PNEUMATECH

PSA nitrogen generators

PPNG 6 HE, PPNG 7 HE, PPNG 9 HE, PPNG 12 HE, PPNG 15 HE,
PPNG 18 HE, PPNG 22 HE, PPNG 28 HE, PPNG 30 HE,
PPNG 37 HE, PPNG 41 HE, PPNG 50 HE, PPNG 63 HE, PPNG 68 HE

Instruction book

pneumatech
Pure air . Pure gas

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PSA nitrogen generators

PPNG 6 HE, PPNG 7 HE, PPNG 9 HE, PPNG 12 HE, PPNG 15 HE, PPNG 18 HE, PPNG 22 HE, PPNG 28 HE, PPNG 30 HE, PPNG 37 HE, PPNG 41 HE, PPNG 50 HE, PPNG 63 HE, PPNG 68 HE

From following serial No. onwards: API 205 997

Instruction book

Original instructions

This instruction book is valid for CE as well as non-CE labelled machines. It meets the requirements for instructions specified by the applicable European directives as identified in the Declaration of Conformity.

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1 Safety precautions

1.1 Safety icons

Explanation

	Danger to life
	Warning
	Important note

1.2 General safety precautions

	All responsibility for any damage or injury resulting from neglecting these precautions, or non-observance of the normal caution and care required for installation, operation, maintenance and repair, even if not expressly stated, will be disclaimed by the manufacturer.

1. The operator must employ safe working practices and observe all related local work safety requirements and regulations.
   If any of the following statements does not comply with local legislation, the stricter of the two shall apply.
2. Installation, operation, maintenance and repair work must only be performed by authorised, trained, specialised personnel.
3. Before carrying out any maintenance, repair work, adjustment or any other non-routine checks, stop the device. In addition, the power isolating switch must be opened and locked.
4. Never play with compressed air or gas. Do not apply an air or gas stream to your skin or direct an air stream at people. Never use compressed air to clean dirt from your clothes. When using the air to clean equipment, do so with extreme caution and wear eye protection.
5. Never operate the device below or in excess of its limit ratings.
6. No external force may be exerted on the air inlet and outlet valve. The connected pipe must be free of strain.
7. The owner is responsible for maintaining the unit in safe operating condition. Parts and accessories shall be replaced if unsuitable for safe operation.
8. It is not allowed to walk or stand on the device or its components.

1.3 Safety precautions during installation

1. Install the equipment where the ambient air is cool and as clean as possible. Consult section Reference conditions and limitations.
2. During installation or any other intervention on the equipment or one of the connected machines, the machines must be stopped, de-energized and the isolating switch opened and locked before any maintenance or repair. As a further safeguard, persons switching on remotely controlled machines shall take adequate precautions to ensure that there is no one

checking or working on the machine. To this end, a suitable notice shall be affixed to the start equipment.

3. Install the equipment in an area free of flammable fumes, vapours and particles, e.g. paint solvents, that can lead to internal fire or explosion.
4. The electrical connections must correspond to the applicable codes. The equipment must be earthed and protected against short circuits by fuses in all phases. A lockable power isolating switch must be installed near the equipment.
5. For machines controlled by a central control system, a sign stating "This machine may start without warning" must be affixed near the instrument panel.
6. In multiple compressor systems, manual valves must be installed to isolate each compressor. Non-return valves (check valves) must not be relied upon for isolating pressure systems.
7. Never remove or tamper with the safety devices.
8. If the maximum pressure of the compressor is higher than the design pressure of the connected equipment (e.g. a nitrogen generator or an oxygen generator), a full flow safety valve must be installed between the compressor and the connected equipment, in order to be able to blow off the excessive pressure.

	Also consult following safety precautions: Safety precautions during operation and Safety precautions during maintenance or repair. These precautions apply to electrical devices. For precautions applying to the connected equipment consult the relevant instruction book. Some precautions are general and cover several machine types and equipment; hence some statements may not apply to your device.

1.4 Safety precautions during operation

	All responsibility for any damage or injury resulting from neglecting these precautions, or non-observance of the normal caution and care required for installation, operation, maintenance and repair, even if not expressly stated, will be disclaimed by the manufacturer.

1. Persons switching on remotely controlled machines shall take adequate precautions to ensure that there is no one checking or working on the machine. To this end, a suitable notice shall be affixed to the remote start equipment.
2. Never operate the device in the presence of flammable or toxic fumes, vapours or particles.
3. Never operate the device below or in excess of its limit ratings.
4. Do not operate the device when there are flammable or toxic fumes, vapors or particles.
5. Keep all bodywork doors and panels closed during operation. The doors may be opened for short periods only, e.g. to carry out routine checks.
6. People staying in environments or rooms where the sound pressure level reaches or exceeds 90 dB(A) shall wear ear protectors.
7. Periodically check that:
   - All guards and fasteners are in place and tight
   - All hoses and/or pipes are in good condition, secure and not rubbing
   - There are no leaks
   - All electrical leads are secure and in good order
8. Never remove or tamper with the safety devices.

	Also consult following safety precautions: Safety precautions during installation and Safety precautions during maintenance or repair. These precautions apply to electrical devices. For precautions applying to the connected equipment consult the relevant instruction book. Some precautions are general and cover several machine types and equipment; hence some statements may not apply to your machine.

1.5 Safety precautions during maintenance or repair

	All responsibility for any damage or injury resulting from neglecting these precautions, or non observance of the normal caution and care required for installation, operation, maintenance and repair, even if not expressly stated, will be disclaimed by the manufacturer.

1. Use only the correct tools for maintenance and repair work.
2. Use only genuine spare parts.
3. A warning sign bearing a legend such as "Work in progress - do not start" shall be attached to the starting equipment, including all remote start equipment.
4. Persons switching on remotely controlled machines shall take adequate precautions to ensure that there is no one checking or working on the machine. To this end, a suitable notice shall be affixed to the remote start equipment.
5. Never use flammable solvents or carbon tetrachloride for cleaning parts. Take safety precautions against toxic vapors of cleaning liquids.
6. Scrupulously observe cleanliness during maintenance and repair. Keep dirt away by covering the parts and exposed openings with a clean cloth, paper or tape.
7. Never use a light source with open flame for inspecting the interior of the device.
8. All regulating and safety devices shall be maintained with due care to ensure that they function properly. They may not be put out of action.
9. Before clearing the device for use after maintenance or repair, check that operating pressures, temperatures and time settings are correct. Check that all control and shutdown devices are fitted and that they function correctly.
10. Make sure that no tools, loose parts or rags are left in or on the device.
11. Never use caustic solvents which can damage materials of the device.

	Also consult following safety precautions: Safety precautions during installation and Safety precautions during operation. These precautions apply to electrical devices. For precautions applying to the connected equipment consult the relevant instruction book. Some precautions are general and cover several machine types and equipment; hence some statements may not apply to your machine.

	Units and/or used parts must be disposed of in an environmentally friendly and safe manner and in line with the local recommendations and legislation.

1.6 Specific safety precautions for nitrogen generating equipment

	The release of oxygen molecules from the carbon molecular sieve material (CMS) is a very slow process. This might cause a pressure buildup in the adsorbers, even after they were depressurized. Make sure the generator is fully depressurized before maintenance.

The nitrogen generator can be installed in the vicinity of the nitrogen consuming application without the requirement for classification of the surrounding area as hazardous, provided that all necessary measures have been taken to guarantee the maximum safety.

The nitrogen generating unit must be installed and used in observance of the instructions in this booklet. Failure to observe these instructions will render the guarantee null and void and release the manufacturer from all liability for direct or indirect damage or physical injury.

Hoses, pipes and connections used must be of the correct size and must be suitable for the working pressure and purity. Never use frayed, damaged or worn hoses. Fixed piping is recommended, especially for high purities. Connections made to the equipment must be free of strain.

Nitrogen is not a toxic gas, but when the percentage of nitrogen in the air exceeds a specific value, there is a risk of asphyxia. You should therefore never directly inhale the produced gas, and avoid working in the immediate vicinity of the flowing nitrogen. Given the low quantities produced, it is sufficient that the flow of nitrogen occurs in a normally ventilated environment to avoid the risk of accumulation. Consult your supplier if in doubt.

Normal oxygen concentration in air is approximately 21% by volume. In general, air containing less than 19.5% or more than 23.5% oxygen constitutes a hazardous working environment. Typical symptoms of oxygen deficient atmospheres are listed in the table below. (ref. ANSI Z88.2)

% oxygen at sea level (atmospheric pressure)	Effects
>23.5	Increased fire hazard
20.9	Normal
19.0	Some adverse physiological effects occur, but they are unnoticeable.
16.0	Increased pulse and breathing rate. Impaired thinking and attention. Reduced coordination.
14.0	Abnormal fatigue upon exertion. Emotional upset. Faulty coordination. Poor judgment.
12.5	Very poor judgment and coordination. Impaired respiration that may cause permanent heart damage. Nausea and vomiting.
<10	Inability to perform various movements. Loss of consciousness. Convulsions. Death.

Oxygen concentrations higher than 23.5% create greater fire hazards than normal air. Oxygen is not combustible, but it promotes very rapid combustion of flammable materials and some materials that are normally regarded as being relatively non flammable.

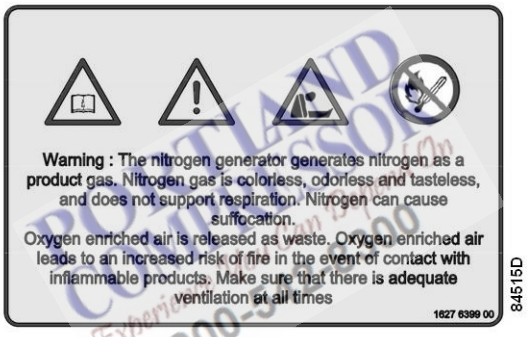
When working on or around the generator, always wear a portable oxygen sensor to indicate safe working conditions.

Although a source of ignition energy is always necessary in combination with flammable materials and oxygen, control or elimination of flammables is a precautionary step.

More details about the characteristics of nitrogen or oxygen can be found in the safety data sheet for nitrogen and oxygen, both available as a separate publication (consult your supplier).

1.7 Safety labelling on nitrogen generators

The following safety label is attached to the nitrogen generator:

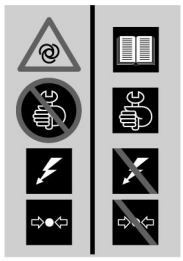


Translation of the text on the label

	Nitrogen is a colorless, odorless and tasteless gas that does not support respiration. Nitrogen can cause suffocation. Oxygen enriched air is released as waste. Oxygen enriched air leads to an increased risk of fire in the event of contact with inflammable products. Make sure that there is adequate ventilation at all times.

Information on safety labels:

	ISO 7000 - symbol 0419	Read the instruction manual
	ISO 7000 - symbol 0434b	General safety alert symbol

	-	Warning: Risk of asphyxiation
	ISO 7010 - symbol P003	Fire hazard: • No open flame near the generator • Fire, open ignition source and smoking prohibited
	1079 9903 48	Warning: • Generator can start automatically • Read the manual before service or repair • Turn off the power and disconnect the power supply before service or repair • Depressurize before service or repair
	1079 9906 29	Warning: dangerous blow off
	ISO 7010 - symbol M003	Wear ear protection

2 Description

2.1 General description

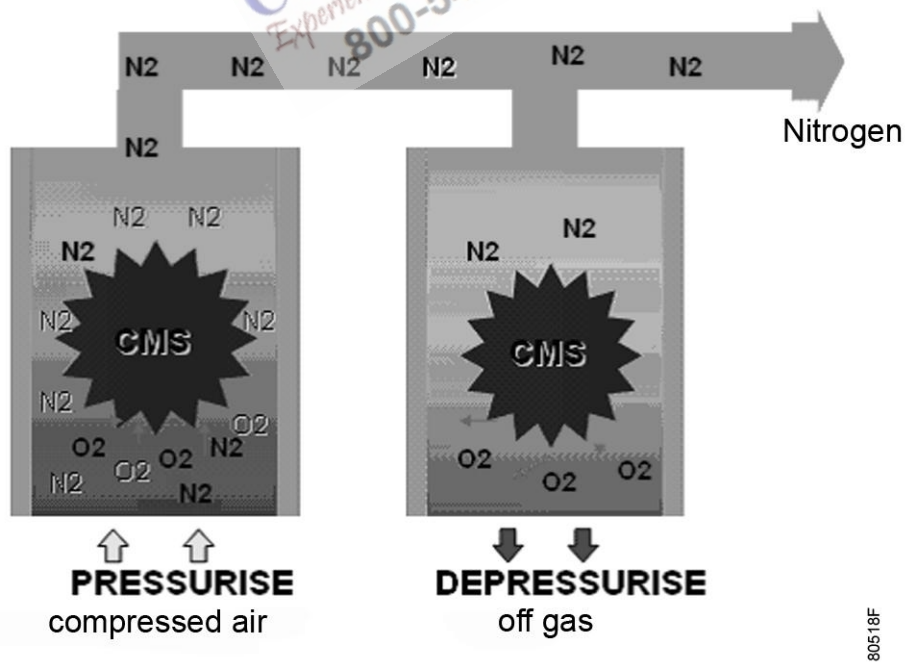
Working principle

PPNG 6 HE up to PPNG 68 HE nitrogen generators are intended to produce nitrogen (N_2) for industrial purposes. They use Pressure Swing Adsorption (PSA) technology to produce nitrogen by passing compressed air through a tank containing adsorbent material.

The adsorbents are chosen on the basis of their adsorption characteristics: the adsorbent has much more affinity for non-product molecules than for the product gas (N_2). This characteristic results in most of the desired molecules (N_2) passing through the bed and remaining in the product stream, while undesired components (product impurities) are captured by the adsorbent.

The PSA process is inherently a batch process, as the adsorbent bed requires periodic desorption. Consequently, PSA systems usually contain two adsorbent tanks (adsorbers) to provide operational continuity. At any time, one of the adsorbers will be delivering product (N_2) by adsorbing undesired components of the air, while the other adsorber is being regenerated by depressurization to atmospheric pressure. When the adsorbing adsorber approaches saturation, a set of valves quickly switches the functions. A nitrogen receiver downstream of the nitrogen generator ensures that the delivery of nitrogen is continuous.

During the adsorption phase, compressed air flows through the sieve and oxygen molecules are caught while nitrogen molecules pass on due to the different molecular size. The sieve continues to adsorb oxygen until a saturation point is reached. During desorption, the entering air stream is cut off and the oxygen is able to leave the tank at low pressure.



Operating principle of the nitrogen generator

Nitrogen PSA vessels contain **Carbon Molecular Sieve (CMS)** material to remove oxygen and other undesired components.

The generator produces nitrogen at a purity level between 95 % and 99.999 % according to the user requirements and the required nitrogen flow and pressure.

The nitrogen flow rate depends on the model size and the required purity.

The nitrogen pressure depends on the pressure of the compressed air at the inlet.

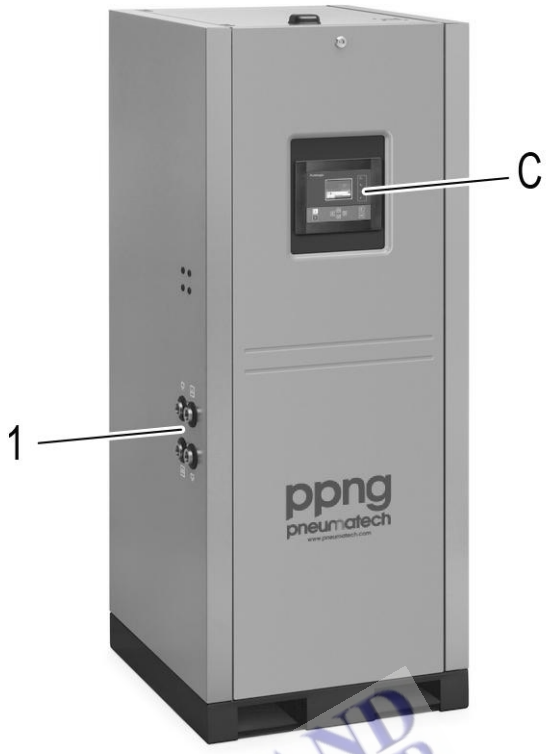
Variant	Nitrogen purity	Residual oxygen concentration
%	95 %	5 %
	96 %	4 %
	97 %	3 %
	98 %	2 %
	99 %	1 %
	99.5 %	0.5 %
	99.9 %	0.1 %
ppm	99.95 %	500 ppm
	99.99 %	100 ppm
	99.999 %	10 ppm

2.2 Detailed description

The nitrogen generator is controlled by a Purelogic™ controller.

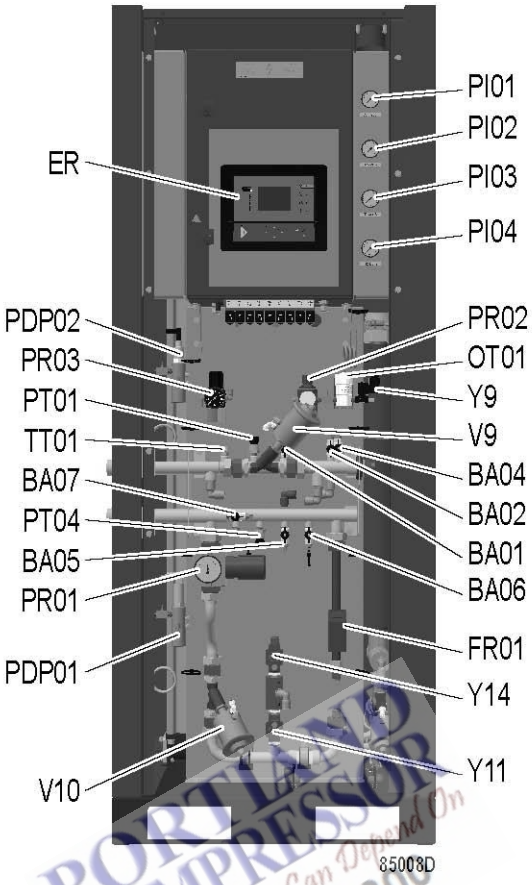
The controller is integrated in a cubicle at the front.

The electric cabinet comprising fuses, transformers, etc. is located behind the door panel of the cubicle.

