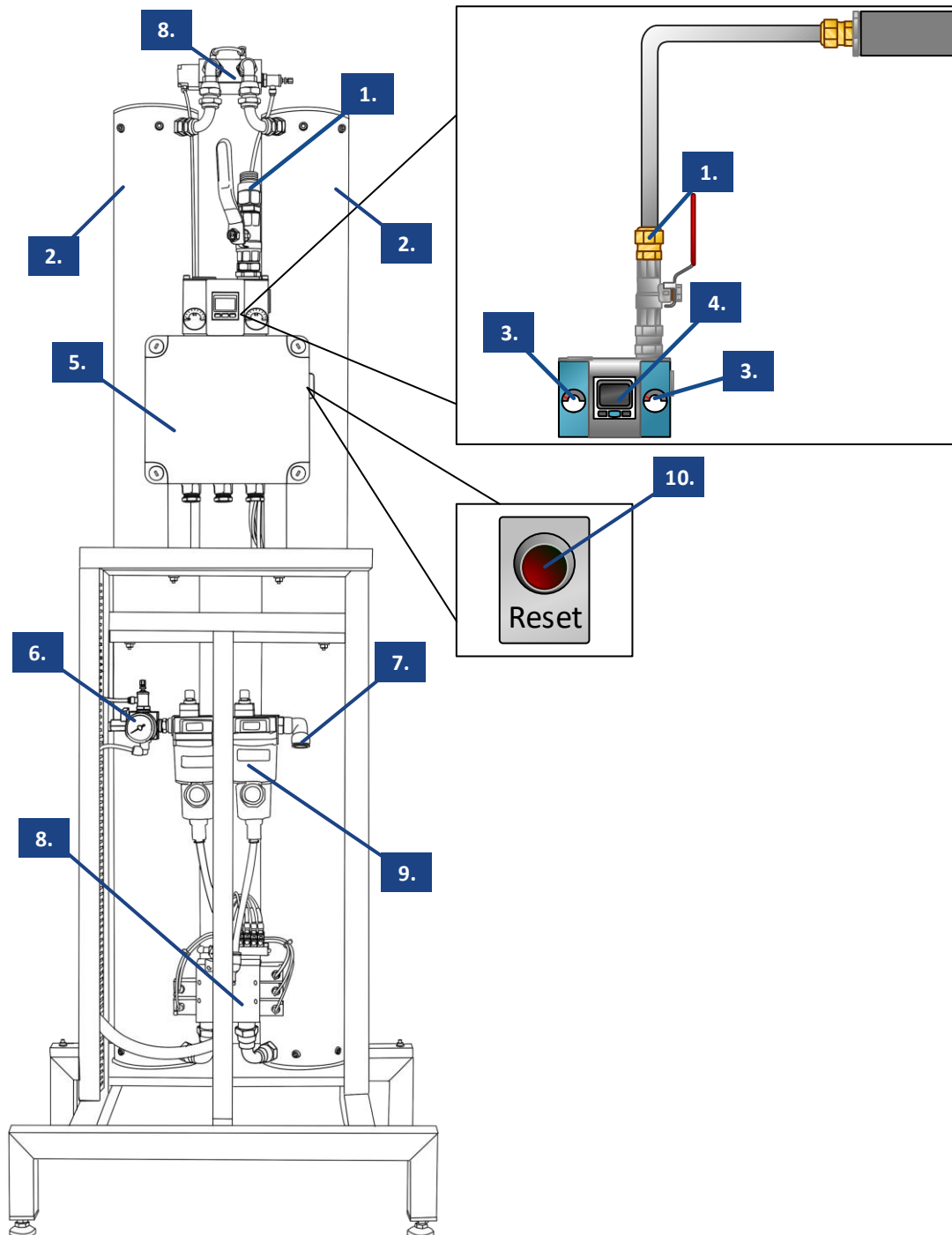


Figure 1. schematic illustration of the N-Gen High Performance nitrogen generator

2.2 N-Gen nitrogen generator High Performance (H.P.) N-gen controller

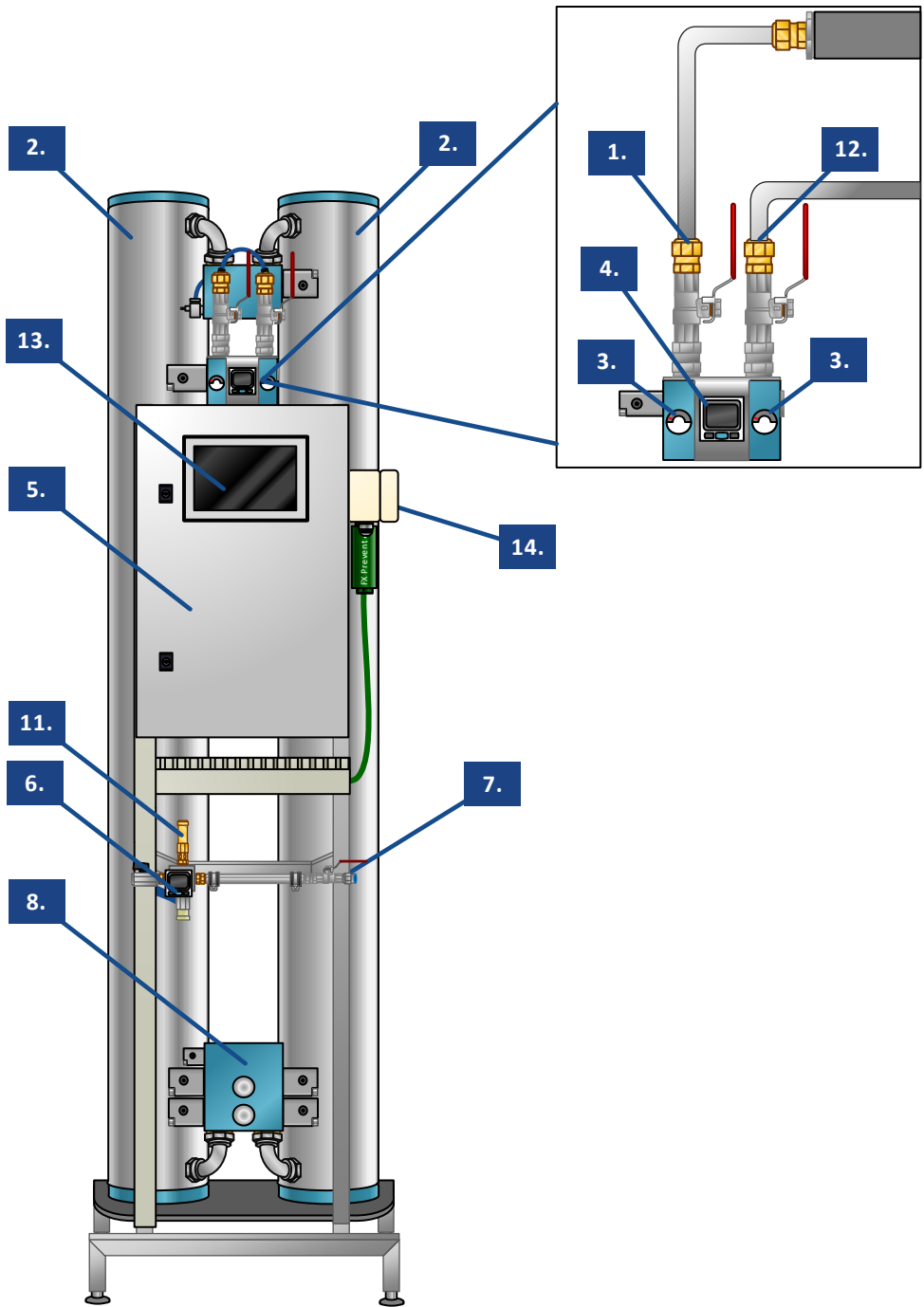


Figure 2. Schematic illustration of the N-Gen High Performance nitrogen generator