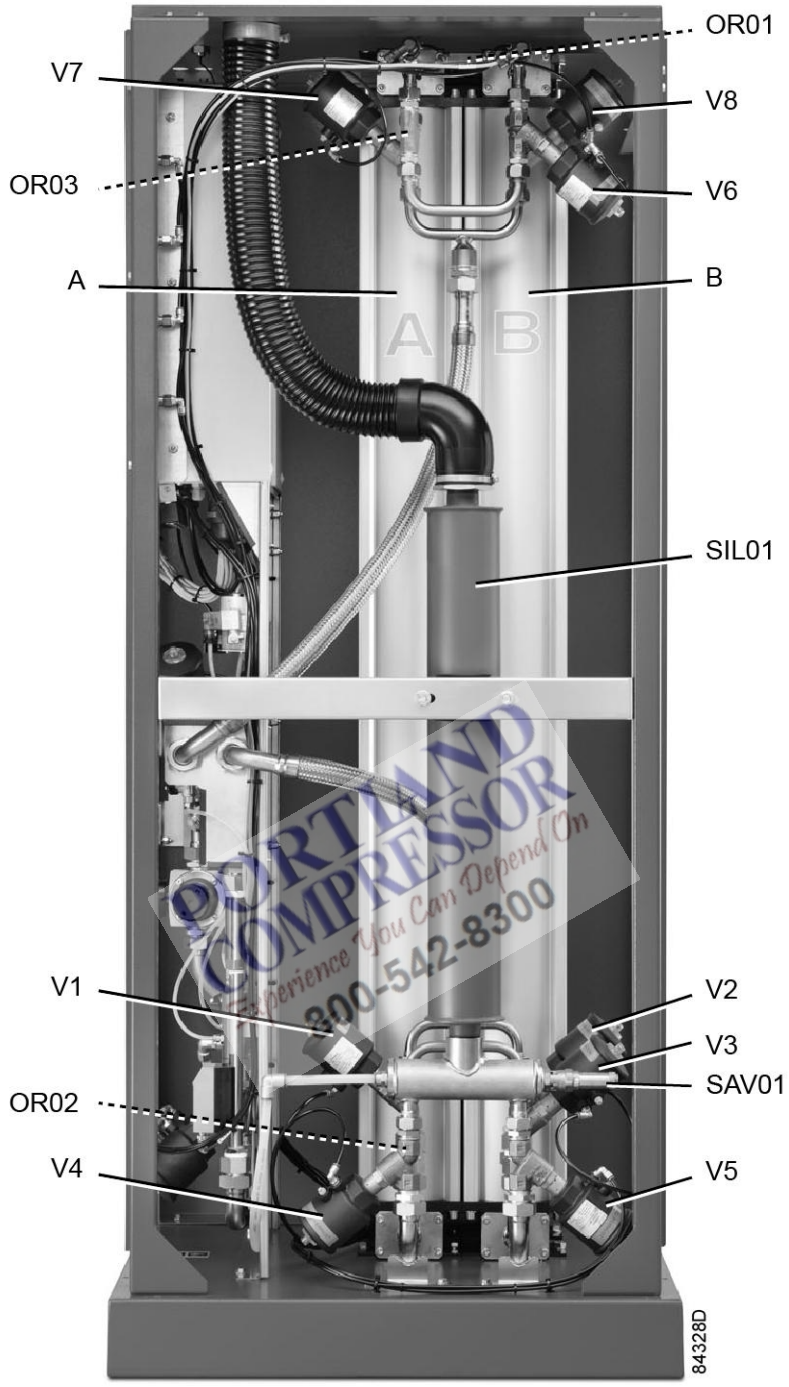


General view

1	Connections
C	Controller

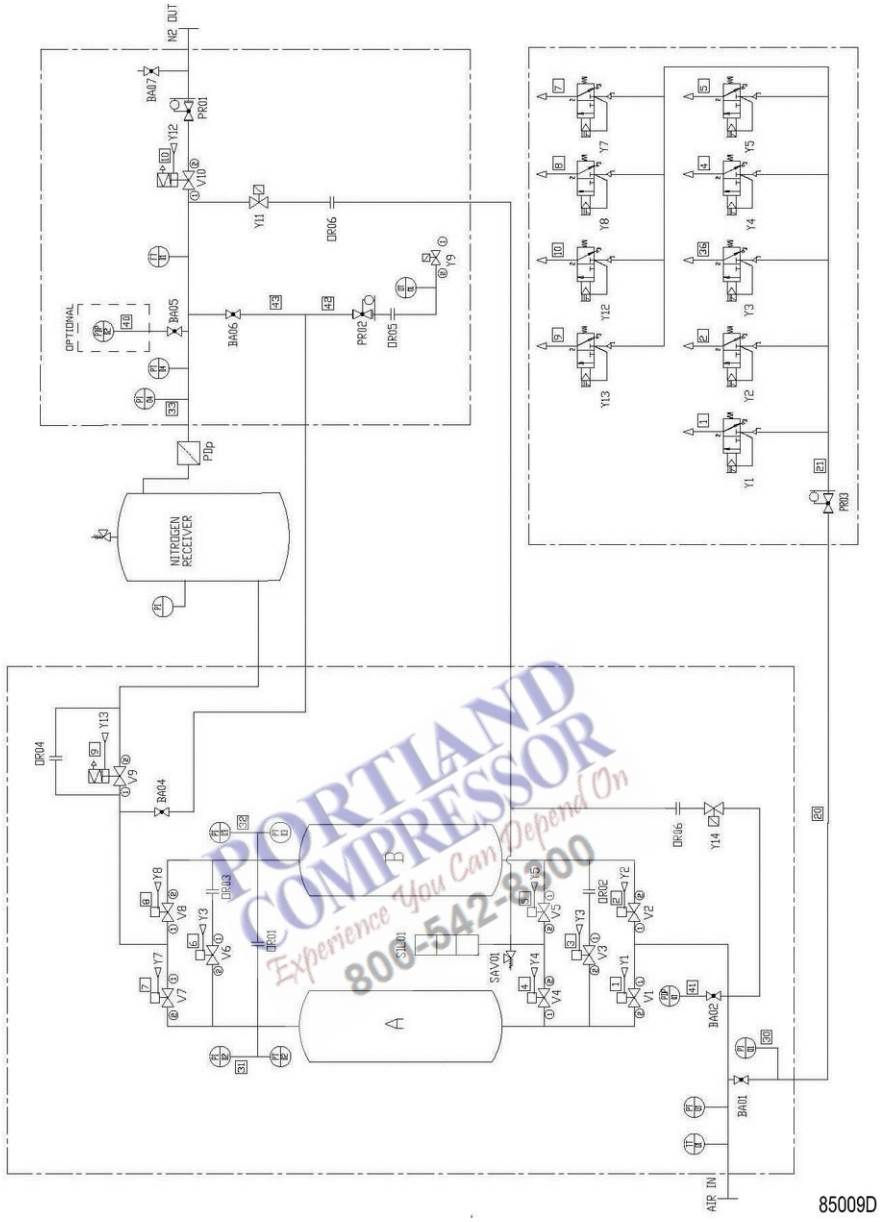


ER	Controller	BA04	Ball valve, nitrogen purity analysis
PI01	Pressure gauge, inlet pressure	BA05	Ball valve, PDP02
PI02	Pressure gauge, adsorber A	BA06	Ball valve, nitrogen purity
PI03	Pressure gauge, adsorber B	BA07	Ball valve, nitrogen sample
PI04	Pressure gauge, outlet pressure	PDP01	Inlet pressure dew point
PR01	Regulator valve, consumer pressure	PDP02	Outlet pressure dew point
PR02	Regulator valve, sample pressure	FT01	Flow transmitter
PR03	Regulator valve, pilot pressure	OT01	Oxygen analyser
PT01	Pressure transmitter, inlet pressure	Y9	Solenoid valve
PT04	Pressure transmitter, outlet pressure	OR04	Startup nozzle
TT01	Temperature transmitter, inlet temperature	V9	Minimum pressure valve
BA01	Ball valve, pilot air	V10	Consumer valve
BA02	Ball valve, PDP01	Y11	Outlet flushing valve
Y14	Inlet flushing valve		



A	Adsorber A	V2	Inlet transfer valve, adsorber B
B	Adsorber B	V3	Bottom equalization valve
SIL01	Blow off silencer	V4	Blow off valve, adsorber A
OR01	Regeneration purge nozzle	V5	Blow off valve, adsorber B
OR02	Bottom equalization nozzle	V6	Top equalization valve
OR03	Top equalization nozzle	V7	Outlet transfer valve, adsorber A
V1	Inlet transfer valve, adsorber A	V8	Outlet transfer valve, adsorber B
SAV01	Safety valve, exhaust circuit		

2.3 Flow diagram



Legend

A	Adsorber vessel A	OT01	Oxygen analyzer
B	Adsorber vessel B	PT01	Inlet pressure transmitter
V1	Inlet transfer valve vessel A	PT02	Adsorber A pressure transmitter
V2	Inlet transfer valve vessel B	PT03	Adsorber B pressure transmitter
V3	Bottom equalization valve	PT04	Outlet pressure transmitter
V4	Blow off valve vessel A	PRO1	Consumer pressure regulating valve
V5	Blow off valve vessel B	PRO2	Sample pressure regulating valve
V6	Top equalization valve	PRO3	Pilot pressure regulating valve
V7	Outlet transfer valve vessel A	PDp	PDp filter
V8	Outlet transfer valve vessel B	PDP01	Inlet pressure dew point
V9	Minimum pressure valve	PDP02	Outlet pressure dew point (optional)

V10	Consumer valve	SIL01	Blow off silencer
Y11	Outlet flushing valve	TT01	Inlet temperature transmitter
FT01	Flow transmitter	Y1–Y13	3/2 spool valve monostable
OR01	Regeneration purge nozzle	Y9A	Solenoid valve
OR02	Bottom equalization nozzle	PI01	Inlet pressure indicator
OR03	Top equalization nozzle	PI02	Adsorber A pressure indicator
OR04	Startup nozzle	PI03	Adsorber Bpressure indicator
OR05	Oxygen sensor nozzle	PI04	Outlet pressure indicator
OR06	Low purity exhaust nozzle	SAV01	Safety valve, exhaust circuit
Y14	Inlet flushing valve		

2.4 Electric diagram

The electric diagram (9827 2703 01) can be found on the CD-ROM, DVD or USB, supplied with the unit.

3 Installation

3.1 Dimensions

The dimension drawing can be found on the CD-ROM, DVD or USB, supplied with the unit.

9829 5284 31	PPNG 6 HE
9829 5284 32	PPNG 7 HE
9829 5284 33	PPNG 9 HE
9829 5284 34	PPNG 12 HE
9829 5284 35	PPNG 15 HE
9829 5284 36	PPNG 18 HE
9829 5284 37	PPNG 22 HE
9829 5284 38	PPNG 28 HE
9829 5284 39	PPNG 30 HE
9829 5284 40	PPNG 37 HE
9829 5284 41	PPNG 41 HE
9829 5284 42	PPNG 50 HE
9829 5284 43	PPNG 63 HE
9829 5284 44	PPNG 68 HE

References used on the dimension drawings

Text on drawing	**Explanation**
Inlet	Air inlet
To N2 buffer vessel	To nitrogen receiver
From N2 buffer vessel	From nitrogen receiver
Outlet	Nitrogen outlet
Exhaust connection	Exhaust connection
COG	Center of gravity
Power supply	Connection of power supply cable
Foundation bolts	Location of foundation bolts
Blowoff Exhaust	Location of the blowoff exhaust opening

	Dimension drawings are subject to change. Please consult your supplier to get the latest versions of the dimension drawings.

3.2 Installation

For a good functionality of the gas generator it is paramount that the installation does not deviate from the prescribed installation proposal. Therefore, consult the latest edition of the installation proposal and its addendum on the Business Portal.

Outdoor operation

- The generator is not intended for outdoor use. Working temperature range is 5°C to 60°C.
- Humidity and dust: to avoid risk of damage to electronic components, install the generator in an environment subject to limited relative humidity and low concentration of dust. The generator must also be protected against water droplets, rain and wind. According to the Low Voltage requirements (EN61010), indoor use is recommended for this unit.

Installation area requirements

- Temperature: the ambient temperature in the generator installation area must be between 5 ˚C (41 ˚F) and 60 ˚C (140 ˚F). Install the generator away from heat sources. Therefore, also avoid direct exposure to sunlight.
- Positioning: when selecting the installation area for the generator, take into account minimum clearances required for operation and maintenance. A minimal free space of 600 mm around the generator is recommended. Consult the Installation proposal drawings further in this chapter. Install the generator on a level floor, suitable for taking its weight.

Handling and positioning of the nitrogen generator

The generator must be handled using suitable equipment such as a pallet mover or a forklift truck.

Remove all packing material, taking care not to damage the generator.

	Keep the generator in vertical position **at all times**. It is not designed to be laid on its side (even not during transport!).

Safety valves

Installation of full flow safety valves on the inlet and outlet receivers is obligatory.

Inlet air quality

	The properties of the compressed air at the inlet of the nitrogen generator, as well as the minimum pressure and flow rate requirements, play an important role with regard to its performance and lifetime. **The compressed air used should be of a quality that meets ISO 8573-1; class 1-4-1 . Using a lower quality of compressed air will cause irreversible damage to the generator. In such case, the manufacturer denies all liability for damages and any costs for repairs will be charged to the client.** The purity of the nitrogen produced is reduced when the air pressure at the inlet decreases. Therefore the installation of an accordingly sized compressed air receiver is mandatory. In case of any doubt with regard to the above, contact your supplier for advice on the most suitable compressed air system (compressor, dryer, filters, receiver) for the specific application.

The inlet dew point should be kept at 3 °C and should not exceed 5 °C (at reference conditions). This dew point can be established by a correctly sized refrigerant dryer. In case of high ambient temperatures, an oversized external refrigerant dryer should be selected.

The nitrogen generators can be used with oil injected compressors as well as with oil free compressors.

Please note however that it is of utmost importance to prevent any dust, water or oil from entering the nitrogen generator, because this will damage the carbon molecular sieve material.

Contact your supplier for advice in case of doubt.

- **If an oil injected compressor is used, the coalescing filter and the activated carbon filter have to be installed upstream the compressed air receiver, just after the compressor outlet. (See installation proposal)** On coalescing filters, a drain tube must be installed. The drain pipes to the drain collector must not dip into the water. For draining of pure water when oil injected compressors are used, install an oil/water separator (consult your supplier).
- If an oil free compressor is used, principally no activated carbon filter is required upstream the compressed air receiver. To protect the generator from dust, a general purpose dust filter is to be installed upstream the compressed air receiver. Also install a dust filter downstream the nitrogen receiver to protect the application from eventual dust contamination.
- If the compressor is not equipped with an automatic water separator, install an automatic water separator upstream the inlet filters.

Piping connections

The installation proposals illustrate the components used in a typical nitrogen generator system.

Avoid distances exceeding 2 m (6.5 ft) between the various components.

Fixed piping is recommended, especially for high purities. As otherwise, O_2 molecules might permeate into the system, affecting the purity.

	To facilitate the installation, AIRnet piping is recommended. All piping must be connected free of stress.

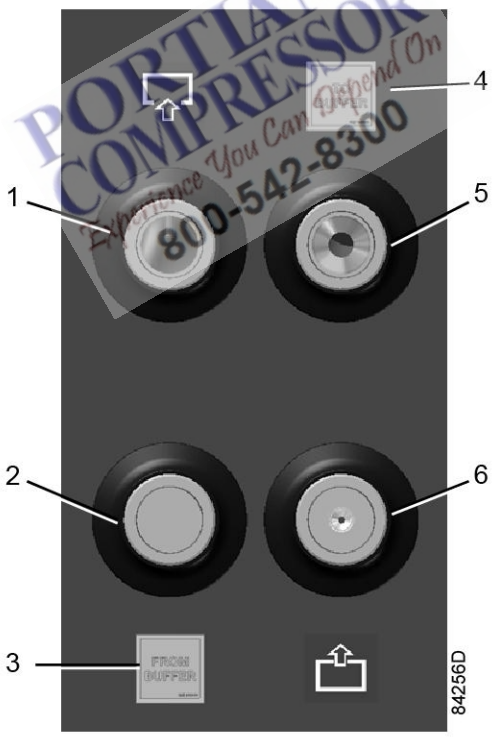
	Attention: Always do a complete leaktest before finalising the installation. To be able to produce high purity nitrogen, the installation has to be entirely leak free. The best way of finding leaks is to isolate the installation under pressure (shut down the generator and close ball valves before air receiver and after nitrogen receiver). Wait for one hour and monitor the drop in pressure. If the drop in pressure is higher than 50 mbar (or 0.72 psi), leaks are present and must be fixed.

The connections are located at the left side panel of the nitrogen generator.

- **Connection of the inlet:**
  Of the four connections, the upper left connection is the compressed air inlet.
  - Connect the hose or pipe.
  - Connect the other end of the hose or pipe to the compressed air receiver (upper connection point).
- **Connection of the nitrogen receiver:**
  - To the nitrogen receiver:
    Of the four connections, the upper right connection (marked TO BUFFER) must be connected to the nitrogen receiver inlet.
    Connect the hose or pipe at the other end to the lower coupling of the nitrogen receiver.
  - From the nitrogen receiver:

Of the four connections, the lower left on (marked FROM BUFFER) must be connected to the nitrogen receiver outlet.
Connect the hose or pipe at the other end to the upper coupling of the nitrogen receiver.

- **Connection of the nitrogen outlet:**
  Of the four connections, the lower right one is the nitrogen outlet.
  From this point on, nitrogen can be consumed. For high purity applications it is recommended to install a second nitrogen receiver to the nitrogen outlet connection.
- **Nitrogen outlet**
  The generator produces nitrogen at a preset purity level (between 95% and 99,999%) according to the user's requirements and required nitrogen flow and pressure.
  The nitrogen flow rate depends on the model and on the required purity.
  The nitrogen pressure depends on the pressure of the compressed air at the inlet.
- **Exhaust**
  In case there is no sufficient ventilation in the room, it is recommended to lead the exhaust of the generator out of the room, since the exhausted air has an increased oxygen concentration.
  To keep the back pressure as low as possible and to guarantee the performance of the generator, the piping to the exhaust has to be sufficiently large. See the table with minimum pipe diameters in section Performance data.
  The back pressure during regeneration (after exhaust) must be kept as low as possible. It should not exceed 100 mbar.



Connections

1	Compressed air inlet connection	4	Label “To buffer” (To buffer tank)
2	From nitrogen receiver connection	5	To nitrogen receiver connection
3	Label “From buffer” (From buffer tank)	6	Nitrogen outlet connection

	• Do not direct the exhaust air towards hot surfaces or heat sources. Increased oxygen levels can increase the risk for fire and explosion hazard. • Keep the exhaust open at all times. Do not block or make the exhaust pipe opening smaller. This might cause decreased performance of the generator or even cause the muffler to explode.

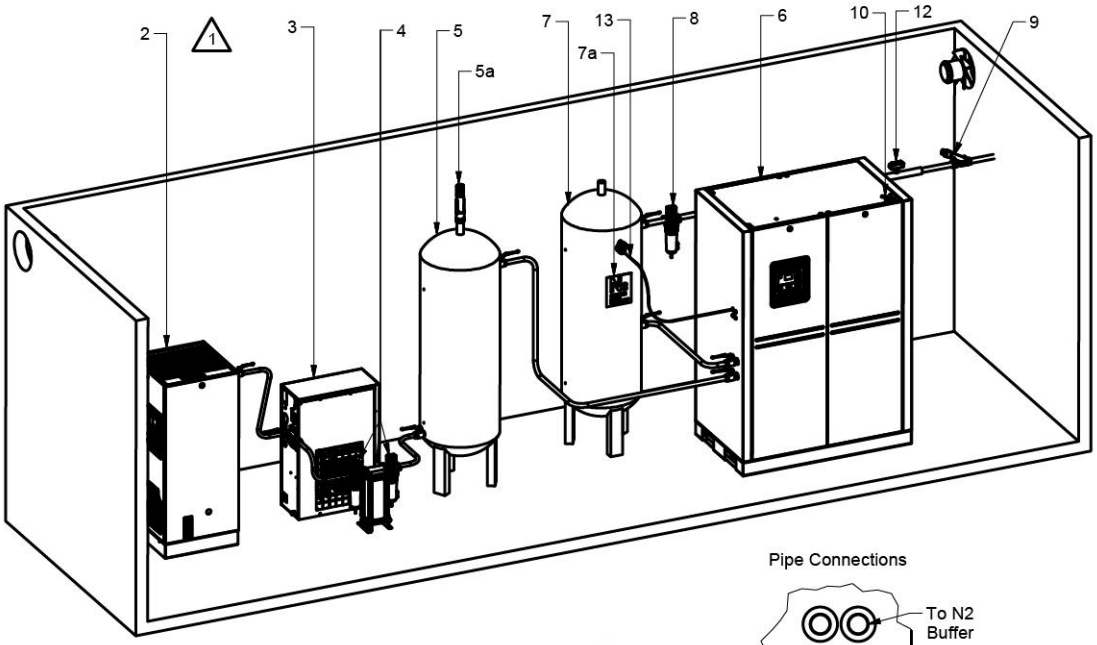
Installation guidelines

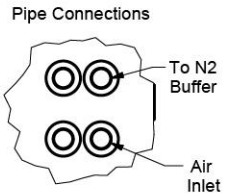
-	It is recommended that the connection of the compressor air outlet pipe is made on top of the main air net pipe in order to minimize carry-over of possible condensate residue. Make sure that no dirt particles (e.g. coming from corrosion in the compressed air network can enter the generator. These particles may be harmful to the generator components).
-	Ventilation: depending on how exhaust air will be vented, appropriate measures have to be taken to make sure that oxygen concentration in the room never exceeds 23.5 % or drops below 19 %. • In many cases, natural ventilation can be sufficient, for example rooms or halls provided with ventilation openings. General guideline is that ventilation openings should at least have a flow area of 1/100 of the floor area; openings should be diagonally opposite to each other and shall ensure a free air circulation without obstacles. When natural ventilation is not possible, a ventilation unit should be foreseen with a capacity of approximately 6 air changes per hour (with a minimum of 4 air changes per hour). There shall be a safety warning in case ventilation fails. • Note that each installation may require specific measures to ensure that oxygen concentration in the room never exceeds the mentioned limits. It is the responsibility of the installer to make sure that adequate measures are taken. • Special consideration to the ventilation of underground rooms, pits, trenches, etc. is to be given: Since oxygen is heavier than air, oxygen gas tends to accumulate in low lying areas.
-	Room oxygen level detection system: When operators are working in the vicinity of gas generating equipment and the oxygen content can rise or drop to a dangerous level, a continuous measurement system is necessary. A system with a visual/audible alarm is advisable. The oxygen level detection systems needs to be put in the working area and near the operator.
-	Filter drain connections should be connected to a drain collector but must not dip into the water of the drain collector.
-	Use the main cable entry to connect the power supply cable to the unit.
-	Make sure that the hose length is as short as possible if it is required to measure nitrogen at a customer defined sample point in the network (for example the nitrogen receiver).

Warnings

	• If a failure in gas supply (e.g. due to a power failure, the activation of an electrical safety device, or a generator fault) is - even temporarily - not admissible, it can be advisable to foresee a backup nitrogen source to enable provisional supply of gas (totally or partially automatic). • To ensure compliance with the standards imposed by the Machinery Directive, the restart of the generator after the electrical power supply is restored cannot be automatic. It must be activated manually by the operator. • If the generator is connected to an existing pressure net, it is recommended to install a pressure regulator and a check valve before the air receiver in order to maintain constant pressure. • When the generator is used to fill a large vessel (larger than 2000 liters) or when it’s used to fill a vessel which will experience large pressure differences (larger than 2 bar), it is advised to install a separate nitrogen buffer vessel.