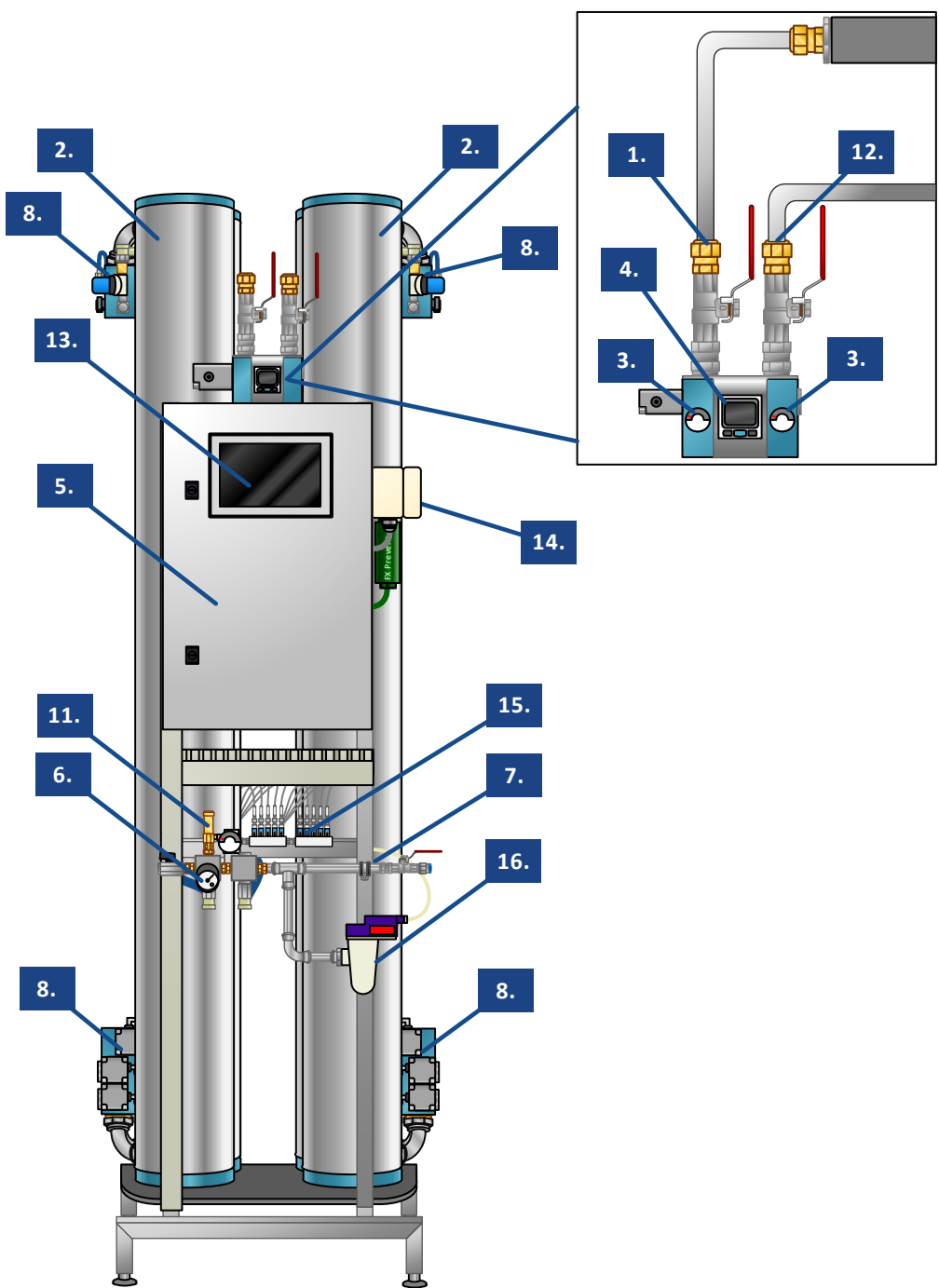


Figure 3. Schematic illustration of the N-Gen High Performance nitrogen generator

Legend

Legend for the N-Gen nitrogen generator.

Ref. No.	Description	Function
1.	Nitrogen output tube	Tube which puts out the nitrogen mixture that is produced by the nitrogen generator. This outlet will be connected to the piping that runs to the pressure vessel.
2.	PSA vessels	High pressure vessels with active carbon inside. The Pressure Swing Adsorption process takes place within these vessels.
3	PSA pressure gauges	0 – 10 bar (0,0 – 1,0 MPa) pressure gauges that indicate the pressure within the PSA vessels. The left pressure gauge is for the left PSA vessel and the right pressure gauge is for the right pressure vessel.
4.	Digital nitrogen HP vessel pressure regulator	Digital pressure switch with a start and stop setting. At default, the pressure regulator will generate a start signal below 4.0 Bar. At 6.5 Bar, the signal will turn off and the text on the display will turn green. If the pressure then drops below 4.0 Bar, the text on the display will turn red and a new start signal is generated.
5.	Control cabinet	Control cabinet containing all the electronic components needed to manage the nitrogen generator.
6.	Compressed air regulator and pressure switch	Composition of pressure control valve and pressure switch. The maximum air pressure for the nitrogen generator is manually setup by adjusting the pressure control valve. The pressure switch notifies the system if there is a pressure drop.
7.	Compressed air inlet	Push-in connection that is used for connecting the compressor to the nitrogen generator. This is commonly done with a 16mm nylon air hose.
8.	PSA control manifold	A pneumatically controlled manifold block that regulates the flow of air and nitrogen during the Pressure Swing Adsorption process.
9.	Compressed air filters	2 filters that filter out dirt and moisture that comes with the compressed air.
10.	Reset button	Red button that lights up when the Multi-F controller receives a signal on its External alarm input. By pressing the button an attempt can be made to reset the alarm.
11.	Spring safety	Mechanical valve that releases the excess pressure from the nitrogen storage tank. This protects the nitrogen storage tank against the creation of a pressure higher than the design pressure of the tank.
12.	Nitrogen high-pressure vessel connection	Pipe that blows out the nitrogen mixture produced by the nitrogen generator. This connection is specially made for a high pressure storage tank.
13.	Touchscreen	The touchscreen is the main control device for reading the statuses and values of the system. The touch screen is used for navigating and adjusting the settings.
14.	Oxysensor	Oxygen sensor that takes a sample of the nitrogen produced by the generator. By measuring the sample, the Oxy sensor verifies that the generator is working properly.
15.	PSA control valves	Electric valves controlled by the generator's controller. The valves provide pneumatic control of the valves on the PSA control manifolds.
16.	Bekoguard	Switch that detects if humidity is present in the supplied compressed air.

3 General operation

3.1 Operation of the N-Gen nitrogen generator

The N-Gen nitrogen generator regulates the pressure in a pressure vessel or directly to a consumer. How the N-Gen does this is explained in the next steps. The system requires a compressed air supply for this.

3.1.1 Compressed air supply

Step 1. The compressor draws in the air from the environment and compresses it to a pressure of 10 bar(g). Depending on the installation, this can also be lower with a minimum supply pressure of 6 bar. The compressor has a storage tank for compressed air and maintains constant pressure. From the storage vessel, the compressed air is transported to the nitrogen generator via a hose or a fixed line. In the nitrogen generator, the water and the oil residue are separated from the compressed air by two filters.

3.1.2 Nitrogen production

- Step 1. The pressure in the pressure vessel is monitored by means of a pressure switch or a pressure measurement from an external system. When the pressure becomes too low, a start command will be generated directly or indirectly and the N-Gen will start producing the nitrogen. If there is no pressure vessel, the system is controlled by an external or other contact.
- Step 2. Nitrogen production starts with drawing in compressed air from the compressor. The compressed air is transported to the PSA tubes where the Pressure Swing Adsorption process takes place. The N-Gen High Performance nitrogen generator has 2 PSA tubes for this process. The N-Gen Single Tube nitrogen generator uses only 1 PSA tube for this in conjunction with a nitrogen storage pressure vessel. The oxygen that is left over from the Pressure Swing Adsorption process is blown back into the immediate area, but can also be discharged into a channel or to the outside if required. The remaining mix of oxygen and nitrogen has a purity between 95.0 and 99.9999 vol. %N₂. The nitrogen mix is fed to the pressure vessel and the pressure is increased.
- Step 3. When the pressure is at the desired level, the start command is canceled. The nitrogen generator completes the production cycle. The compressor will continuously maintain the compressed air pressure. When compressed air is no longer used by the nitrogen generator, the compressor will also turn off.

3.2 Schematic overview of the N-Gen nitrogen generator

Figure 4 gives a schematic overview of the N-Gen nitrogen generator. It shows how all components in the system communicate with each other.