Single generator set-up





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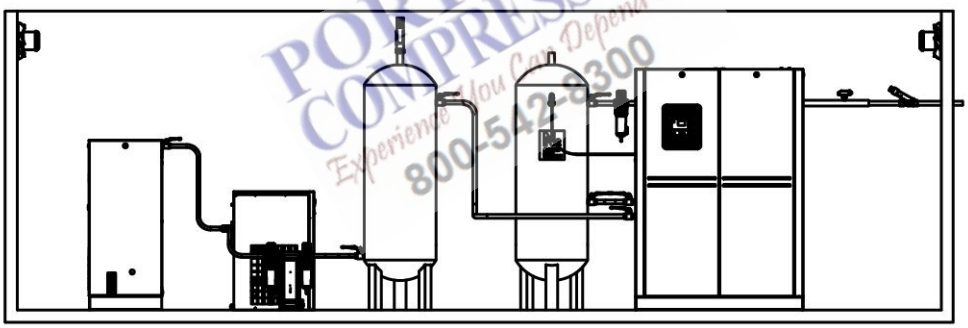
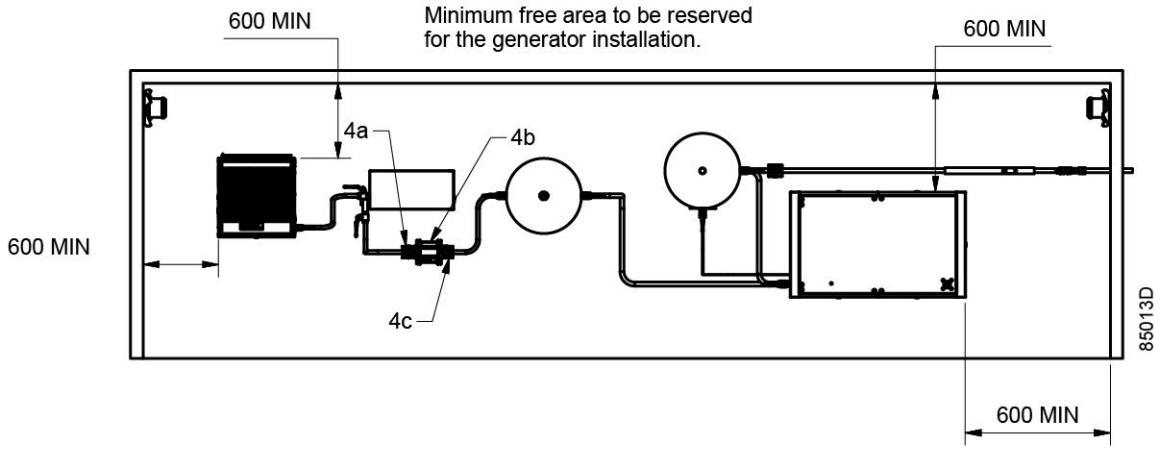




1	Compressor with integrated refrigerant dryer	6	Solid particle filter
2	Filters (oil coalescing filter + activated carbon tower + solid particle filter)	7	Needle valve
3	Air receiver	8	Purity sample line
4	Nitrogen generator	9	Optional flow sensor
5	Nitrogen receiver		

Text on image:

(1)	Minimum free area to be reserved for the generator installation	(2)	Exhaust

Ventilation requirements: minimum 4 air changes per hour.

Observe the minimal vessel sizes and pipe sizes. See the tables with minimum piping diameters and minimum receiver sizes in section Performance data.

	When the generator is used to fill a large vessel (larger than 2 times the recommended volume) or when it is used to fill a vessel which will experience large pressure differences (larger than 1,0 bar), it is advised to install a separate buffer vessel downstream the flow regulator valve. When a load/unload compressor is used as a single source of compressed air, the inlet air receiver should be oversized by a factor of at least 1.5. This allows for the compressor pressure band to be set at 0.5 bar.

	The nitrogen generators only work properly when the inlet pressure is stable (inlet pressure fluctuation within 0.5 bar). To achieve this, follow the listed recommendations according to the situation: • When the compressor is oversized (load/unload period lower than 2 minutes): increase inlet pressure so the oversizing is compensated. This also allows for more nitrogen to be produced. • When the compressor is undersized (running continuously): decrease the inlet pressure. • When the generator is connected to an existing compressed air installation: install a check valve and pressure regulator before the air receiver.

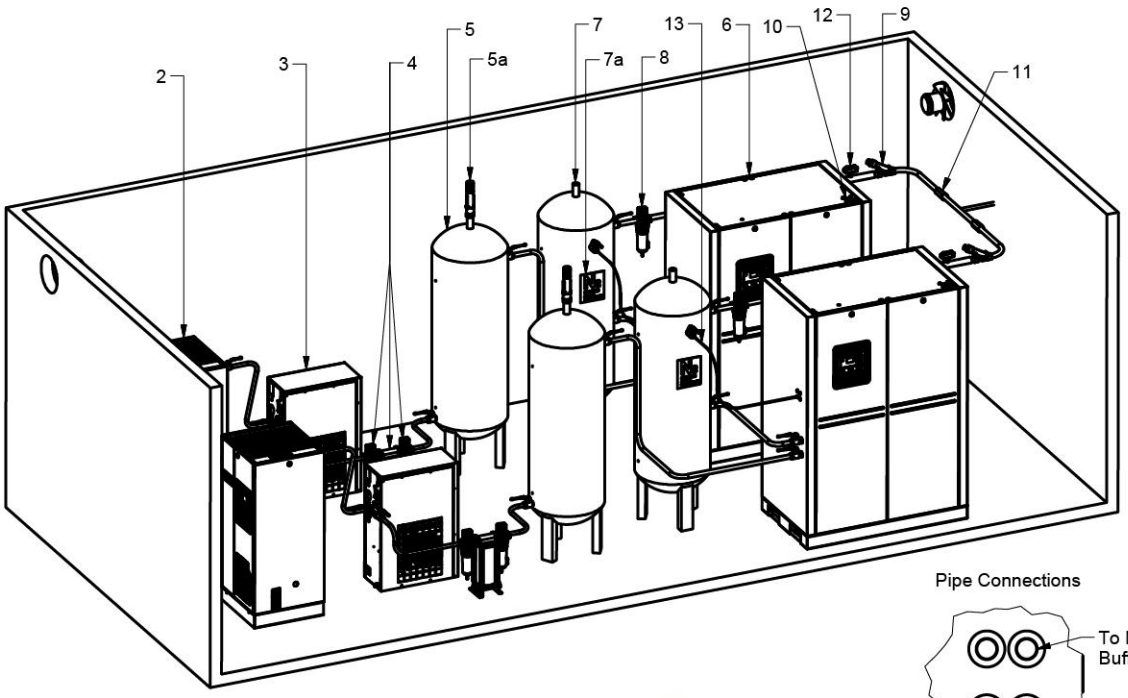
Filters:

The prefilter (2a) for general-purpose filtration (particle removal down to 1micron with a maximum oil carry-over of 0.5 ppm). A high efficiency prefilter (2b) installed downstream the prefilter (2a) (particle removal down to 0.01 micron and max. oil carry-over of 0.01 ppm). An activated carbon tower filter (2c) (max. oil vapour carry-over of 0.003 ppm.) must be installed downstream the Prefilter (2b). An afterfilter dust filter downstream the activated carbon tower filter particle remove down to 1 micron. In case of an oil-free air compressor, no prefilter (2a) or activated carbon tower filter is to be installed.

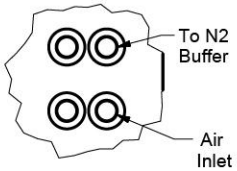
The outlet filter type afterfilter dust (7) for general purpose filtration (particle removal down to 1 micron).

Generators in parallel

When assembling more units in parallel, it is recommended to install a separate nitrogen receiver for each unit.



Pipe Connections



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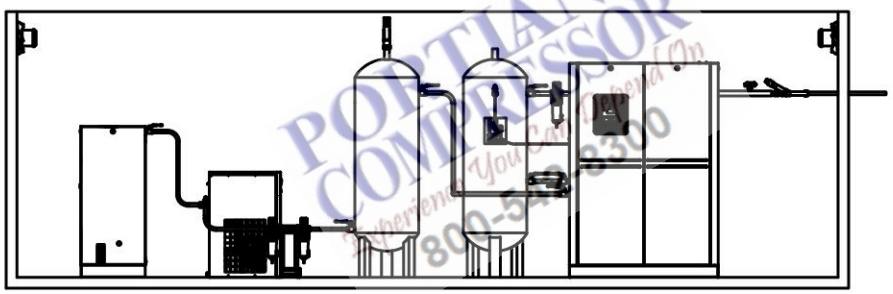
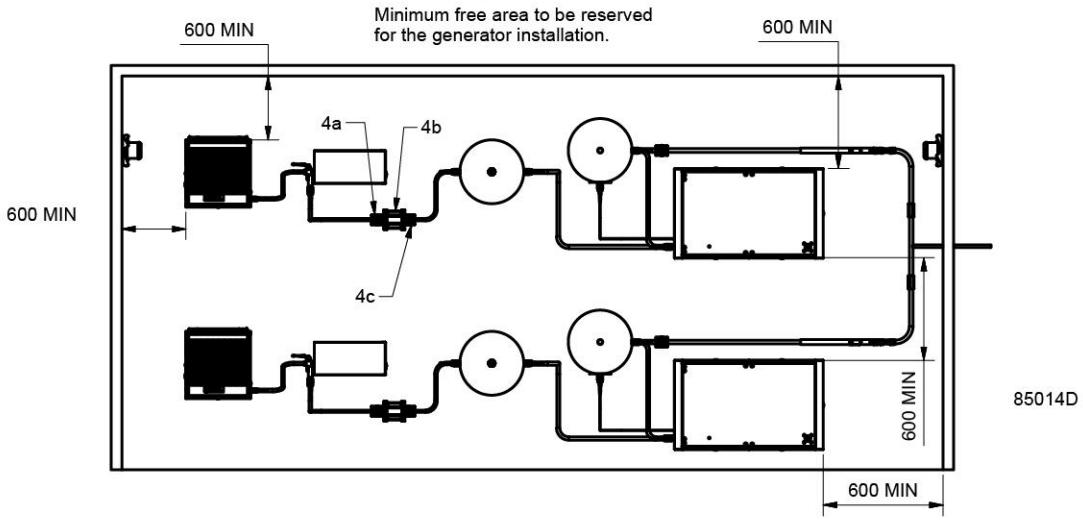




85014D

1	Compressor with integrated refrigerant dryer	6	Solid particle filter
2	Filters (oil coalescing filter + activated carbon tower + solid particle filter)	7	Needle valve
3	Air receiver	8	Check valve
4	Nitrogen generator	9	Optional flow sensor
5	Nitrogen receiver	10	Purity sample line

Text on image:

(1)	Minimum free area to be reserved for the generator installation	(2)	Exhaust

Ventilation requirements: minimum 4 air changes per hour.

Observe the minimal vessel sizes and pipe sizes. See the tables with minimum piping diameters and minimum receiver sizes in section Performance data.

Filters:

The prefilter (2a) for general-purpose filtration (particle removal down to 1micron with a maximum oil carry-over of 0.5 ppm). A high efficiency prefilter (2b) installed downstream the prefilter (2a) (particle removal down to 0.01 micron and max. oil carry-over of 0.01 ppm). An activated carbon tower filter (2c) (max. oil vapour carry-over of 0.003 ppm.) must be installed downstream the Prefilter (2b). An afterfilter dust filter downstream the activated carbon tower filter particle remove down to 1 micron. In case of an oil-free air compressor, no prefilter (2a) or activated carbon tower filter is to be installed.

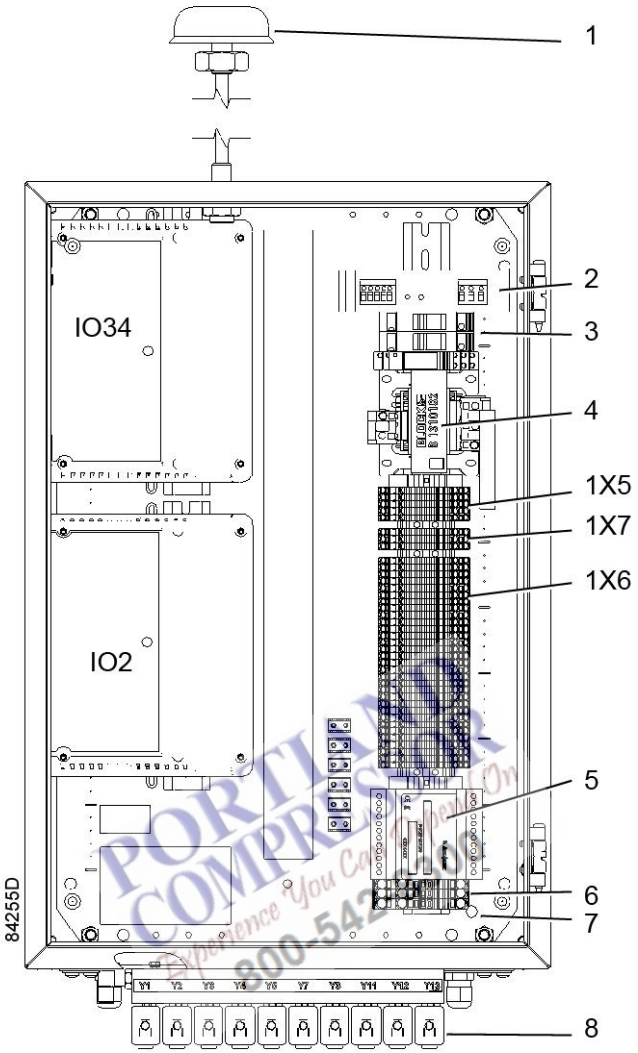
The outlet filter type afterfilter dust (7) for general purpose filtration (particle removal down to 1 micron).

3.3 Electrical connections

Electric power supply

⚠	For safety reasons, the following instructions must be observed strictly. The electrical installation must comply with current standards, in particular regarding the earthing line. Recommendations: • Always connect the earthing line. • The main socket must be located in an easily accessible position. • Low voltage fuses on the unit and fuse installation at customer location is specified on the service diagram included in the documentation. Before any service intervention on the unit please make sure that the electrical power is totally disconnected. Therefore, please unplug the unit from the main power supply.

Electrical wiring

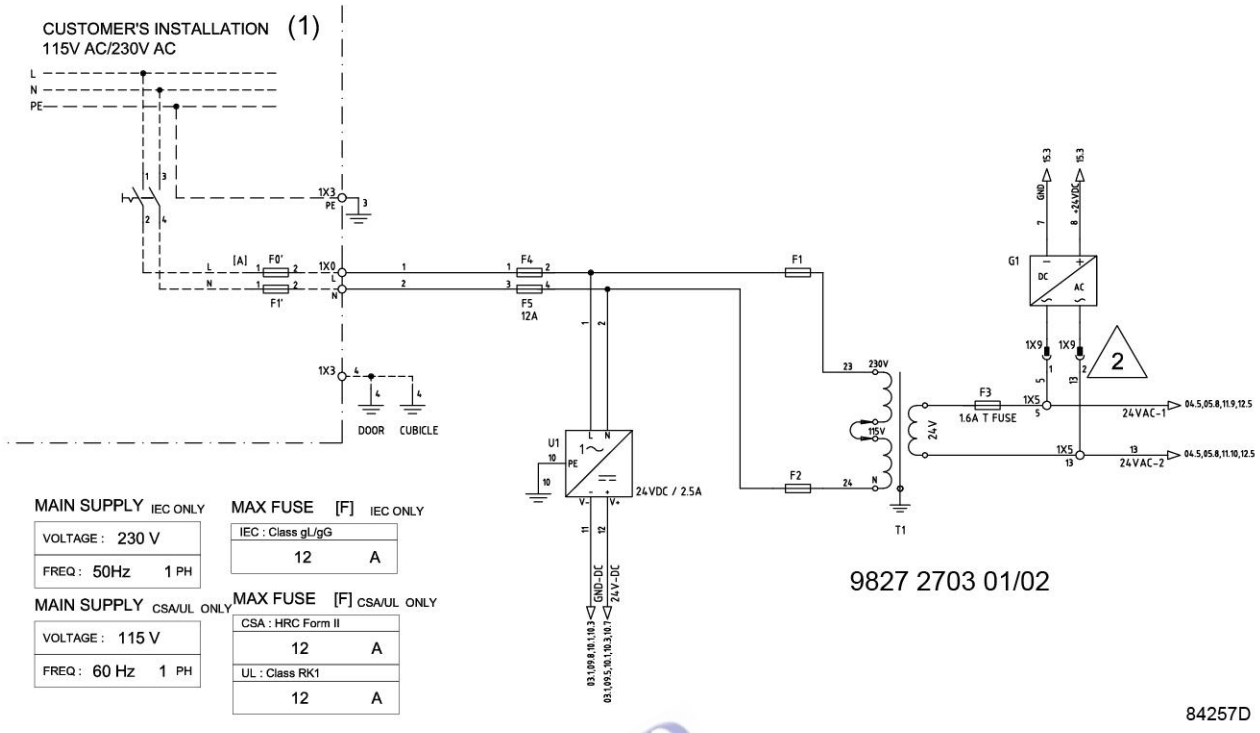


Typical cubicle view

1	Antenna	5	Oxygen analyzer
2	DC power supply	6	Power connection
3	Main fuses	7	PE connection
4	Transformer	8	Solenoid valves
1X5	Connection terminals	IO34	Expansion module
1X7	Connection terminals	IO2	Expansion module
1X6	Connection terminals		

Connection procedure:

- Make sure to check the supply voltage and connect the transformer's primary winding accordingly. Refer to the electrical diagram to ensure proper connection.
- The power cable is not supplied with the generator. Follow local regulations for the main power cord. Please refer to the electrical diagram to properly connect the main supply cable.



(1)	Customer's Installation

- External alarm signal
  If desired, the general alarm and generator running signals, generated by the controller of the generator, can be brought to the customer's installation. To do so, please refer to the electrical diagram for the proper connections to terminals 1X7:72 and 1X7:82 of the electrical control box.
- Re-transmitting purity signal
  The 4-20 mA signal from the oxygen sensor can be re-transmitted to an external system by connecting to terminals 1X6:36 and 1X6:37 of the electrical control box. Please refer to the electrical diagram for the appropriate connections.

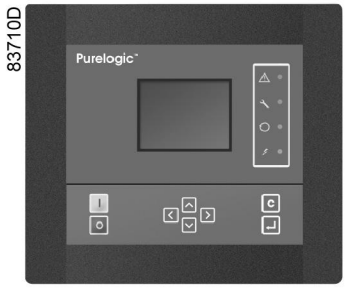
	Nitrogen purity	
Variant	**4 mA**	**20 mA**
% variant	100 %	90 %
ppm variant	100 %	99.9 %

Electrical power consumption	200 W
Electrical fuse rating	12 A

4 Purelogic™ controller

4.1 General

Controller



General description

The Purelogic™ controller automatically controls and protects the generator, i.e.:

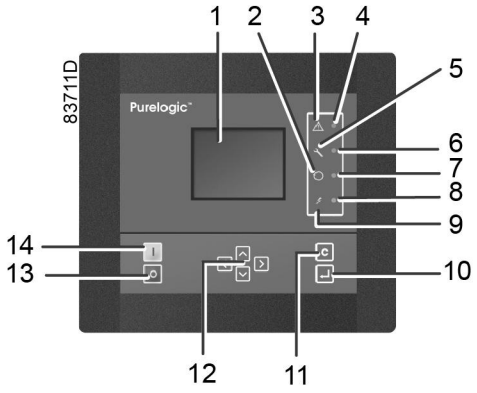
- monitoring pressures, dew points, flow and digital switches to ensure safe operation, and stopping the generator whenever necessary
- provide guaranteed purity to the consumer.

In order to control the generator and to read and modify programmable parameters, the controller has a control panel provided with:

- LEDs indicating the status of the generator
- a display indicating the operating conditions or a fault
- keys to control the generator and to access the data collected by the controller
- buttons to manually start and stop the generator

4.2 Control panel

Purelogic™ controller



Parts and functions

Reference	Designation	Function
1	Display	Shows the generator operating condition and a number of icons to navigate through the menu.
2	Pictograph	Automatic operation
3	Pictograph	General alarm
4	General alarm LED	Flashes if a shut-down warning condition exists.
5	Pictograph	Service
6	Service LED	Lights up if service is needed
7	Automatic operation LED	Indicates that the controller is automatically controlling the generator.
8	Voltage on LED	Indicates that the voltage is switched on.
9	Pictograph	Voltage on
10	Enter key	Key to activate the selected menu or to modify the selected parameter.
11	Escape key	To go to previous screen or to end the current action
12	Scroll keys	Keys to scroll through the menu.
13	Stop button	Button to stop the generator. LED (7) goes out.
14	Start button	Button to start the generator. LED (7) lights up indicating that the Purelogic™ controller is operative.