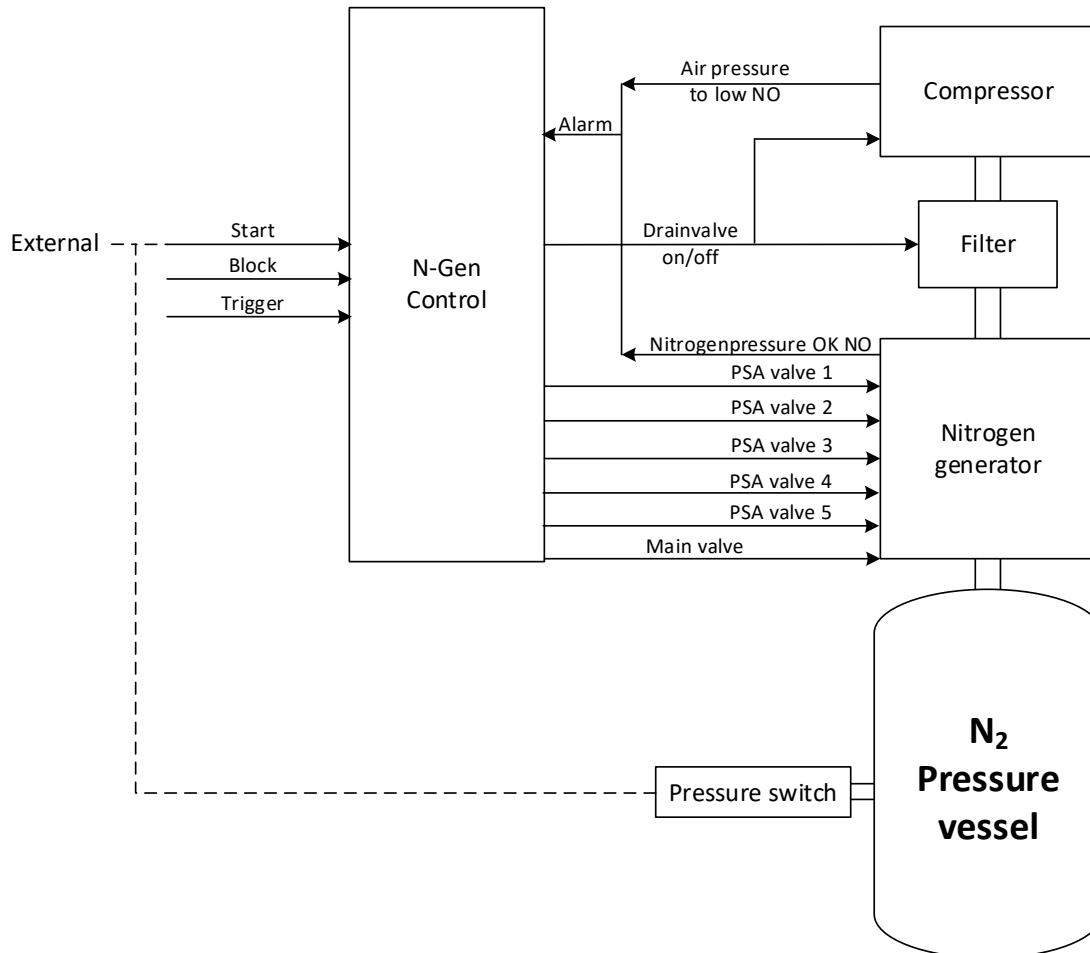


Figure 4. N-Gen nitrogen generator system overview

4 Controller

The N-Gen nitrogen generator can be controlled by a Multi-F controller or a N-Gen controller.

4.1 Multi-F Controller

The JGA 944B Multi-F controller is the motherboard that controls the N-Gen nitrogen generator. It processes the incoming start and stop signals and thereby generates the correct output signals.

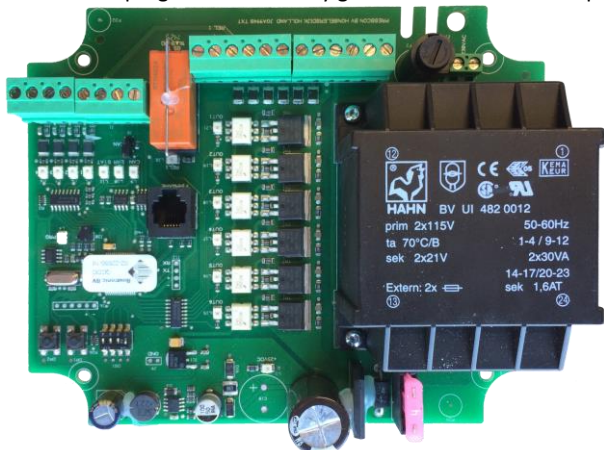


Figure 5. JGA 944B Multi-F controller

4.2 N-Gen Controller

The N-Gen Control is the control board for measuring and controlling. A N-Gen nitrogen generator consists of one or more N-Gen Controls. For the N-Gen Control two hardware versions can be used: the JGA2000 and the JGA2024. These boards are fully compatible except for the expansion connector which is only present on the JGA2000.