4.3 Icons used

Status icons

Name	Icon	Description
Stopped/Running	 57786F	When the generator is stopped, the icon stands still. When the generator is running, the icon is rotating.
Machine control mode	 83815F	Local start/stop
	 57791F	Remote start/stop
	 57792F	Network control
Automatic restart after voltage failure	 57793F	Automatic restart after voltage failure is active

Week timer	 57794F	Week timer is active
Active protection functions	 57796F	Shutdown
	 57797F	Warning
Service	 57798F	Service required
Main screen	 83776F	Change main screen
	 82196F	Main chart
Operation mode	 83881F	Automatic
	 83882F	Manual

System icons

Icon	Description
 57804F	Generator
 57808F	Filter
 57810F	Failure expansion module
 57792F	Network problem
 57812F	General alarm

Menu icons

Icon	Description

 57813F	Inputs
 57814F	Outputs
 57812F	Alarms (Warnings, shutdowns)
 57815F	Counters
 58499D	Test
 57817F	Settings
 57798F	Service
 57818F	Event history (saved data)
 57819F	Access key/User password
 57792F	Network
 57820F	Set point
 57867F	Info
 59807D	General settings
 59804D	Valves

Navigation arrows

Icon	Description
 57821F	Up
 57822F	Down

4.4 Main screen

Control panel

(1)	Scroll keys
(2)	Enter key
(3)	Escape key

Function

The Main screen shows the status of the generator operation and is the gateway to all functions implemented in the controller.

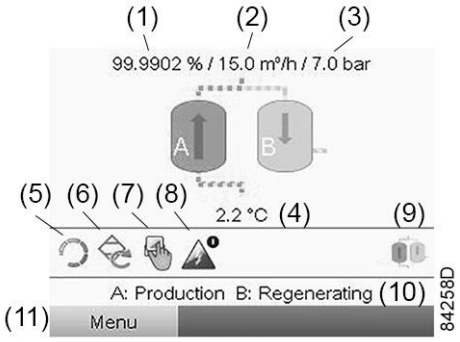
The Main screen is shown automatically when the voltage is switched on and one of the keys is pushed. It is switched off automatically after a few minutes when no keys are pushed.

Typically, 6 different main screen views can be chosen:

1. Generator animation
2. Two value lines
3. Four value lines
4. Chart (High resolution)
5. Chart (Medium resolution)
6. Chart (Low resolution)

Generator animation

This type of Main screen shows the operating of the generator as an animation.

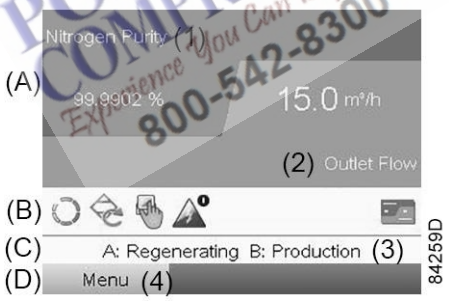


Text on image

(1)	Nitrogen purity	(7)	Regulation
(2)	Outlet flow (optional)	(8)	Automatic restart after voltage failure
(3)	Outlet pressure	(9)	Main screen layout
(4)	Inlet pressure dew point (optional)	(10)	Generator operation (A: producing nitrogen, B is regenerating)
(5)	Running mode	(11)	Menu
(6)	Operation mode		

Two and four value lines views

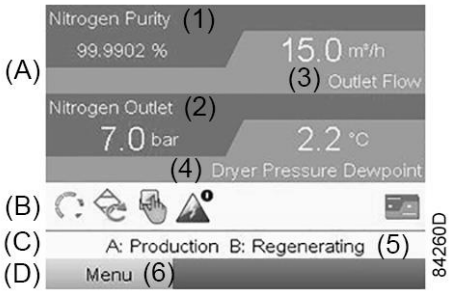
This type of Main screen shows the value of 2 or 4 parameters (see section Inputs menu).



Two value lines view

Text on image

(1)	Nitrogen Purity	(3)	A: Regenerating B: Production
(2)	Outlet Flow (optional)	(4)	Menu



Four value lines view

Text on image

(1)	Nitrogen Purity	(4)	Dryer Pressure Dewpoint
(2)	Nitrogen Outlet	(5)	A: Production B Regenerating
(3)	Outlet Flow (optional)	(6)	Menu

- **Section A** shows information regarding the generator operation.
- **Section B** shows Status icons. Following icon types are shown in this field:
  - Fixed icons
    These icons are always shown in the main screen (e.g. generator stopped or running, generator status).
  - Optional icons
    These icons are only shown if their corresponding function is activated (e.g. week timer, automatic restart after voltage failure , etc.)
  - Pop up icons
    These icons pop up if an abnormal condition occurs (warnings, shutdowns, service,...)

  To call up more information about the icons shown, select the icon concerned using the scroll keys and press the enter key.
  For more information on these icons, see Icons used.
- **Section C** is called the Status bar.
  This bar shows the text that corresponds to the selected icon.
- **Section D** shows the Action buttons. These buttons are used:
  - To call up or program settings
  - For service message or emergency stop
  - To have access to all data collected by the controller

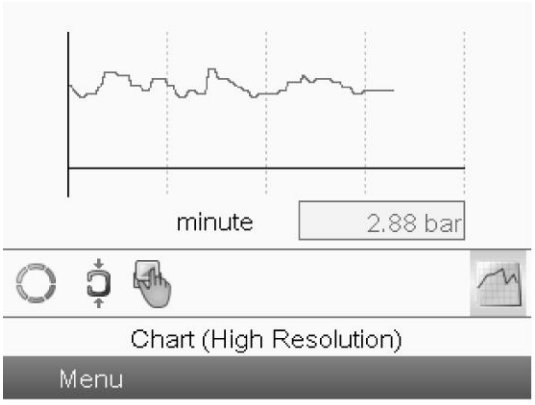
  The function of the buttons depends on the displayed menu. The most common functions are:

Designation	Function
Menu	To go to the menu
Modify	To modify programmable settings
Reset	To reset a timer or message

To activate an action button, highlight the button by using the Scroll keys and press the Enter key.
To go back to the previous menu, press the Escape key.

Chart views

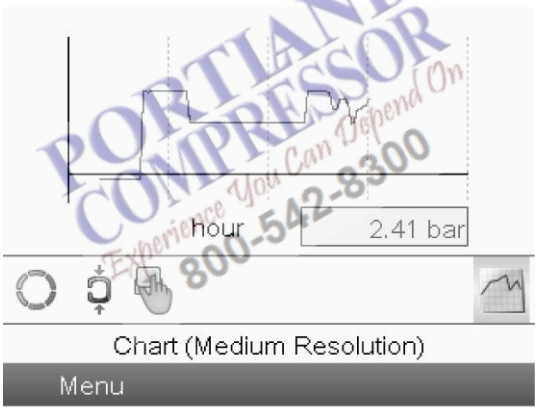
To change the plotted input signal, go to the input menu and select the desired input signal.



59166D

When Chart (High Resolution) is selected, a chart showing the value of a parameter selected in the Inputs menu per minute is shown on the Main screen. Each point in the chart is 1 second. The screen shows the last 4 minutes.

The switch button icon for selecting other screens is changed into a small Chart and is highlighted (active).



59167D

When Chart (Medium Resolution) is selected, a chart showing the parameter per hour is shown on the Main screen. Each point is the average of 1 minute. The screen shows the last 4 hours.

The switch button icon for selecting other screens is changed into a small Chart and is highlighted (active).

When Chart (Low Resolution) is selected, a chart showing the parameter per day is shown on the Main screen. Each point is the average of 1 hour. The screen shows the evolution over the last 10 days.

The switch button icon for selecting other screens is changed into a small Chart and is highlighted (active).

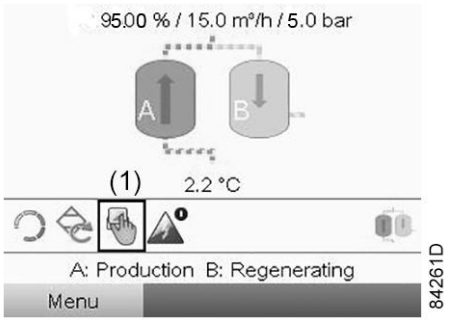
4.5 Control mode selection

Function

To select the regulation mode, i.e. whether the generator is in local control, remote control or controlled via a local area network (LAN).

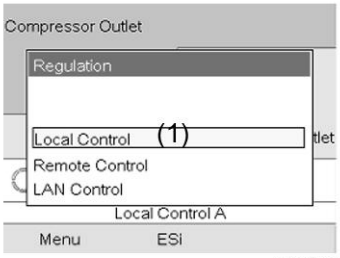
Procedure

Starting from the main screen, use the scroll buttons to go to the Local start/stop icon (1) and press the Enter button:



There are 3 possibilities:

- Local control
- Remote control
- LAN (network) control



After selecting the required regulation mode, press the Enter button on the controller to confirm your selection. The new setting is now visible on the Main screen. See section Icons used for the meaning of the icons.

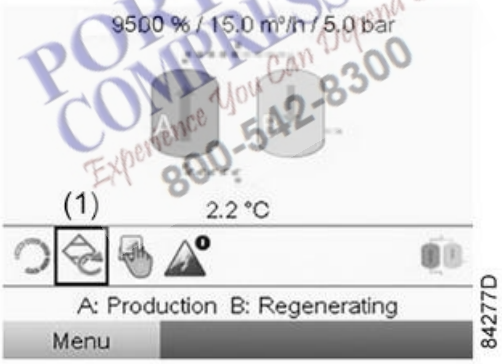
4.6 Operation mode selection

Function

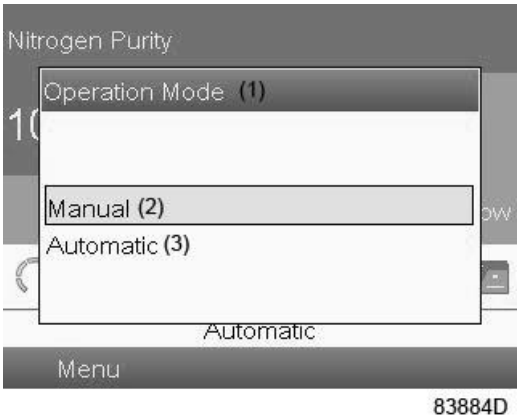
To select the operation mode, i.e. whether the generator is in automatic mode or manual mode.

Procedure

Starting from the Main screen, use the Scroll keys to go the Operation icon and press the Enter button.



The following screen appears:



Text on figure

(1)	Operation Mode
(2)	Manual
(3)	Automatic

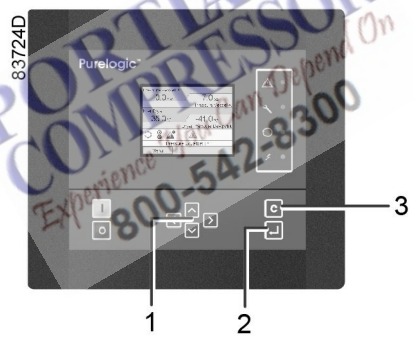
There are two modes:

- Manual mode: The generator operates independently of the nitrogen consumption. After selecting this mode, the operation mode will switch automatically to automatic operation after 24 hours of operation.
- Automatic mode: in automatic mode, the generator will monitor the outlet pressure and enter standby mode when the standby limit (Stop Pressure) is reached. When the pressure drops to Start Pressure, the generator will restart automatically.

After selecting the required operation mode, press the Enter button to confirm your selection. The new setting is now visible on the Main screen. For information on the icons, see Icons used.

4.7 Calling up menus

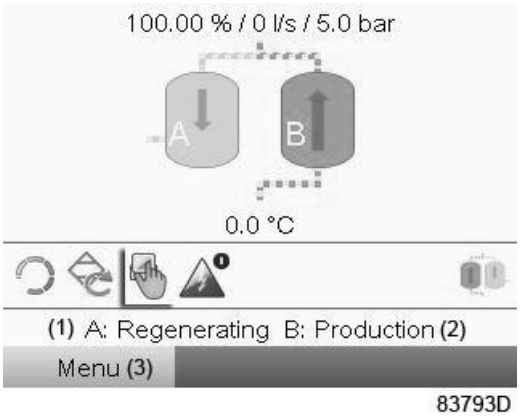
Control panel



(1)	Scroll keys
(2)	Enter key
(3)	Escape key

Description

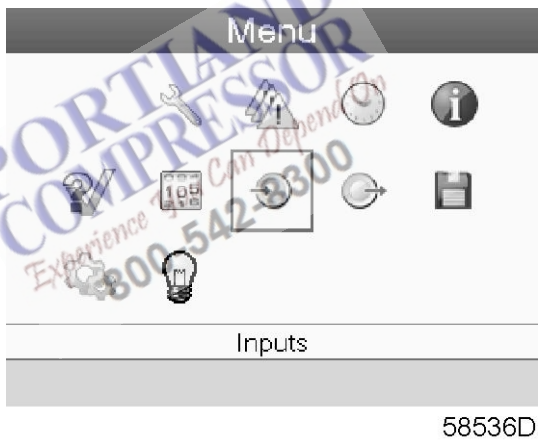
When the voltage is switched on, the main screen is shown automatically (see section Main screen):



Text on figure

(1)	A: Regenerating
(2)	B: Production
(3)	Menu

- To go to the Menu screen, highlight the Menu button (3), using the Scroll keys.
- Press the Enter key to select the menu. Following screen appears:



- The screen shows a number of icons. Each icon indicates a menu item. By default, the Inputs icon is selected. The status bar shows the name of the menu that corresponds with the selected icon.
- Use the Scroll keys to select an icon.
- Press the Enter key (2) to open the menu or press the Escape key (3) to return to the Main screen.

4.8 Inputs menu

Menu icon, Inputs

Function

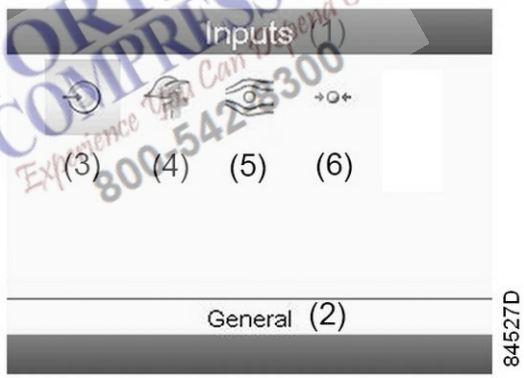
To call up information regarding the actually measured data and the status of some inputs such as the Vessel Pressure.

Procedure

Starting from the main screen (see Main screen):

- Move the cursor to the Menu button and press the Enter key.
- Using the Scroll keys, move the cursor to the Inputs icon.

- Press the Enter key. Following screen appears:



Text on figure

(1)	Inputs	
(2)	General	Contacts status
(3)	Inputs icon	
(4)	Air quality icon	Inputs for inlet and outlet gas quality
(5)	Flow icon	Outlet flow
(6)	Pressure icon	Inlet, outlet and absorber pressures

- The screen shows a list of icons.
- Using the Scroll keys, move the cursor to the desired icon and press the Enter button (2).
- A pop-up screen appears.

4.9 Outputs menu

Menu icon, Outputs

Function

To call up information regarding the actual status of some outputs such as the generator standby, purity alarm, general shutdown, etc.

Procedure

Starting from the Main screen (see section Main screen):

- Move the cursor to the Menu button and press the Enter key.
- Move the cursor to the Outputs icon using the Scroll keys.

83817D

- Press the Enter key. Following screen appears:

83864D

Text on figure

(1)	Outputs
(2)	Pressure Dewpoint
(3)	Purity
(4)	Outlet Flow
(5)	Running

The screen shows a list of data.

4.10 Counters

Menu icon, Counters

Function

To call up:

- The running hours
- The number of generator starts
- The number of hours that the controller has been powered
- The operational state timers

Procedure

Starting from the Main screen (see Main screen):

- Move the cursor to the Menu button and press the Enter key.
- Using the Scroll keys, move the cursor to the Counters icon. Following screen appears:

- Press the Enter key. Following screen appears:

Text on figure

(1)	Counters
(2)	Running Hours
(3)	Module Hours
(4)	Loaded Hours
(5)	Actual state time

The screen shows a list of all counters with their actual readings. A number of counters keep track of the state of the generator:

- **Running hours:** counts the operation hours of the generator.
- **Loaded hours:** the same as running hours, but shows to which time interval the energy counters refer; this counter is also reset when the energy counters are reset.
- **Actual state time:** shows how long the current state has been active.
- **Programmed state time:** shows how long (at most) the current state should be active.
- **Actual half cycle time:** shows how long the adsorbing vessel has been adsorbing (since last vessel shift).
- **Programmed half cycle time:** shows how long the half cycle should take.
- **Regeneration cycles vessel A:** integer that counts how many cycles vessel A has performed.
- **Regeneration cycles vessel B:** integer that counts how many cycles vessel B has performed.
- **Module hours:** shows how long the Purelogic™ controller has been active. This timer can not be reset, not even when downloading new Purelogic™ software.

4.11 Event history menu

Menu icon, Event History

Function

To call up the last shut-down and last emergency stop data.

Procedure

Starting from the Main screen (see Main screen):

- Move the cursor to the action button Menu and press the Enter key.
- Using the Scroll keys, move the cursor to the Event History icon. Following screen appears:

- The list of last shut-down and emergency stop cases is shown.
- Scroll through the items to select the desired shut-down or emergency stop event.
- Press the Enter key to find the date, time and other data reflecting the status of the generator when that shut-down or emergency stop occurred.

4.12 Service menu

Menu icon, Service

Function

- To reset the service plans which are carried out.
- To check when the next service plans are to be carried out.
- To find out which service plans were carried out in the past.
- To modify the programmed service intervals.

Procedure

Starting from the Main screen (see Main screen):

- Move the cursor to the Menu button and press the Enter key.
- Using the Scroll keys, move the cursor to the Service icon. Following screen appears:

83820D

- Press the Enter key. Following screen appears:

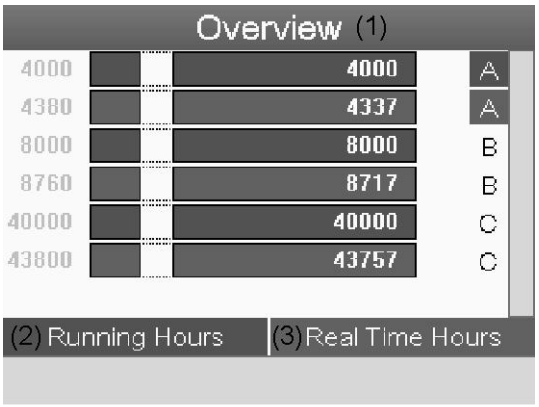
57847F_1

Text on figure

(1)	Service
(2)	Overview
(3)	Service plan
(4)	Next service
(5)	History

- Scroll through the items to select the desired item and press the Enter key to see the details as explained below.

Overview



58542D

Text on figure

(1)	Overview
(2)	Running Hours (green)
(3)	Real Time hours (blue)

Example for service level (A):

The figures at the left are the programmed service intervals. For Service interval A, the programmed number of running hours is 4000 hours (upper row, green) and the programmed number of real time hours is 4380 hours, which corresponds to six months (second row, blue). This means that the controller will launch a service warning when either 4000 running hours or 4380 real hours are reached, whichever comes first. Note that the real time hours counter keeps counting, also when the controller is not powered.

The figures within the bars are the number of hours to go till the next service intervention. In the example above, the generator was just started up, which means it still has 4000 running hours or 4337 hours to go before the next Service intervention.

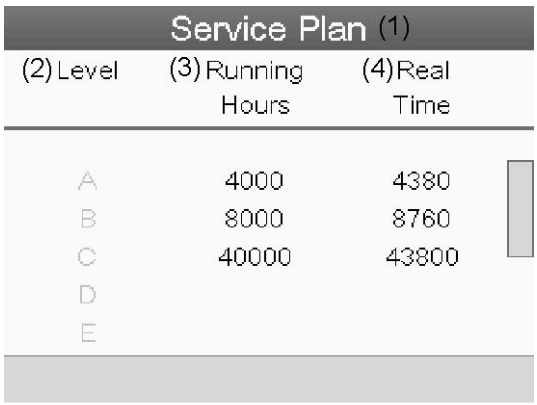
Service plans

A number of service operations are grouped (called Level A, Level B, etc...). Each level stands for a number of service actions to be carried out at the time intervals programmed in the Purelogic™ controller.

When a service plan interval is reached, a message will appear on the screen.

After carrying out the service actions related to the indicated levels, the timers must be reset.

From the Service menu above, select Service plan (3) and press Enter. Following screen appears:

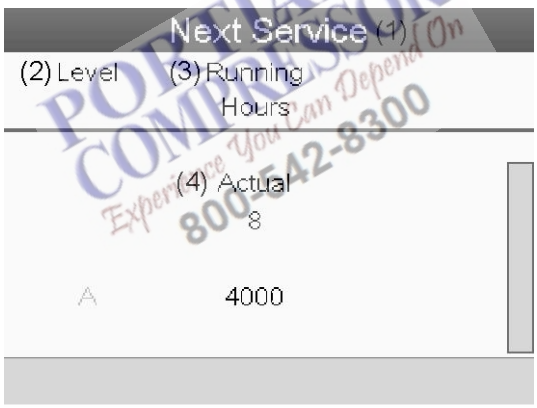


58543D

Text on figure

(1)	Service plan
(2)	Level
(3)	Running hours
(4)	Real time

Next Service



58544D

Text on figure

(1)	Next service
(2)	Level
(3)	Running hours
(4)	Actual

In the example above, the A Service level is programmed at 4000 running hours, of which 8 hours have passed.

History

The History screen shows a list of all service actions done in the past, sorted by date. The date at the top is the most recent service action. To see the details of a completed service action (e.g.

Service level, Running hours or Real time hours), use the Scroll keys to select the desired action and press the Enter key.

4.13 Protections menu

Menu icon, Protections

Function

To call-up the protections.

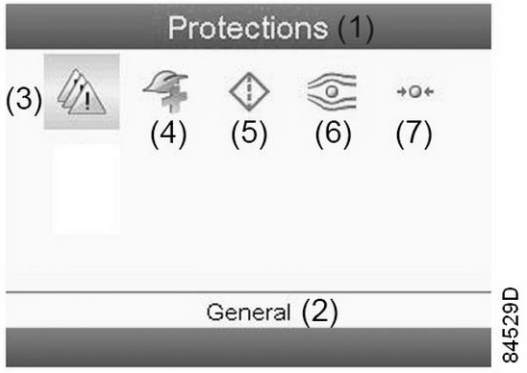
	Before resetting a warning or shut down message, always remedy the problem. Frequently resetting these messages without remedying may damage the generator.

Procedure

Starting from the Main screen (see Main screen):

- Move the cursor to the Menu button and press the Enter key (2).
- Using the scroll keys, move the cursor to the Protections icon. Following screen appears:

- Press the enter key (2). Following screen appears:



Text on figure

(1)	Protections	
(2)	General	Status of contacts and special alarms
(3)	Warnings icon	
(4)	Air quality icon	Inputs for inlet and outlet gas quality
(5)	Filters icon	Filters status
(6)	Flow icon	Outlet flow
(7)	Pressures icon	Inlet, outlet and absorber pressures

- Use the Scroll keys to select a protection.
- Press the Enter key (2) to modify the warning/shutdown level.
- If a protection is a warning or shutdown, the warning or shutdown icon blinks below the protection icon.

4.14 Week timer menu

Menu icon, Week timer

Function

	In case the generator is programmed to automatically stop, make sure the nitrogen buffer vessel remains pressurized during standstill. If not, the start-up procedure needs to be followed each time.

- To program time-based start/stop commands for the generator.
- To program time-based change-over commands for the net pressure band.
- Four different week schemes can be programmed.
- A week cycle can be programmed; a week cycle is a sequence of 10 weeks. For each week in the cycle, one of the four programmed week schemes can be chosen.

Procedure

Starting from the Main screen (see Main screen):

- Move the cursor to the Menu button and press the Enter key. Use the Scroll buttons to select the Week timer icon.

83822D

- Press the Enter key on the controller. Following screen appears:

58497D

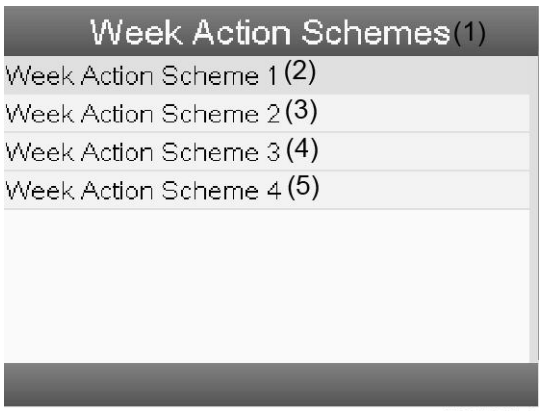
Text on figure

(1)	Week Timer
(2)	Week Action Schemes
(3)	Week Cycle
(4)	Status
(5)	Week 1
(6)	Remaining Running Time

The first item in this list is highlighted in red. Select the item requested and press the Enter key on the controller to modify.

Programming week schemes

- Select Week action schemes and press Enter. A new window opens. The first item in the list is highlighted in red. Press the Enter key on the controller to modify Week Action Scheme 1.



58498D

Text on figure

(1)	Week Action Schemes
(2)	Week Action Scheme 1
(3)	Week Action Scheme 2
(4)	Week Action Scheme 3
(5)	Week Action Scheme 4

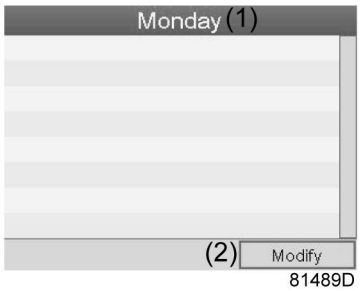
- A weekly list is shown. Monday is automatically selected and highlighted in red. Press the Enter key on the controller to set an action for this day.

81488D

Text on figure

(1)	Week Action Scheme 1
(2)	Monday
(3)	Tuesday
(4)	Wednesday
(5)	Thursday
(6)	Friday
(7)	Saturday
(8)	Sunday

- A new window opens. The Modify action button is selected. Press the Enter button on the controller to create an action.

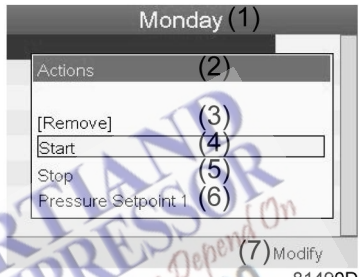


81489D

Text on figure

(1)	Monday
(2)	Modify

- A new pop-up window opens. Select an action from this list by using the Scroll keys on the controller. When ready press the Enter key to confirm.

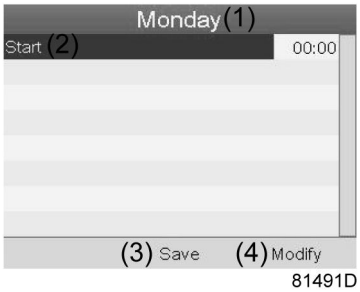


81490D

Text on figure

(1)	Monday
(2)	Actions
(3)	Remove
(4)	Start
(5)	Stop
(6)	Pressure Set point 1
(7)	Modify

- A new window opens. The action is now visible in the first day of the week.

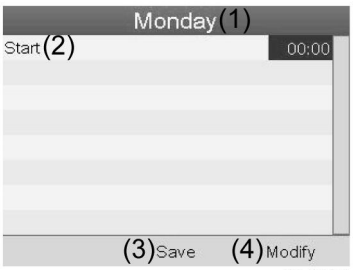


81491D

Text on figure

(1)	Monday
(2)	Start
(3)	Save
(4)	Modify

- To adjust the time, use the Scroll keys on the controller and press the Enter key to confirm.

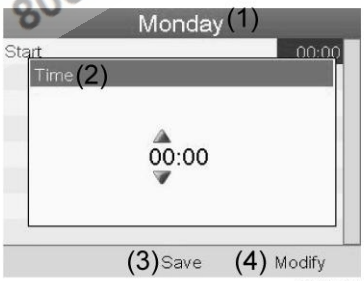


81492D

Text on figure

(1)	Monday
(2)	Start
(3)	Save
(4)	Modify

- A pop-up window opens. Use the ↑ or ↓ key of Scroll keys to modify the values of the hours. Use the ← or → Scroll keys to modify the minutes.

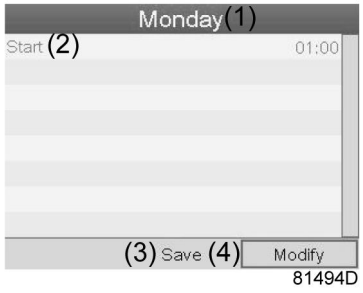


81493D

Text on figure

(1)	Monday
(2)	Time
(3)	Save
(4)	Modify

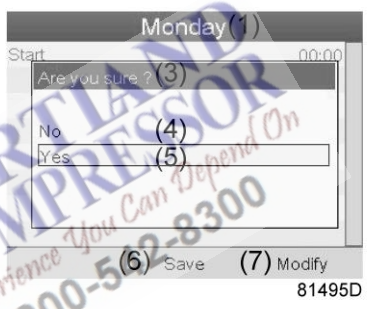
- Press the Escape key on the controller. The action button Modify is selected. Use the Scroll keys to select the action Save.



Text on figure

(1)	Monday
(2)	Start
(3)	Save
(4)	Modify

- A new pop-up window opens. Use the Scroll keys on the controller to select the correct actions. Press the Enter key to confirm.

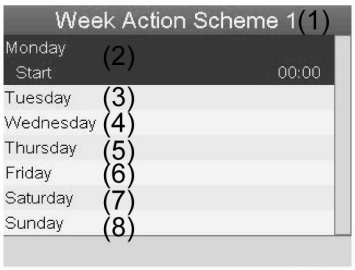


Text on figure

(1)	Monday
(3)	Are you sure?
(4)	No
(5)	Yes
(6)	Save
(7)	Modify

Press the Escape key to leave this window.

- The action is shown below the day the action is planned.



81497D

Text on figure

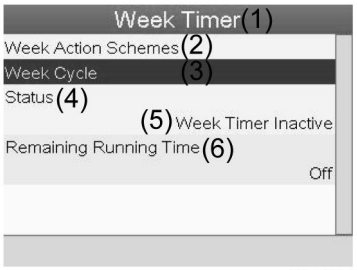
(1)	Week Action Scheme 1
(2)	Monday - Start
(3)	Tuesday
(4)	Wednesday
(5)	Thursday
(6)	Friday
(7)	Saturday
(8)	Sunday

Press the Escape key on the controller to leave this screen.

Programming the week cycle

A week cycle is a sequence of 10 weeks. For each week in the cycle, one of the four programmed week schemes can be chosen.

- Select Week Cycle from the main Week Timer menu list.

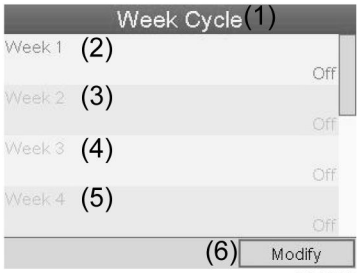


81496D

Text on figure

(1)	Week Timer
(2)	Week Action Schemes
(3)	Week Cycle
(4)	Status
(5)	Week Timer Inactive
(6)	Remaining Running Time

- A list of 10 weeks is shown.

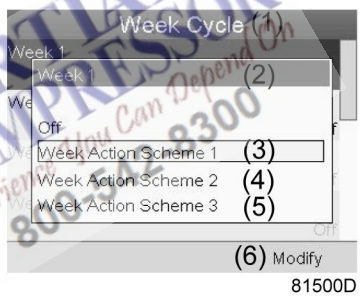


Text on figure

(1)	Week Cycle
(2)	Week 1
(3)	Week 2
(4)	Week 3
(5)	Week 4
(6)	Modify

Press twice the Enter key on the controller to modify the first week.

- A new window opens. Select the action, example: Week Action Scheme 1



Text on figure

(1)	Week Cycle
(2)	Week 1
(3)	Week Action Scheme 1
(4)	Week Action Scheme 2
(5)	Week Action Scheme 3
(6)	Modify

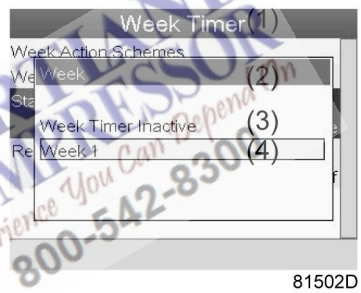
- Check the status of the Week Timer
  Use the Escape key on the controller to go back to the main Week Timer menu. Select the status of the Week Timer.

81501D

Text on figure

(1)	Week Timer
(2)	Week Action Schemes
(3)	Week Cycle
(4)	Status
(5)	Week Timer Inactive
(6)	Remaining Running Time

- A new window opens. Select Week 1 to set the Week Timer active.



81502D

Text on figure

(1)	Week Timer
(2)	Week
(3)	Week Timer Inactive
(4)	Week 1

- Press the Escape key on the controller to leave this window. The status shows that week 1 is active.

81503D

Text on figure

(1)	Week Timer
(2)	Week Action Schemes
(3)	Week Cycle
(4)	Status
(5)	Remaining Running Time

- Press the Escape key on the controller to go to the main Week Timer menu. Select Remaining Running Time from the list and press the Enter key on the controller to Modify.

81504D

Text on figure

(1)	Week Timer
(2)	Week Action Schemes
(3)	Week Cycle
(4)	Status
(5)	Remaining Running Time

- This timer is used when the week timer is set and for certain reasons the unit must continue working. The remaining running time, for example 1 hour, can be set in this screen. This timer is prior to the Week Timer action.

81505D

Text on figure

(1)	Week Timer
(2)	Week action schemes
(3)	Remaining Running Time

4.15 Info menu

Menu icon, Info

Function

To show the MAC address.

Procedure

Starting from the Main screen (see Main screen):

- Move the cursor to the Menu button and press the Enter key.
- Using the Scroll keys, move the cursor to the Info icon. Following screen appears:

- Press the Enter key. The Pneumatech internet address appears on the screen.

4.16 Modifying settings

Menu icon, Settings

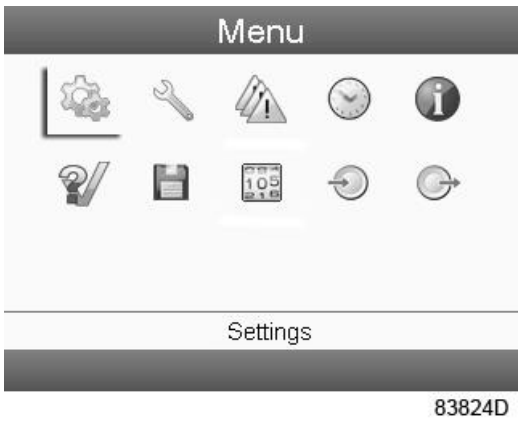
Function

To display and modify a number of settings (e.g. Time, Date, Date format, Language, units ...).

Procedure

Starting from the Main screen (see Main screen), move the cursor to the Menu button and press the Enter key.

A screen, similar to following screen appears:



Using the Scroll keys, move the cursor to the Settings icon and press the Enter key. Following screen appears:

Text on figure

(1)	Settings
(2)	Automatic Restart (text is linked to the selected icon)

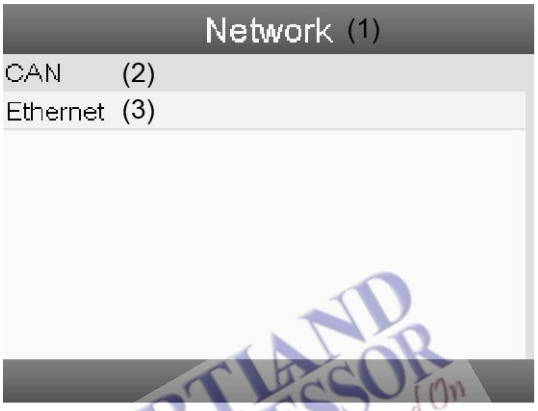
The screen shows a number of icons. Move the cursor to the icon of the function to be modified and press the Enter key.

Icon	Function
 57792F	Network settings
 58470D	General settings
 83922D	Automatic Restart
 82196F	Main chart

Icon	Function
 83795F	Generator settings
 57819F	Access key

Network settings

Select the network settings icon as described above and press the Enter button (2). Following screen appears:



58466D_1

Text on figure

(1)	Network
(2)	CAN
(3)	Ethernet

By default, the first item (CAN) is selected. Press the Enter key. Following screen appears:

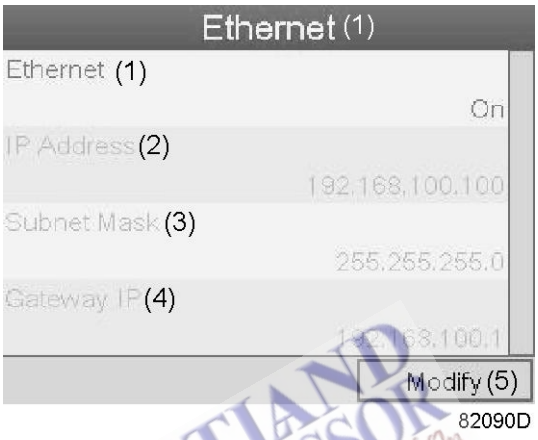
59819D

CAN settings menu

Text on figure

(1)	CAN
(2)	CAN Address
(3)	PC Tools Channel
(4)	ES Channel
(5)	Modify

Use the Scroll keys to select the setting to be modified, press Enter and follow the indications on the screen.



Ethernet settings menu

Text on figure

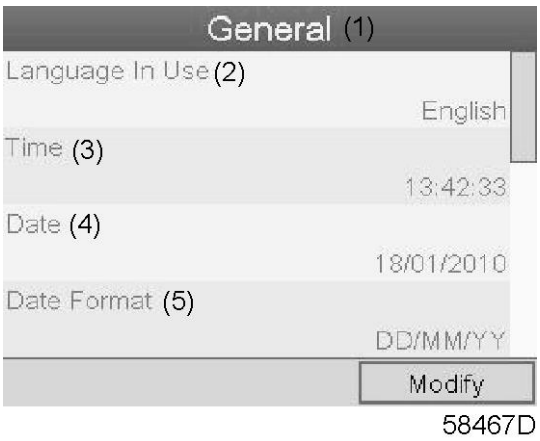
(1)	Ethernet
(2)	IP Address
(3)	Subnet mask
(4)	Gateway IP
(5)	Modify

Using the Scroll keys, move the cursor to the setting to be modified (e.g. Ethernet) and press the Enter button (2).

A pop-up screen appears. Use the ↑ or ↓ key to select the required parameter and press the Enter key to confirm.

General settings

Select the General settings icon as described above and press the Enter button (2). Following screen appears:



Text on figure

(1)	General
(2)	Language in use
(3)	Time
(4)	Date
(5)	Date format

The screen shows the first items of a list of all settings. Use the scroll button to see the other items in the list.

Press the Enter button (2). By default, the first item (Language in use) is selected.

Use the ↓ key of the Scroll keys to select the setting to be modified and press the Enter key.

A pop-up screen appears. Use the ↑ or ↓ key to select the required parameter and press the Enter key to confirm.

Automatic Restart

The controller has a built-in function to automatically restart the generator if the voltage is restored after voltage failure, called Automatic Restart.

 83922D	Provided the automatic restart function is activated and the controller was in the automatic operation mode, the generator will automatically restart if the supply voltage to the module is restored within a programmed time period. The power recovery time (the period within which the voltage must be restored to have an automatic restart) can be set between 15 and 3600 seconds or to 'Infinite'. If the power recovery time is set to 'Infinite', the generator will always restart after a voltage failure, no matter how long it takes to restore the voltage. A restart delay can also be programmed allowing for example the generator and the compressors to be restarted one after the other. This is strongly recommended in case the function is activated.

To deactivate/activate the restart function, use password 4735. If the function is activated, this is visible in the Main screen.

	By default, "Automatic Restart" is deactivated.

To modify the Automatic Restart settings:

- Select the Automatic Restart icon as described and press the Enter button (2). Following screen appears:

83917D

Text on figure

(1)	Automatic Restart
(2)	Automatic Restart
(3)	Maximum Power Down Time
(4)	Restart Delay
(5)	Modify

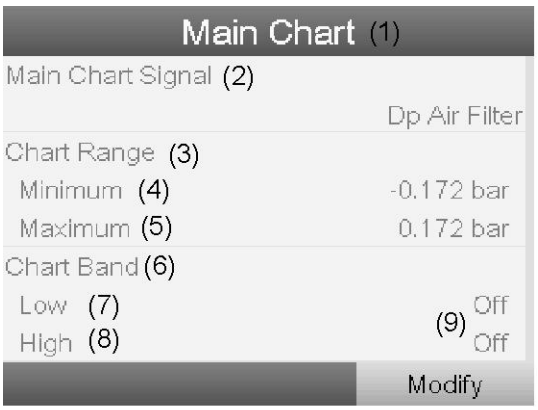
- The screen shows a list of settings. By default, the first item is highlighted.
  Using the Scroll keys, move the cursor to the setting to be modified and press the Enter button (2). A pop-up screen appears. Use the ↑ or ↓ key to select the required value and press the Enter button (2) to confirm.

Main chart settings

	Chart ranges and bands can be modified. This can cause the current value to be out of range and can thus cause the absence of a visible curve in the graph.

The main chart settings menu allows to adjust the scale and curves on the graph. To modify these settings, proceed as follows:

- Select the Main chart settings icon as described above and push the Enter button (2). A screen similar to the one below appears:



59175D

Text on figure

(1)	Main chart
(2)	Main chart signal
(3)	Chart range
(4)	Minimum
(5)	Maximum
(6)	Chart band
(7)	Low
(8)	High
(9)	Off

The screen shows the main chart signal, the current chart range and band settings. To modify these settings, proceed as follows:

Push the Enter button, select Chart Range or Chart Band as desired and confirm.