Figure 6. JGA 2024B-1 N-Gen controller

4.2.1 Display 1085

The operation of the N-Gen control can be done by means of a JGA1085. This board has a display on the front. At the back of the display the intelligence board is mounted. On the display the status of the system is shown and the settings can be made.

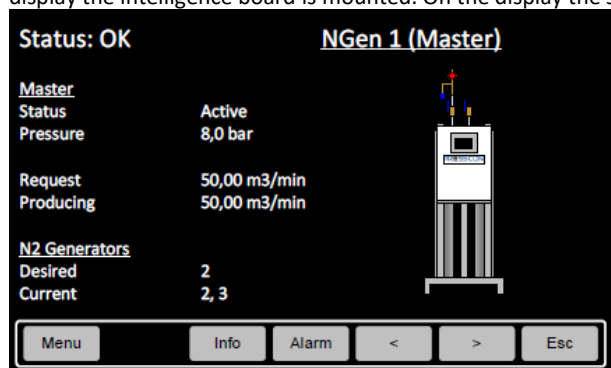


Figure 7. JGA 2024B-1 N-Gen controller

5 Alarm and error handling

5.1 Multi-F

5.1.1 Alarm button

There is a red alarm button on the right side of the switch panel. The red button will light up as soon as the Multi-F controller of the N-Gen nitrogen generator receives an alarm signal. The Multi-F controller has 1 digital input to which an alarm signal can be connected. These can be alarm signals of, for example, temperature protection or thermal protection of the compressor or a pressure switch that indicates the minimum compressed air pressure of the nitrogen generator. Which alarm it is depends on what is connected to the digital input. This will usually be the pre-pressure alarm for the N-Gen nitrogen generator, which indicates that there is too little compressed air pressure for the nitrogen generator. By pressing the button an attempt can be made to reset the alarm.



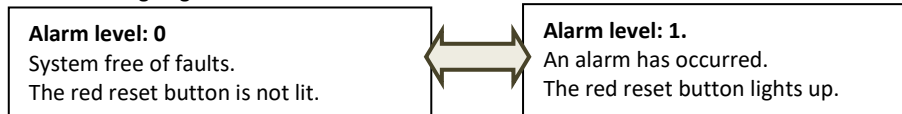
Figure 8. Alarm button no alarm



Figure 9. Alarm button active alarm

5.1.2 Faults and alarms

When an alarm occurs, this will be reported via the red button on the side of the switch panel. It lights up when one or more alarms have occurred. The N-Gen nitrogen generator therefore has two alarm levels.



If one of the alarms occurs, the nitrogen generator is stopped and the main valve and the drain valve are closed. The nitrogen generator is still completing its cycle. In short, during an alarm, the nitrogen generator will:

- Stop generating nitrogen;
- Close the drain valve;
- Close the main valve;
- Light up the red alarm button.



The N-Gen will respond the same to each of the alarms below. All alarms have the same urgency and the priority of which depends primarily on the nitrogen demand from other machines.

5.1.3 Alarm messages

EEPROM errors		
F01	Eeprom adres	An address fault has occurred.
F02	Eeprom adr0	„
F03	Eepromcomm	There is no communication with the Eeprom.
Can errors		
F04	Canbus halt	The Canbus could not send or receive.
F05	CanrxFifo	The receive buffer of the Canbus is full.
F06	CanrxMBox	The receive messagebox of the Canbus is full.
F07	CantxFifo	The send buffer of the Canbus is full.
RTC errors		
F08	RTC comm.	There is no communication with the RTC.
F09	RTC new	The RTC is not set.
RS232 errors		
F10	Uart1 rxFifo	The receive buffer of the RS232 is full
F11	Uart1 txFifo	The send buffer of the RS232 is full

General errors		
F12	Configuration	There is a fault in the configuration.
F13	Base value	The basic value is incorrect.
F14	Current	The current has dropped.
F15	1st boot	The PsaControl boots for the first time.
F16	Button displ.	A button has been pressed during boot.
F17	PsaCtrl N/A	The PsaControl controller was not found.
F18	SW version	The softwareversions do not correspond.
F19	Taskfifo	The taskfifo is full.
Special errors		
F20	External alarm	There is an alarm on the alarm input.

5.1.4 Resetting alarms

All alarms can be reset by pressing the red reset button once. The alarms that are no longer applicable will disappear. The alarms which are still active will return which causes the red button to remain lit.