Modifying the chart signal

Select the main chart signal and proceed as follows:

To change the plotted input signal, go to the input menu and select the desired input signal

Modifying the Chart Band

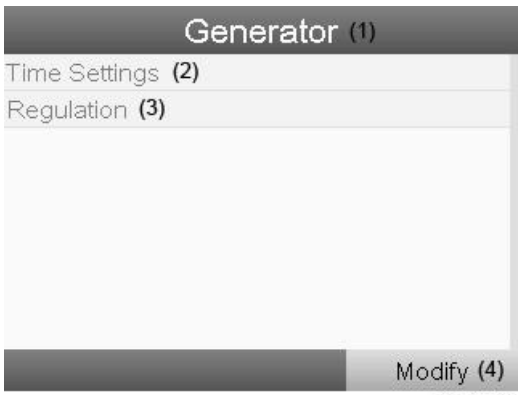
Select Chart Band as described above and proceed as follows:

- Push the Enter button: the low band setting becomes highlighted. Push the Enter button to modify the on/off setting or use the arrow down key to modify the low setting.
- Push the Enter button to confirm the modification.
- Proceed to modify the high band setting.

Generator settings

	To be able to modify the settings, you need a password. Otherwise, you can only consult the active settings.

Select the Generator settings icon as described above and press the Enter button (2). Following screen appears:



Text on figure

(1)	Generator
(2)	Time Settings (password protected)
(3)	Regulation
(4)	Modify

The screen shows a list of settings. By default, the first item (Time Settings) is highlighted.

Press the Enter button (2). The following screen appears:

- **Time settings**

Time Settings (only for service)

Text on figure

(1)	Time Settings
(2)	Equalization Time
(3)	Production Time

	These settings are password protected!

If the service password is entered, the cycle timings can be adjusted between the limits which are displayed in small characters.

⚠	The timings are set in the factory. Changing these settings might impact the performance of the generator.

- **Regulation**
  If the service password is entered the regulation settings can be modified.
  - Using the scroll keys, move the cursor to the setting to be modified and press the Enter button (2).
  - A popup screen appears. Use the ↑ or ↓ key to select the required value and press the Enter button (2).

Regulation

Text on figure

		Description
(1)	Regulation	
(2)	Minimum Purity	Below this level, the generator will not enter standby mode.
(3)	Purity	Below this value, an alarm will be generated.
(4)	Stop Pressure	If this level is reached, the generator stops producing (in the product buffer receiver).
(5)	Start Pressure	If this level is reached, the generator starts producing (in the product buffer receiver).
(6)	Modify	

Access key

Different security levels are programmed in the controller (e.g. user, service technician, etc). This menu item is used to change the security level. Scroll to the correct icon using the scroll key. Press the Enter button. Press the Enter button again to modify the security level. Press the Enter button again, a pop-up menu appears. Use the scroll keys to enter the password of the new security level. Press the Enter button to confirm the change.

4.17 Programmable settings

Description

The regulation and safety devices are factory-adjusted to obtain optimum performance of the generator. No adjustments are required.

5 Operating instructions

5.1 Operation

Start-up procedure

For the designation of the components, see section Air flow diagram.

Step	Description
1	Check the supply voltage. If 230V is available, continue to step 2. Adjust the transformer connections in case 115V is available (see service diagram)
2	Make sure all ball valves between the generator and the receivers are opened and the ball valve after the compressor is closed.
3	Make sure the following ball valves inside the generator are closed: BA04, BA05 (if option outlet PDP is not selected) and BA07 (PDP = Pressure Dew point).
4	Make sure the following ball valves inside the generator are opened: BA01, BA02, BA05 (if option outlet PDP is selected) and BA06.
5	Make sure the refrigerant dryer (ID or FD) is not running in energy efficient mode. This mode can cause an increase of outlet dew point and a shutdown of the generator as a consequence.
6	Switch on the refrigerant dryer 10 minutes in advance of the compressor (if applicable).
7	Start the compressor.
8	Slowly open the valve after the compressor so the compressor can slowly fill the air receiver in order to fill the air receiver with compressed air dried down to a dew point of 3 °C .
9	Enter the required nitrogen purity in the controller by navigating to Menu - Settings - Generator - Regulation - Purity. The controller will use this setting to tune its capacity to the consumed nitrogen flow (capacity control energy saving feature).
10	Enter the minimum required nitrogen purity in the controller by navigating to Menu - Settings - Generator - Regulation - Min Purity. The controller will use this setting to start flushing the nitrogen receiver when the minimum purity is reached. Note: during flushing, the consumer valve V10 is closed and no nitrogen is available at the outlet.
11	Make sure the pilot air pressure regulator PR03 is set to a pressure of 6 bar (85 psi).
12	Check the inlet dew point on the controller display. If this value exceeds 5 °C, the air receiver needs to be flushed until a value below 5 °C is reached. The flushing of the inlet receiver will be done automatically by solenoid Y14. During this time, the generator is in standby until a dewpoint of 5°C has been achieved at the inlet.
13	Start the generator by pushing the start button on the controller. The generator will now start automatically. During "startup" the nitrogen receiver is filled through restriction orifice OR04 until the pressure difference between the air receiver and nitrogen receiver is less than the delta pressure setting (found in Menu - Settings - Generator - Regulation - Delta Pressure). During "flushing" the nitrogen receiver is flushed through orifice OR06 until the purity in the vessel is equal to the Min Purity setting as entered in step 7. Flushing can take up to 2 hours for "%" generators and up to 6 hours for "ppm" generators. After flushing, the generator is ready for nitrogen production.
14	Regulate the outlet nitrogen pressure with pressure regulator PR01 to the requested nitrogen pressure.

Step	Description
15	Make sure the outlet flow measured by FT01 does not exceed the nominal flow of the nitrogen generator. Exceeding the nominal flow will cause the purity to drop. If the purity drops below Min Purity setting, the outlet flow is cut off to enable flushing of the nitrogen receiver. More flow means lower nitrogen purity, less flow means higher nitrogen purity. The purity in the nitrogen receiver can be read on the main screen.
16	Set the time and date in the settings menu: . Menu - Settings - General Settings - Time. Format: dd/mm/yy and hh:mm:ss.
17	Set the required warning and shutdown levels in the Protections menu.
18	Set the generator in automatic operation mode on the main screen. This enables standby and capacity control modes.

Manual operation mode

In manual mode, the generator runs at normal timer based operation, independently from the detected flow rate.

Automatic operation mode

In automatic mode, the generator will apply capacity control in 5 stages:

Nitrogen consumption level compared to nominal generator capacity	Capacity control
100 %	Normal operation
Less than 80 %	Cycle time modulation stage 1
Less than 60 %	Cycle time modulation stage 2
Less than 40 %	Cycle time modulation stage 3
Less than 1 %	Standby

Capacity control

PPNG HE generators are equipped with a capacity control feature. This feature enables the controller to modulate the capacity (and thus the required amount of compressed air) depending on the consumed nitrogen flow.

The capacity is controlled by varying the cycle times (e.g. cycle time modulation). A lower capacity means longer cycle times, a higher capacity means shorter cycle times. By doing this, the purity setting can be lowered and as a consequence less compressed air will be used (energy saving up to 50%).

The feature also enables a generator which has been sized for high temperature to use less energy when it is colder than the temperature for which the generator is sized.

Overflow protection

To protect the generator from being overloaded, the adsorbers are protected by the minimum pressure valve V9 (see section Air flow diagram).

During normal operation, i.e. when the pressure difference between the air receiver and nitrogen receiver is less than theDelta Pressure setting, see section Modifying settings (Menu - Settings - Generator - RegulationDelta Pressure), the minimum pressure valve is open.

If the nitrogen demand would become too high,, the pressure difference will increase and when it is higher than the Delta Pressure setting, minimum pressure valve V9 will close. At this stage, the flow is restricted by startup nozzle OR04 as long as the pressure difference between the air receiver and the nitrogen receiver is larger than the Delta Pressure setting. To recover from this state, the outlet flow must be restricted to the nominal flow of the generator or less. When the pressure difference becomes smaller than the Delta Pressure setting, the generator will wait 10 minutes before opening minimum pressure valve V9.

Guaranteed purity

To protect the installation from low purity that could harm its process, the PPNG HE is equipped with a guaranteed purity control. The minimum purity that is allowed in the installation can be set in the controller. See section Modifying settings (Menu - Settings - Generator - Regulation - Min Purity).

If the purity in the nitrogen receiver becomes lower than the Min Purity setting, the flow to the installation is cut off by closing consumer valve V10. At the same time, flushing valve Y11 is opened to flush the nitrogen receiver with a flow, controlled by flushing nozzle OR06. This way, the purity in the nitrogen receiver is recovered as fast as possible. Once the measured purity is better than the Min Purity setting, flushing valve Y11 will close and consumer valve V10 will open.

Changing the purity

Before changing the purity level of the generator, make sure which variant of nitrogen generator has been installed:

Variant	Nitrogen purity	Residual oxygen concentration
%	95 %	5 %
	96 %	4 %
	97 %	3 %
	98 %	2 %
	99 %	1 %
	99.5 %	0.5 %
	99.9 %	0.1 %
ppm	99.95 %	500 ppm
	99.99 %	100 ppm
	99.999 %	10 ppm

The % variant has an oxygen sensor with a measurement range from 0 % to 10% oxygen level, corresponding with 4-20 mA.

The ppm variant has an oxygen sensor with a measurement range from 0 ppm to 1000 ppm oxygen level, corresponding with 4-20 mA.

Both variants are optimized in cycle times, purge flow and nozzle sizes to deliver maximum performance at the desired purity.

To change the desired outlet purity, navigate to Menu - Settings - Generator - Regulation - Purity. Based on this setting, the generator will adapt its capacity control and apply cycle time modulation when necessary. When changing the purity setting, the Min Purity setting also needs to be changed (navigate to Menu - Settings – Generator – Regulation – Min Purity). Based on

this setting, the generator will only allow nitrogen with a better purity than the Min Purity setting to be sent to the installation.

Stopping procedure

To stop the generator, press the stop button on the controller. The generator will finish its current cycle and vent both adsorber vessels.

5.2 Checking the display

Check the display regularly for readings and messages.

The main screen shows the generator inlet dew point, outlet purity, outlet flow and outlet pressure.

Always check the display and remedy the trouble if the alarm LED (see section Control panel) is alight or blinking.

The display will show a service message if a service plan interval has been exceeded or if a service level for a monitored component has been exceeded. Carry out the service actions of the indicated plans or replace the component and reset the relevant timer, see section Service menu.

5.3 Taking out of operation

Procedure

Step	Action
1	Stop the generator and close the air inlet and nitrogen outlet valve.
2	Depressurize the generator. Switch off the voltage and disconnect the generator from the mains.
3	Close the ball valves towards the generator and depressurize the air and nitrogen connections.

6 Maintenance

6.1 General recommendations and precautions

Safety

Before carrying out any maintenance or corrective activity read the following recommendations and safety precautions and act accordingly.

	• To depressurize the adsorbers, navigate to Menu - Test - Depressurize vessels. Make sure the pressure in the adsorbers drops to 0 bar and maintain this depressurizing state for at least two minutes. • Switch off the generator.

	The release of oxygen molecules from the CMS is a very slow process. This might cause a pressure buildup in the adsorbers, even after they were depressurized. Before maintenance, make sure the generator is fully depressurized. To manually depressurize the adsorbers, navigate to Menu - Test - Depressurize.

Warranty - Product liability

Use only authorized parts. Any damage or malfunction caused by the use of unauthorized parts is not covered by Warranty or Product Liability.

Service kits

For overhauling and for preventive maintenance, a wide range of service kits is available. Service kits comprise all parts required for servicing the component and offer the benefits of genuine spare parts while keeping the maintenance budget low.

Consult your supplier.

Service contracts

Your supplier offers several types of service contracts, relieving you of all preventive maintenance work. Consult your supplier.

6.2 Maintenance schedule

General

To maintain the generator efficiency and to reduce the risks of faults, strictly observe the recommended maintenance schedule.

On the Main screen, the remaining number of hours before service is displayed. This is a counter that counts down from 4000 hours. For more information, see Service menu.

The following table specifies the frequency of the recommended maintenance operations, expressed in operating hours of the generator:

Programmed service interventions

Frequency	Service plan	Activity
Daily		Check the controller for information on the purity, alarms and service messages.
Every 4000 hours of operation or every 6 months (1)	A	• Check fitted connections in and around the unit for potential leaks. • Check for damaged wiring or loose connections. • Replace the in- and outlet filter cartridges. • Replace the activated carbon filter.
Every 8000 hours of operation or every year (1)	B	• Replace the inlet dew point sensor and outlet dew point sensor (optional). • Replace the filter of the inlet dew point sensor and outlet dew point sensor (optional). • Replace the actuators of the pneumatic valves V3 and V6.
Every 16000 hours of operation or every 2 years (1)	C	• Replace the actuators of the pneumatic valves V1, V2, V4, V5, V7 and V8. • Check the wire mesh of the purge nozzle and clean with compressed air if necessary.
Every 40000 hours of operation or every 5 years	D	• Replace the oxygen sensor and analyser • Replace the solenoid valve block. • Replace silencer SIL01.

(1): whichever comes first

After maintenance activities, the service counter needs to be reset. Contact your supplier.

All spare parts required for scheduled maintenance are included in a specific Service kit. Part numbers of the Service kits can be found in the spare parts list.

	Proper and timely maintenance is extremely important to safeguard the lifetime of the molecular sieves bed. The manufacturer cannot take any responsibility for improper functioning of the generator if maintenance is not done as prescribed. In this respect, regular maintenance of all equipment upstream of the generator, including but not limited to the compressor and the filter package used is of extreme importance. For maintenance instructions of this equipment, please be referred to the instruction manual of the equipment involved.

6.3 Disposal of used material

Used filters or any other used material (e.g. adsorbent, lubricants, cleaning rags, machine parts, etc.) must be disposed of in an environmentally friendly and safe manner, and in line with the local recommendations and environmental legislation.

7 Adjustments and service

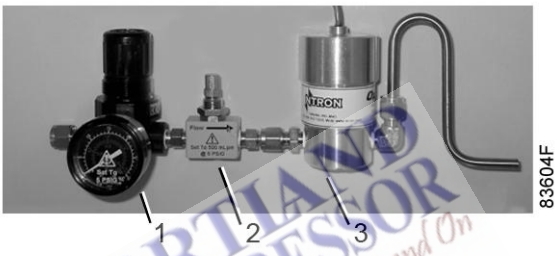
7.1 Calibration check of the oxygen sensor

General information

The zirconium type sensor does not need to be calibrated periodically because the outlet signal and the deviation are guaranteed to be stable during the 5 year lifetime of the sensor.

Before commencing the calibration check, make sure the oxygen analyser sample flow is set at the correct pressure and flow. Please refer to the table below for the correct settings.

Maintenance interval	Service
At replacement (every 5 years)	Replace sensor (see section Sensor replacement) and calibrate the sensor.

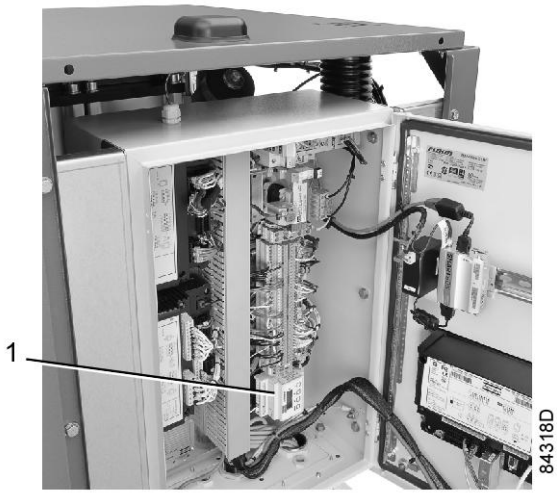


Typical sampling arrangement with zirconium sensor

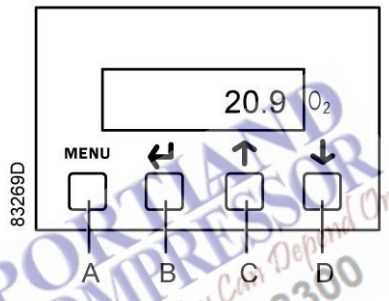
1	Pressure regulator (adjusted to 0.35 bar (5 psig))
2	Flow restrictor (adjusted to 500 ml/min at a pressure of 0.35 bar (5 psig))
3	Zirconium sensor

Location of the oxygen analyzer

The oxygen analyzer is located in the electrical cabinet:



Oxygen analyser (1)



Oxygen analyzer display

The keypad has the following functionality:

Button	Function
A	**Menu** Open/Close
B	Enter button
C	Next (increment) button
D	Previous (decrement) button

Sensor range

Sensor type	O_2 measurement range	O_2 concentration of calibration gas
Nitrogen generator with % sensor	0–10 %	5000 ppm / 0.50 %
Nitrogen generator with ppm sensor	0-1000 ppm	100 ppm / 0.01 %

Calibration check

1. Put the generator in manual operation mode (see section Operating mode selection).
2. Close the ball valve (BA06) of the purity measurement (sample) line.

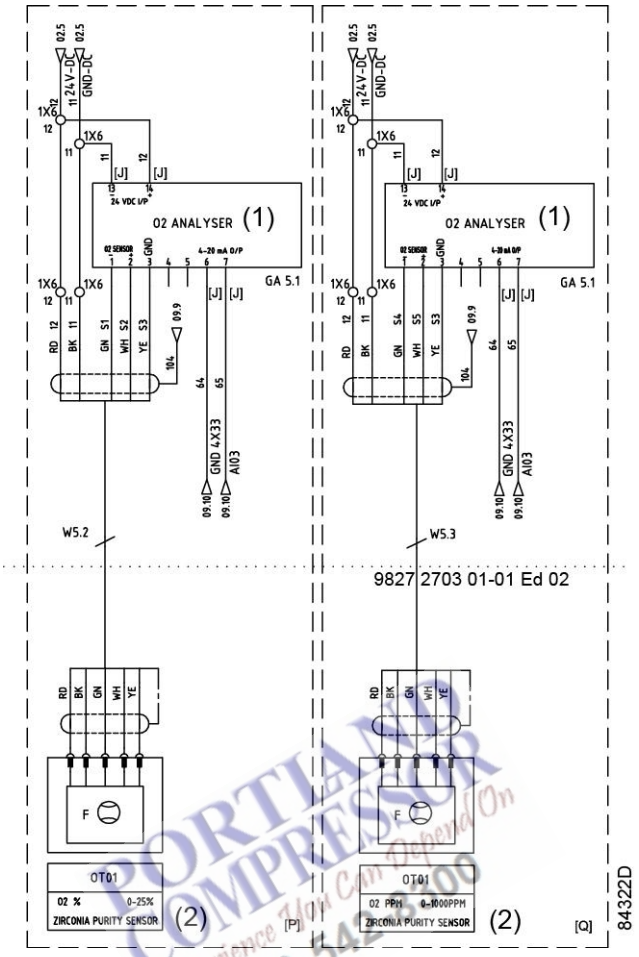
3. Apply calibration gas (see the table above) to the sensor at 500 ml/min and a pressure of 0.35 bar(g) (5 psi(g)). (The needle valve is adjusted to this flow when the pressure applied is 0.35 bar).
   Allow time (approx. 15 min.) for the sensor to respond. To know if a stable value is reached, it should be shown during 5 minutes without changing.
   Note:
   The concentration of the calibration check gas can vary depending on the application. The values in the table are guide values.
4. Confirm that the value which reads from the display corresponds to the value on the calibration gas certificate. If the value does correspond, continue to step 5 of this procedure. If not, replace the sensor and analyser. These components are shipped as a complete kit which is calibrated at the factory.
5. Disconnect the calibration check gas and reconnect the feedback line to the pressure regulator.
6. Open the purity measurement line ball valve (BA06).
7. Set the generator back to **Automatic** mode.

7.2 Replacement of the O_2 sensor

General information

⚠	Oxygen sensors have to be disposed of according to the applicable regulations.

Electrical connections



1	Oxygen analyzer
2	Oxygen sensor

Oxygen sensor replacement procedure

	The zirconium oxygen sensor and the oxygen analyzer need to be replaced as a couple.

OT01	Zirconium oxygen sensor
PR02	Pressure regulator for oxygen sensor (to be set at max. 0.35 bar(g) (5 psi(g)))

1. Shut down the generator
2. Close the ball valve (BA06) of the purity measurement line.
3. Switch off the voltage.
4. Open the electrical cabinet and disconnect the oxygen sensor wiring from the oxygen analyzer. Also disconnect the wiring of the oxygen analyzer.
5. Remove the oxygen sensor and the oxygen analyzer from sampling system.
6. Fit the new oxygen sensor and analyzer, and connect them to the control box (see electrical connections).
7. Open the purity measurement line ball valve (BA06).
8. Switch on the power and start the generator.

7.3 Adjustment of flow sensor

The flow sensor (FT01) is fitted as standard and measures the nitrogen flow rate.

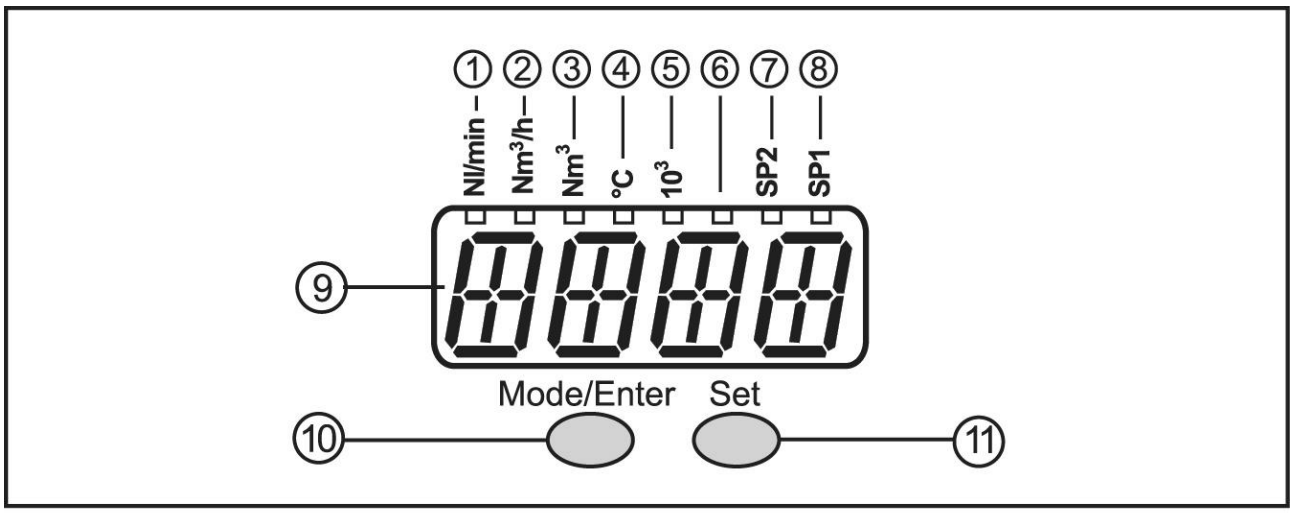
Overview of model versus flow sensor

The table below gives an overview of which flow sensor is to be used in combination with which model.

Model	ppm	%	Model	ppm	%
PPNG 6 HE	IFM SD 5100	IFM SD 6100	PPNG 28 HE	IFM SD 6100	IFM SD 8100
PPNG 7 HE	IFM SD 5100	IFM SD 6100	PPNG 30 HE	IFM SD 6100	IFM SD 8100
PPNG 9 HE	IFM SD 5100	IFM SD 6100	PPNG 37 HE	IFM SD 6100	IFM SD 8100
PPNG 12 HE	IFM SD 5100	IFM SD 6100	PPNG 41 HE	IFM SD 6100	IFM SD 8100
PPNG 15 HE	IFM SD 5100	IFM SD 6100	PPNG 50 HE	IFM SD 6100	IFM SD 8100
PPNG 18 HE	IFM SD 6100	IFM SD 8100	PPNG 63 HE	IFM SD 6100	IFM SD 8100
PPNG 22 HE	IFM SD 6100	IFM SD 8100	PPNG 68 HE	IFM SD 6100	IFM SD 8100

Entering settings

Operating and display elements



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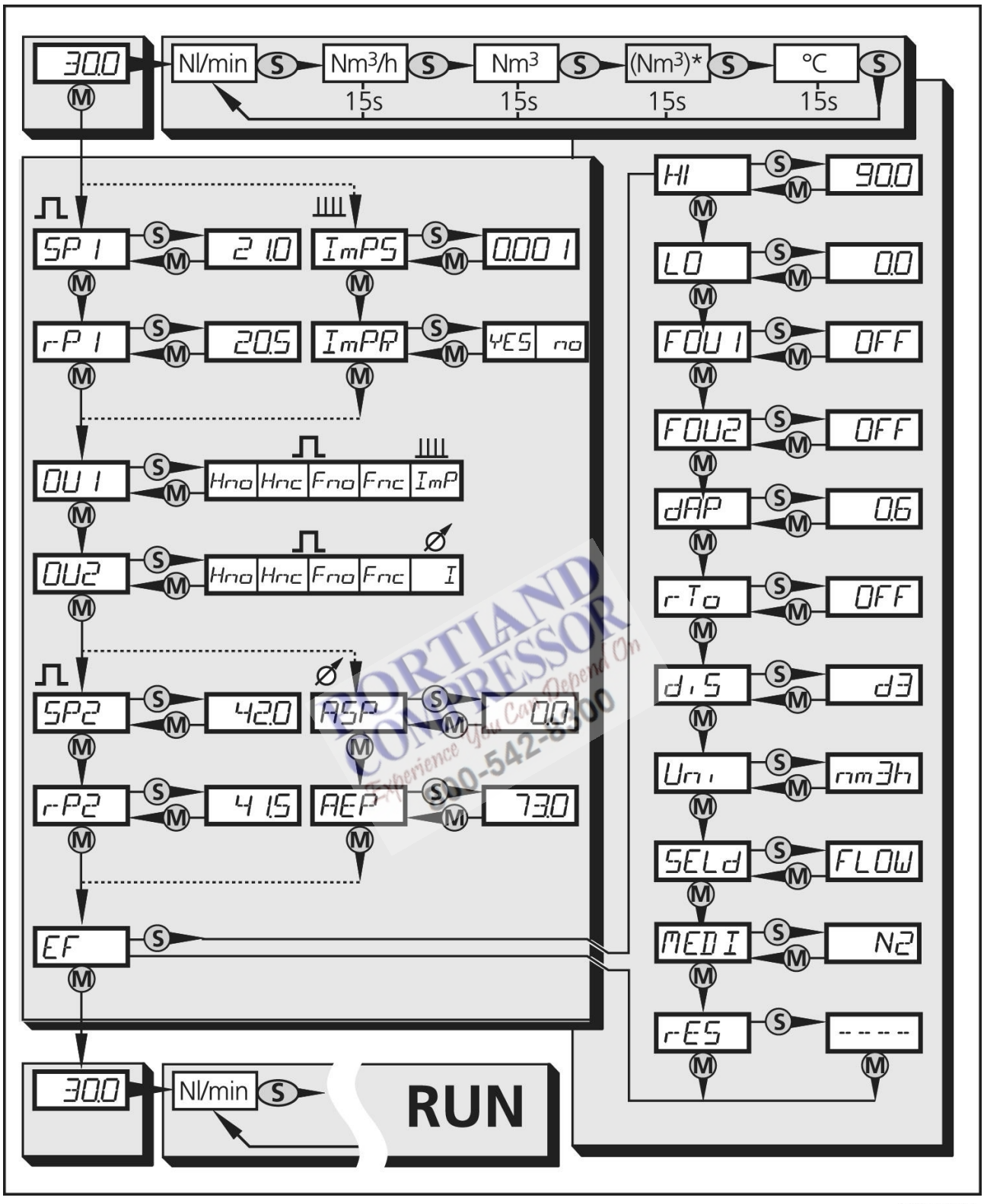
1 to 8: Indicator LED's	
LED 1	Current volumetric flow in standard litres/minute (Nl/min).
LED 2	Current volumetric flow in standard cubic metres/hour (Nm³/h).
LED 3	Current consumed quantity since the last reset in standard cubic metres (Nm³).
LED 3 flashing	Consumed quantity before the last reset in standard cubic metres.
LED's 3 and 5	Current consumed quantity since the last reset in 10³ standard cubic metres.
LED's 3 and 5 flashing	Consumed quantity before the last reset in 10³ standard cubic metres.
LED 4	Current medium temperature in °C.
LED 6	Not used.
LED 7, LED 8	Switching state of the corresponding output.

9: Alphanumeric display, 4 digits
Indication of the current volumetric flow (if [SELd] : [FLOW] is set).
Indication of the meter count (if [SELd] = [TOTL] is set).
Indication of the current medium temperature.
Indication of the parameters and parameter values.

10: Mode/Enter push button
Selection of the parameters and acknowledgement of the parameter values.

11: Set push button
Setting of the parameter values (scrolling by holding pressed, incremental by pressing briefly).
Change of the display unit in the normal operating mode (Run mode).

Menu, structure



Structure of the menu

Legend

	[Mode/Enter]
	Set
Nm³	current meter count in standard m³
(Nm³)	stored meter count in standard m³

Menu, explanation

The table below gives an overview of the settings.

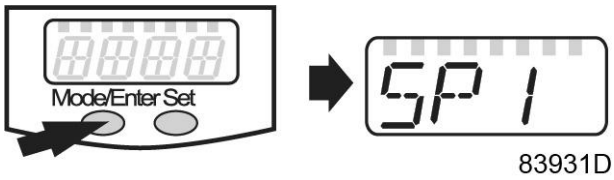
SP1/rP1	Maximum/minimum value for volumetric flow, at which OUT1 changes its switching status.
ImPS	Pulse value.
ImPR	Pulse repetition active (= pulse output) or not active (= function preset meter).
OU1	Output function for OUT1 (volumetric flow or consumed quantity): • Switching signal for limit values: hysteresis function or window function, normally open or normally closed. • Pulse or switching signal for quantity meter.
OU2	Output function for OUT2 (volumetric flow): • Switching signal for limit values: hysteresis function or window function, normally open or normally closed. • Analogue signal: 4-20mA
SP2/rP2	Maximum/minimum value for volumetric flow, at which OUT2 changes its switching status.
ASP	Analogue start value for volumetric flow.
AEP	Analogue end value for volumetric flow.
EF	Extended functions/opening of menu level 2.
HI/LO	Maximum/minimum value memory for volumetric flow.
FOU1	Behaviour of output 1 in case of an internal fault.
FOU2	Behaviour of output 2 in case of an internal fault.
dAP	Measured value damping/damping constant in seconds.
rTo	Meter reset: manual reset/time controlled reset.
diS	Update rate and orientation of the display.
Uni	Standard unit of measurement for volumetric flow: standard litres/minute or standard cubic metres/hour.
SELd	Standard process category of the display: volumetric flow value/meter count.
MEDI	Selection of the medium to be monitored.
rES	Restore factory setting.

General parameter setting

During parameter setting, the unit remains in the operating mode. It continues its monitoring function with the existing parameters until the parameter setting has been completed.

Three steps must be taken for each parameter set:

1. **Parameter selection:** Press [Mode/Enter] until the requested parameter is displayed.



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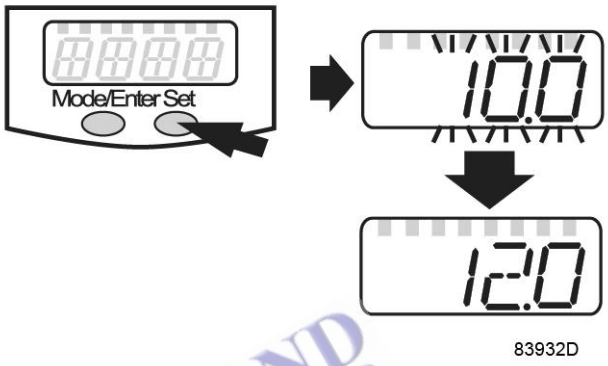
2. **Setting of the parameter value:** Press [Set] and keep it pressed.
   - Current setting value of the parameter flashes for 5 s.
   - After 5 s, the setting value is changed: incremental by pressing briefly or scrolling by holding pressed.



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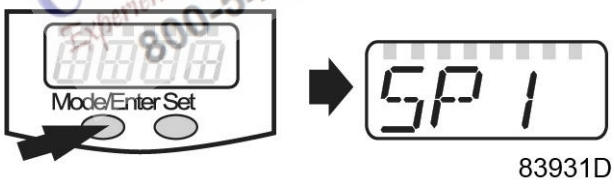
   Numerical values are incremented continuously. If the value is to be reduced: let the display move to the maximum setting value. Then the cycle starts again at the minimum setting value.
3. **Acknowledgement of the parameter value:** Press [Mode/Enter] briefly. The parameter is displayed again. The new setting value is stored.



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Setting of other parameters: Start again with step 1.

Finishing the parameter setting: Press [Mode/Enter] several times until the current measured value is displayed or wait for 15 s. The unit returns to the operating mode.

Factory setting

The table below gives an overview of the factory settings. If there is a specific setting depending on the flow sensor type, it is mentioned as user setting.

Parameter		SD5100	SD6100	SD8100
SP1	Switch-on point 1			
rP1	Switch-off point 1			
SP2	Switch-on point 2			
rP2	Switch-off point 2			
OU1	Configuration of output 1	Hno	Hno	Hno

Parameter		SD5100	SD6100	SD8100
OU2	Configuration of output 2	I	I	I
ImPS	Pulse / Counter settings			
ImPR	Pulse repetition			
ASP	Analogue start point	0 m³/h	0 m³/h	0 m³/h
AEP	Analogue end point	15 m³/h	75 m³/h	225 m³/h
FOU1	Response of output 1 in case of a fault	Off	Off	Off
FOU2	Response of output 2 in case of a fault	Off	Off	Off
dAP	Damping of the measured value	2 sec	2 sec	2 sec
rTo	Reset of the quantity meter	Off	Off	Off
dis	Setting of the display	d3	d3	d3
Uni	Display unit for flow rate	Nm³/h	Nm³/h	Nm³/h
SELd	Standard measuring unit of the display	FLOW	FLOW	FLOW
MEDI	Setting to the monitored medium	N2	N2	N2
	Electronically locking active	no	no	no

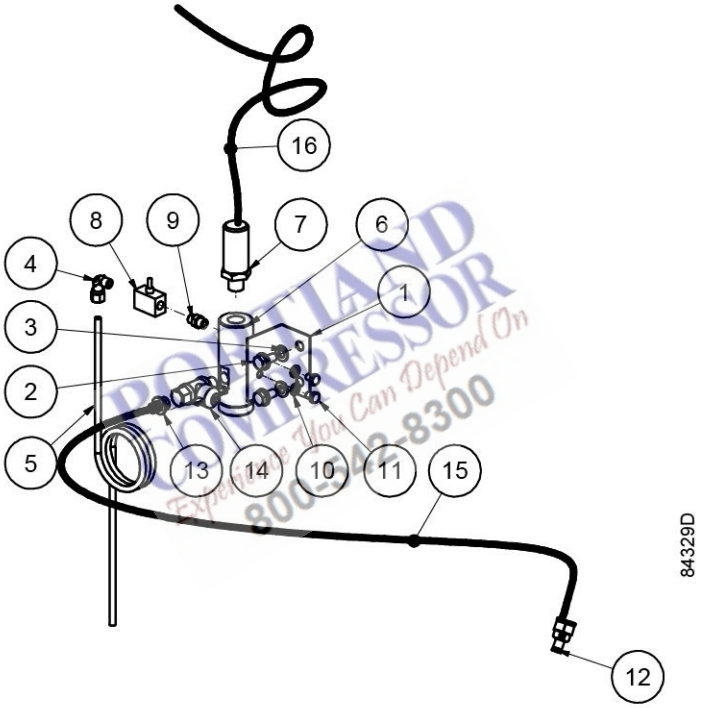
8 Optional equipment

8.1 Outlet pressure dew point

An outlet pressure dew point sensor (PDP02) is available as an extra measure to monitor the dew point of the consumed nitrogen. This feature is especially useful if the nitrogen dew point is a critical parameter in the process where the nitrogen is used.

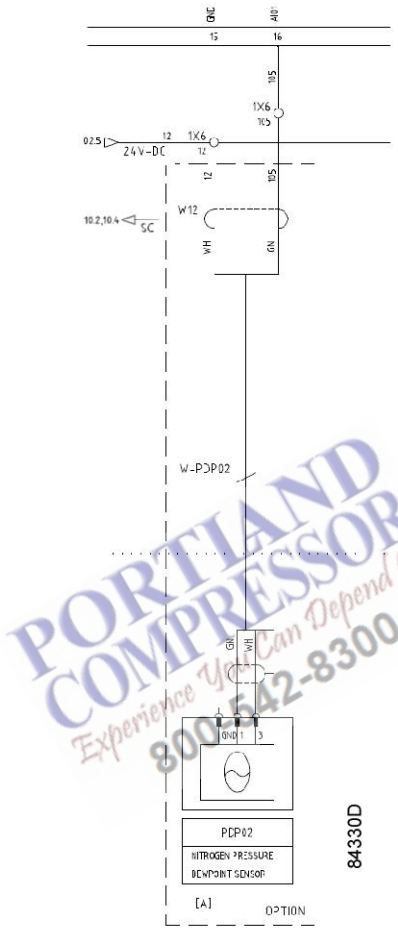
Note that the outlet dew point of a nitrogen generator is not stable and can make large variations depending on operating conditions. The highest outlet dew point will be -40 °C PDP, but this can drop down to -70 °C in some cases.

Contact Pneumatech for more information.



Reference	Description
1	Support
2	Screw
3	Washer
4	Elbow
5	Tube
6	Housing
7	Sensor
8	Valve
9	Nipple
10	Washer
11	Bolt
12	Fitting

Reference	Description
13	Fitting
14	Ball valve
15	Plastic tube
16	Sensor cable



Electrical connections of PDP sensor

9 Trouble shooting

Low purity warning

When the nitrogen concentration in the nitrogen receiver becomes lower than the Minimum Purity setting, the generator will start flushing the nitrogen receiver and show a low purity alarm. At this point, no nitrogen is available at the outlet of the generator.

Check the following possible causes:

- Check that the nitrogen purity ball valve BA06 is in open position and nitrogen sample ball valve BA04 is in closed position.
- Make sure the generator is in running mode.
- Variations in operating conditions, such as flow, pressure and temperature can have a large impact on the outlet purity. To check whether the generator's capacity at the current operating conditions is exceeded or not, check the Consumption Level reading by navigating to Menu – Settings – Generator – Capacity Control. When the consumption level is higher than 100%, it means that the generator has less capacity than requested. In this case, the nitrogen consumption is too high and the amount of nitrogen flow at the outlet needs to be reduced. If this is not an option, increasing capacity on a particular nitrogen generator can be done by:
  - Decreasing the purity setting to a lower purity
  - Increasing the inlet pressure
  - Decreasing the ambient temperature if the current temperature is higher than 20 °C.
- Inlet pressure should remain constant at all times. This is a direct cause of compressor sizing. If the compressor is running at full load over a complete cycle, the compressor is sized too small. If this is the case, lower the pressure setpoint of the compressor. If the compressor is oversized, then it would run in unload during one or more complete cycles. In this case, increase the pressure setting of the compressor so it's capacity is matched to that of the nitrogen generator. Alternatively, a pressure regulator should be installed before the air receiver in order to have a constant inlet pressure during multiple cycles.
- Make sure the exhaust opening is not blocked.
- In case of a load/unload compressor, make sure that the load/unload period is shorter that two minutes. Do this by lowering the pressure band of the compressor and oversizing of the inlet air receiver.
- If the exhaust is connected to outdoors, make sure the exhaust line is sized correctly. Refer to section Installation proposal for details.
- Check the reading of the pressure on sample pressure regulating valve PR02. This should read 0.35 bar (5 psi).
- Check the reading of the oxygen sensor OT01 by applying a reference gas to the oxygen sensor. See section Calibration of the oxygen sensor for a detailed procedure.

High dryer pressure dew point

The inlet pressure dew point of a nitrogen generator should be 3 °C and may not exceed 5 °C. PPNG HE nitrogen generators are equipped as standard with an inlet dew point monitoring sensor, which monitors the dew point of the refrigerant dryer used.

Make sure that a dedicated FD dryer is used if ambient temperatures exceed 35°C.

A high dew point can be caused by an overload of the refrigerant dryer, which can occur during startup. To prevent this from happening, the refrigerant dryer should be switched on before the compressor. When the compressor is switched on, the outlet flow of the compressor should be

reduced by means of choking with a ball valve. This causes the produced compressed air to have enough time to pass the dryer and fill the air receiver with the correct quality of inlet air.

If the air receiver has been filled with air that has a higher dew point than 6° C, the air receiver will be purged automatically by inlet flushing valve Y14. As a consequence, the dewpoint of the air receiver will drop to the required level for operation.

Failed To Pressurize

This alarm is triggered when adsorber A or B failed to build up pressure. In normal working conditions, the pressure inside an adsorber vessel should rise to the inlet pressure during the production state. If this does not happen, the process of producing nitrogen has to be halted.

Check the following possible causes:

- Make sure the inlet air pressure is higher than 4 bar (58 psi).
- Make sure the pilot air pressure regulator PR03 is regulated to 6 bar (87 psi).
- Check if the pilot air tubing has been correctly installed. Refer to the flow diagram for detailed instructions. The flow diagram shows which solenoid valves connect to which process valves. It also shows the tubing numbering.

Failed To Blow Off Vessel A (or Vessel B)

This alarm is triggered when adsorber A (or B) failed to depressurize. In normal working conditions, the pressure inside an adsorber vessel should lower to the atmospheric pressure during the regeneration state. If this does not happen, the process of producing nitrogen has to be halted.