If the compressed air pressure is OK and an alarm remains, one of the other alarms related to the Multi-F's hardware is active. A service technician must read out the controller. Please contact PRESSCON. Also in case of technical failure, questions or other issues you can contact PRESSCON at any time.

5.2 N-Gen control

5.2.1 Faults and alarms

The error levels are divided into four categories. Of these four categories, the lowest two are warnings and the highest two are alarms. Warnings report the error, but do not affect the operation of the N-Gen Control. When an alarm occurs the N-Gen Control will stop functioning. It will then no longer be used in the system. Per type of error message (Warning and Alarm) there is a difference between local and system error messages. If the error message is local, it is only handled locally. If the error message is for the system, the system will respond to this error message.

Level	Name	Description	Range
None	None	No error level	N-Gen Control
Level 1	Warning local	Warning for this N-Gen control only	N-Gen Control
Level 2	System warning	Warning for the whole system	System
Level 3	Local alarm	Alarm for this N-Gen control only	N-Gen Control
Level 4	Alarm system	Alarm for the whole system	System

6 Maintenance and service

6.1 Maintenance of the N-Gen nitrogen generator

To make sure that the N-Gen nitrogen generator continues to work well, the owner must provide the system with its essential maintenance. A part of the maintenance, the weekly checks, are usually done by the owner or its technical personnel. Other annual checks should be performed by a service engineer.

Activity	To be done by	Weekly	Each year or every 2.000 hours	Every 2 years or every 4.000 hours	Every 2 years
Nitrogen generator					
Visual inspection	Owner	X			
Tightening PSA spindles	Service engineer		X		
Check compressed air filters	Service engineer		X		
Check output flow and purity.	Service engineer		X		
Clean dirt catcher of compressor*	Service engineer		X		
Replace the compressed air filters	Service engineer			X	

**The compressors supplied by PRESSCON with the N-Gen nitrogen generator have an extra dirt trap at the bottom of the compressed air tank. This is not mentioned further in the compressor manual and is therefore included in the overview above.*

6.2 Compressor maintenance

Although the N-Gen nitrogen generator is generally equipped with a separate compressor, the maintenance instructions are different for each type and brand of machine. The maintenance instructions for the compressor are described in the user manual which is supplied as a separate document together with the compressor.

7 Warranty

PRESSCON provides a warranty of 1 year on the components of the N-Gen nitrogen generator, assuming that the following conditions are met:

- The equipment has been installed by PRESSCON or under direct or indirect supervision of PRESSCON.
- The equipment is undamaged and unprocessed and not defective due to improper use.
- The equipment is not defective by inadequate maintenance or other proceedings.
- The equipment is not defective or non-speech hit by negligence, accident or whatsoever.

The warranty includes checking, repair or replacement if defective from proven equipment. Faulty equipment, which has been replaced shall become property of PRESSCON.

Regarding the products supplied by PRESSCON in the Netherlands, PRESSCON refers to the general terms of conditions. All offers and agreements relating to goods to be delivered and / or services within the Netherlands are applicable the general terms and conditions for the technology industry, as last filed by the FME-CWM with the court in The Hague. A Dutch copy of these terms is included with all Dutch offers and agreements. Other terms and conditions are expressly rejected.

8 Appendix

In addition to this document, the description of the content extends to the following appendixes:

Appendix ID	Description	Version
-	-	V0.0_R00

9 Document history

Version **1.0** to **2.0** indicates : **Modification**, in lay-out, structure or other major modifications;
 Version **1.0** to **1.1** indicates : **Supplement**, a chapter of paragraph has been added to the document;
 Revision **_R01** to **_R02** indicates : **Correction**, an image, language error or text error has been corrected.

Version	Date	Modification
1.1_R00	20-04-2020	Manual version 1.1_R00 translated from Dutch to English.
1.1_R01	28-04-2020	Corrected descriptions about variety of nitrogen purities in: <ul style="list-style-type: none"> - Introduction. - Important to know - 1.1 Working with the N-Gen nitrogen generator - 3.1.2. Nitrogen production.
2.0	12-2020	New schematic views added. Textual improvements made. Display 1085 added N-Gen control Faults and alarms added

10 To conclude

This manual has been written in order to support the mechanic, installer or customer in adjusting, modifying or working with a product of PRESSCON. Its aim is to maintain and possibly improve the quality of its products. If additional information or support is requested then PRESSCON can be consulted through the following information.



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