Check the following possible causes:

- Make sure the pilot air pressure regulator PR03 is regulated to 6 bar (87 psi).
- Make sure the exhaust opening is not blocked.
- If the exhaust is connected to outdoors, make sure the exhaust line is sized correctly. Refer to section Installation proposal for details.
- Check if the pilot air tubing is installed correctly. Refer to the flow diagram for details. The flow diagram shows which solenoid valve connects to which process valve. It also shows the tubing numbering.

High Working Pressure

This alarm is activated when the inlet pressure exceeds 13 bar (188 psi). This Is the maximum design pressure of the generator.

Low Working Pressure

This alarm is activated when the inlet pressure drops below 4 bar (58 psi). This is the minimum working pressure of the generator.

High Inlet temperature

This alarm is activated when the inlet temperature exceeds 60 °C (140 °F). This is the maximum inlet temperature of the generator.

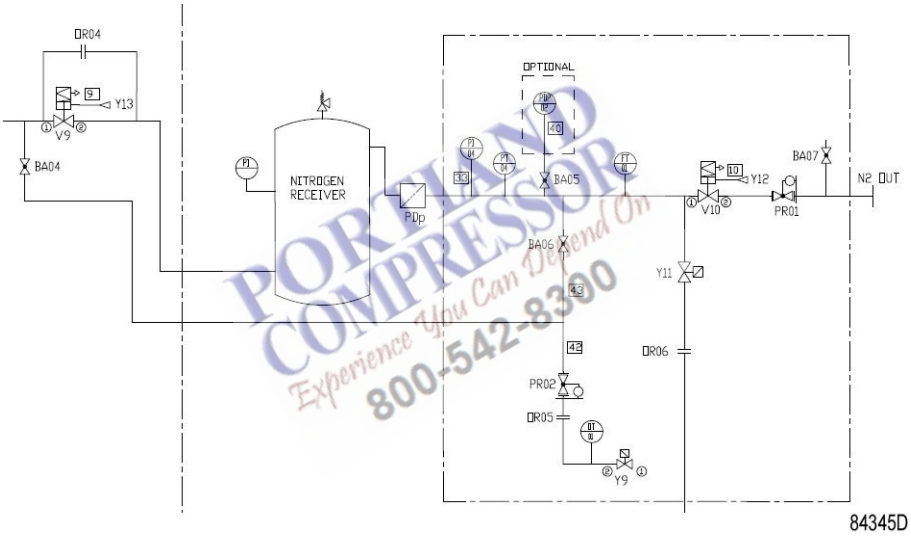
No outlet pressure

The PPNG HE nitrogen generator features protections against overflow and regulations for guaranteed purity. Because of these features, it is able to shut off the pressure to the outlet by control valves.

If no pressure is available at the outlet, check the protection conditions of the generator:

- Is the generator started up properly? This can be checked by comparing the pressure of the air receiver to the pressure of the nitrogen receiver. The difference in pressure should be less than 0.5 bar.
- Make sure the nitrogen receiver is able to build up pressure by checking that there are no restrictions in the piping between the generator “to buffer” connection and the nitrogen receiver. Double check that the connection diameter is corresponding to the installation proposal.
- Check the purity of the nitrogen receiver. This parameter is displayed on the main screen. This parameter should be higher than the Minimum Purity setting before pressure will be available on the outlet.

The following description describes the conditions to actuate the control valves:



Minimum pressure valve V9:

Opens when the Delta Pressure over the CMS bed is within operating limits. This Delta Pressure is adjustable on the controller in Menu – Settings – Generator – Regulation – Delta Pressure. **Caution:** changes to this setting can only be made if there is no alternative way to remedy the problem. Changing this setting can cause overflow of the CMS bed. Increase the setting if the pressure in the nitrogen receiver is stable, but not high enough to open the Minimum pressure valve.

Consumer valve V10:

Opens when minimum pressure valve V9 is opened and the actual purity is higher than the Minimum Puritysetting. The minimum purity setting is adjustable on the controller in Menu – Settings – Generator – Regulation – Minimum Purity.

Outlet flushing valve Y11:

Opens when minimum pressure valve V9 is opened and the actual purity is lower than the Minimum Purity setting or when minimum pressure valve V9 is opened and the nitrogen receiver pressure is lower than 2 bar. The Minimum Purity setting is adjustable on the controller in Menu – Settings – Generator – Regulation – Minimum Purity.

Inlet flushing valve Y14:

Opens when the inlet PDP is higher than 6°C. During this period, the wet inlet receiver will be flushed until it is dry at 3°C PDP.

10 Technical data

10.1 Reference conditions

Air pressure at generator inlet	7.0 bar	102 psi
Ambient temperature (air inlet temperature)	20 ˚C	68 ˚F
Air inlet quality	ISO 8573-1 class 1-4-1	ISO 8573-1 class 1-4-1

10.2 Limitations for operation

Compressed air inlet pressure, maximal	13 bar	189 psi
Compressed air inlet pressure, minimal*	4.0 bar	58 psi
Ambient air temperature, maximal	60 ˚C	140 ˚F
Ambient air temperature, minimal	5 ˚C	41 ˚F

*When operating at this low pressure, make sure the pneumatic valves switch in time.

10.3 Performance data

Outlet flow rate at reference conditions (1)

If the feed air pressure deviates from reference pressure, the performance of the nitrogen generator will have to be corrected.

	Purity	**PPNG 6 HE**	**PPNG 7 HE**	**PPNG 9 HE**	**PPNG 12 HE**	**PPNG 15 HE**	**PPNG 18 HE**	**PPNG 22 HE**
Nitrogen flow (Nm^3/h)	95.0000 %	17.7	22.8	27.8	35.4	45.5	55.7	68.3
	96.0000 %	15.6	20.1	24.6	31.3	40.3	49.3	60.4
	97.0000 %	13.6	17.6	21.5	27.3	35.1	43.0	52.7
	98.0000 %	11.7	15.0	18.4	23.4	30.1	36.8	45.1
	99.0000 %	9.4	12.1	14.7	18.7	24.1	29.5	36.2
	99.5000 %	7.9	10.1	12.4	15.7	20.2	24.7	30.3
	99.9000 %	5.5	7.1	8.7	11.0	14.2	17.3	21.3
	99.9500 %	4.1	5.3	6.5	8.3	10.7	13.0	16.0
	99.9900 %	3.0	3.9	4.7	6.0	7.7	9.4	11.8
	99.9990 %	1.7	2.2	2.7	3.5	4.5	5.5	7.7

	Purity	**PPNG 6 HE**	**PPNG 7 HE**	**PPNG 9 HE**	**PPNG 12 HE**	**PPNG 15 HE**	**PPNG 18 HE**	**PPNG 22 HE**
Nitrogen flow (cfm)	95.0000 %	10.4	13.4	16.4	20.8	26.8	32.8	40.2
	96.0000 %	9.2	11.9	14.5	18.4	23.7	29.0	35.6

	Purity	PPNG 6 HE	PPNG 7 HE	PPNG 9 HE	PPNG 12 HE	PPNG 15 HE	PPNG 18 HE	PPNG 22 HE
	97.0000 %	8.0	10.3	12.6	16.1	20.7	25.3	31.0
	98.0000 %	6.9	8.9	10.8	13.8	17.7	21.7	26.6
	99.0000 %	5.5	7.1	8.7	11.0	14.2	17.4	21.3
	99.5000 %	4.6	6.0	7.3	9.3	11.9	14.6	17.9
	99.9000 %	3.2	4.2	5.1	6.5	8.3	10.2	12.5
	99.9500 %	2.4	3.1	3.8	4.9	6.3	7.7	9.4
	99.9900 %	1.8	2.3	2.8	3.5	4.5	5.5	6.9
	99.9990 %	1.0	1.3	1.6	2.0	2.6	3.2	4.5

	Purity	PPNG 28 HE	PPNG 30 HE	PPNG 37 HE	PPNG 41 HE	PPNG 50 HE	PPNG 63 HE	PPNG 68 HE
Nitrogen flow (Nm³/h)	95.0000 %	83.5	91.0	111.3	125.2	153.1	/	/
	96.0000 %	73.9	80.6	98.5	111.6	136.5	171.4	/
	97.0000 %	64.5	70.3	85.9	96.5	118.0	149.5	157.3
	98.0000 %	55.2	60.2	73.6	83.5	102.1	118.9	136.1
	99.0000 %	44.2	48.2	59.0	66.1	80.9	96.8	107.8
	99.5000 %	37.1	40.5	49.5	55.8	68.3	84.8	91.0
	99.9000 %	26.0	28.4	34.7	39.6	48.4	60.1	64.5
	99.9500 %	19.6	21.3	26.1	32.0	39.1	47.3	52.1
	99.9900 %	14.4	15.7	19.2	23.6	28.8	35.3	38.4
	99.9990 %	9.4	10.3	12.6	15.4	18.9	22.1	25.2

	Purity	PPNG 28 HE	PPNG 30 HE	PPNG 37 HE	PPNG 41 HE	PPNG 50 HE	PPNG 63 HE	PPNG 68 HE
Nitrogen flow (cfm)	95.0000 %	49.2	53.6	65.5	73.7	90.1	/	/
	96.0000 %	43.5	47.4	58.0	65.7	80.4	100.9	/
	97.0000 %	37.9	41.4	50.6	56.8	69.4	88.0	92.6
	98.0000 %	32.5	35.4	43.3	49.1	60.1	70.0	80.1
	99.0000 %	26.0	28.4	34.7	38.9	47.6	57.0	63.5
	99.5000 %	21.8	23.8	29.1	32.9	40.2	49.9	53.6
	99.9000 %	15.3	16.7	20.4	23.3	28.5	35.4	38.0
	99.9500 %	11.5	12.5	15.3	18.8	23.0	27.8	30.7
	99.9900 %	8.5	9.2	11.3	13.9	17.0	20.8	22.6
	99.9990 %	5.6	6.1	7.4	9.1	11.1	13.0	14.8

(1): The indicated flow (N_2 flow) is the Free Nitrogen Delivery (FND), i.e. the nitrogen flow referred to 20 °C, 1000 mbar and 0 % relative humidity. During testing of the units, the rejection limit is + or – 5 % of the nominal nitrogen flow.

Inlet air flow at reference conditions (2)

	Purity	PPNG 6 HE	PPNG 7 HE	PPNG 9 HE	PPNG 12 HE	PPNG 15 HE	PPNG 18 HE	PPNG 22 HE
Compressed air inlet (Nm³/h)	95.0000 %	32.9	42.3	51.7	65.7	84.6	103.5	126.9
	96.0000 %	29.9	38.5	47.1	59.8	77.0	94.1	115.5
	97.0000 %	27.5	35.4	43.3	55.0	70.8	86.6	106.2
	98.0000 %	24.9	32.1	39.2	49.8	64.1	78.4	96.2
	99.0000 %	22.1	28.5	34.8	44.3	57.0	69.7	85.5
	99.5000 %	20.4	26.2	32.1	40.8	52.5	64.2	78.7
	99.9000 %	17.6	22.6	27.7	35.2	45.3	55.4	67.9
	99.9500 %	14.5	18.7	22.9	29.0	37.4	45.7	56.1
	99.9900 %	12.9	16.7	20.4	25.9	33.3	40.7	51.0
	99.9990 %	10.9	14.1	17.2	21.9	28.2	34.4	43.0

	Purity	PPNG 6 HE	PPNG 7 HE	PPNG 9 HE	PPNG 12 HE	PPNG 15 HE	PPNG 18 HE	PPNG 22 HE
Compressed air inlet (cfm)	95.0000 %	19.3	24.9	30.4	38.7	49.8	60.9	74.7
	96.0000 %	17.6	22.7	27.7	35.2	45.3	55.4	68.0
	97.0000 %	16.2	20.8	25.5	32.4	41.7	51.0	62.5
	98.0000 %	14.7	18.9	23.1	29.3	37.7	46.1	56.6
	99.0000 %	13.0	16.8	20.5	26.1	33.5	41.0	50.3
	99.5000 %	12.0	15.4	18.9	24.0	30.9	37.8	46.3
	99.9000 %	10.3	13.3	16.3	20.7	26.6	32.6	40.0
	99.9500 %	8.5	11.0	13.5	17.1	22.0	26.9	33.0
	99.9900 %	7.6	9.8	12.0	15.2	19.6	24.0	30.0
	99.9990 %	6.4	8.3	10.1	12.9	16.6	20.3	25.3

	Purity	PPNG 28 HE	PPNG 30 HE	PPNG 37 HE	PPNG 41 HE	PPNG 50 HE	PPNG 63 HE	PPNG 68 HE
Compressed air inlet (Nm³/h)	95.0000 %	155.2	169.2	206.9	236.6	289.4	/	/
	96.0000 %	141.2	154.0	188.3	218.0	266.7	331.2	/
	97.0000 %	129.9	141.7	173.3	200.5	245.3	304.6	327.0
	98.0000 %	117.6	128.2	156.8	184.0	225.1	255.8	300.1
	99.0000 %	104.5	113.9	139.4	160.4	196.1	236.7	261.5
	99.5000 %	96.3	104.9	128.3	148.3	181.4	220.9	241.8
	99.9000 %	83.0	90.5	110.7	131.7	161.0	191.2	214.7
	99.9500 %	68.6	74.8	91.4	112.1	137.1	153.9	182.9
	99.9900 %	62.4	68.0	83.1	102.0	124.7	139.2	166.3
	99.9990 %	52.6	57.3	70.1	85.9	105.1	120.6	140.2

	Purity	PPNG 28 HE	PPNG 30 HE	PPNG 37 HE	PPNG 41 HE	PPNG 50 HE	PPNG 63 HE	PPNG 68 HE
Compressed air inlet (cfm)	95.0000 %	91.3	99.6	121.8	139.3	170.3	/	/
	96.0000 %	83.1	90.6	110.8	128.3	156.9	195.0	/
	97.0000 %	76.5	83.4	102.0	118.0	144.4	179.3	192.5
	98.0000 %	69.2	75.5	92.3	108.3	132.5	150.6	176.6
	99.0000 %	61.5	67.1	82.0	94.4	115.4	139.3	153.9
	99.5000 %	56.7	61.8	75.5	87.3	106.7	130.0	142.3
	99.9000 %	48.9	53.3	65.2	77.5	94.8	112.5	126.4
	99.9500 %	40.4	44.0	53.8	66.0	80.7	90.6	107.6
	99.9900 %	36.7	40.0	48.9	60.0	73.4	81.9	97.9
	99.9990 %	30.9	33.7	41.2	50.6	61.9	71.0	82.5

(2): The indicated flow (FAD) is the average Free Air Delivery flow (FAD = Free Air Delivery, i.e. referred to the inlet conditions). The air requested by the nitrogen generator is not constant during the production cycle. Every time the vessels are pressurized there will be an air consumption peak during a few seconds which can be 3 to 4 times the average consumption. Therefore it is important to size the air receiver correctly. During testing of the units, the rejection limit is + or – 5 % on the air demand.

Air factor at reference conditions

	Purity	PPNG 6 HE	PPNG 7 HE	PPNG 9 HE	PPNG 12 HE	PPNG 15 HE	PPNG 18 HE	PPNG 22 HE
Air factor	95.0000 %	1.86	1.86	1.86	1.86	1.86	1.86	1.86
	96.0000 %	1.91	1.91	1.91	1.91	1.91	1.91	1.91
	97.0000 %	2.02	2.02	2.02	2.02	2.02	2.02	2.02
	98.0000 %	2.13	2.13	2.13	2.13	2.13	2.13	2.13
	99.0000 %	2.36	2.36	2.36	2.36	2.36	2.36	2.36
	99.5000 %	2.59	2.59	2.59	2.59	2.59	2.59	2.59
	99.9000 %	3.19	3.19	3.19	3.19	3.19	3.19	3.19
	99.9500 %	3.51	3.51	3.51	3.51	3.51	3.51	3.51
	99.9900 %	4.33	4.33	4.33	4.33	4.33	4.33	4.33
	99.9990 %	6.30	6.30	6.30	6.30	6.30	6.30	5.57

	Purity	PPNG 28 HE	PPNG 30 HE	PPNG 37 HE	PPNG 41 HE	PPNG 50 HE	PPNG 63 HE	PPNG 68 HE
Air factor	95.0000 %	1.86	1.86	1.86	1.89	1.89	/	/
	96.0000 %	1.91	1.91	1.91	1.95	1.95	1.93	/
	97.0000 %	2.02	2.02	2.02	2.08	2.08	2.04	2.08
	98.0000 %	2.13	2.13	2.13	2.21	2.21	2.15	2.21
	99.0000 %	2.36	2.36	2.36	2.43	2.43	2.45	2.43
	99.5000 %	2.59	2.59	2.59	2.66	2.66	2.60	2.66
	99.9000 %	3.19	3.19	3.19	3.33	3.33	3.18	3.33

	Purity	PPNG 28 HE	PPNG 30 HE	PPNG 37 HE	PPNG 41 HE	PPNG 50 HE	PPNG 63 HE	PPNG 68 HE
	99.9500 %	3.51	3.51	3.51	3.51	3.51	3.26	3.51
	99.9900 %	4.33	4.33	4.33	4.33	4.33	3.94	4.33
	99.9990 %	5.57	5.57	5.57	5.57	5.57	5.46	5.57

Dimensions and weight

		PPNG 6 HE	PPNG 7 HE	PPNG 9 HE	PPNG 12 HE	PPNG 15 HE	PPNG 18 HE	PPNG 22 HE
Width	mm	840	840	840	840	840	840	840
Length	mm	775	775	775	775	775	775	1400
Height	mm	2015	2015	2015	2015	2015	2015	2015
Net mass	kg	276	289	312	335	367	410	608
Width	in	33	33	33	33	33	33	33
Length	in	31	31	31	31	31	31	55
Height	in	79	79	79	79	79	79	79
Net mass	lbs	609	637	688	739	809	904	1341

	Purity	PPNG 28 HE	PPNG 30 HE	PPNG 37 HE	PPNG 41 HE	PPNG 50 HE	PPNG 63 HE	PPNG 68 HE
Width	mm	840	840	840	970	970	970	970
Length	mm	1400	1400	1400	1400	1400	1400	1400
Height	mm	2015	2015	2015	2015	2015	2015	2015
Net mass	kg	648	681	734	764	1039	1209	1209
Width	in	33	33	33	38	38	38	38
Length	in	55	55	55	55	55	55	55
Height	in	79	79	79	79	79	79	79
Net mass	lbs	1429	1502	1618	1685	2291	2666	2666

Mechanical connections

		PPNG 6 HE	PPNG 7 HE	PPNG 9 HE	PPNG 12 HE	PPNG 15 HE	PPNG 18 HE	PPNG 22 HE
inlet	G/NPT	1"	1"	1"	1"	1"	1"	1"
From nitrogen receiver	G/NPT	1"	1"	1"	1"	1"	1"	1"
To nitrogen receiver	G/NPT	1"	1"	1"	1"	1"	1"	1"
Nitrogen outlet	G/NPT	1"	1"	1"	1"	1"	1"	1"
Exhaust connection		M8 x Ø95	M8 x Ø95	M8 x Ø95	M8 x Ø95	M8 x Ø95	M8 x Ø95	M8 x Ø95

	Purity	PPNG 28 HE	PPNG 30 HE	PPNG 37 HE	PPNG 41 HE	PPNG 50 HE	PPNG 63 HE	PPNG 68 HE
Air inlet	G/NPT	1"	1"	1"	1"	1"	1"	1"
From nitrogen receiver	G/NPT	1"	1"	1"	1"	1"	1"	1"
To nitrogen receiver	G/NPT	1"	1"	1"	1"	1"	1"	1"
Nitrogen outlet	G/NPT	1"	1"	1"	1"	1"	1"	1"
Exhaust connection		M8 x Ø95	M8 x Ø95	M8 x Ø95	M8 x Ø95	M8 x Ø95	M8 x Ø95	M8 x Ø95

Minimum piping diameters

		PPNG 6 HE	PPNG 7 HE	PPNG 9 HE	PPNG 12 HE	PPNG 15 HE	PPNG 18 HE	PPNG 22 HE
Air inlet	G/NPT	1/2"	1/2"	1/2"	3/4"	3/4"	1"	1"
From nitrogen receiver	G/NPT	1/2"	1/2"	1/2"	3/4"	3/4"	1"	1"
To nitrogen receiver	G/NPT	1/2"	1/2"	1/2"	3/4"	3/4"	1"	1"
Nitrogen outlet	G/NPT	1/2"	1/2"	1/2"	1/2"	1/2"	3/4"	3/4"
Exhaust connection < 3m		1 x DN 70	1 x DN 70	1 x DN 70	1 x DN 70	1 x DN 70	1 x DN 70	1 x DN 70
Exhaust connection > 3m		1 x DN100	1 x DN100	1 x DN100	1 x DN100	1 x DN100	1 x DN100	1 x DN100

	Purity	PPNG 28 HE	PPNG 30 HE	PPNG 37 HE	PPNG 41 HE	PPNG 50 HE	PPNG 63 HE	PPNG 68 HE
Air inlet	G/NPT	1"	1"	1"	1 1/4"	1 1/4"	1 1/2"	1 1/2"
From nitrogen receiver	G/NPT	1"	1"	1"	1 1/4"	1 1/4"	1 1/2"	1 1/2"
To nitrogen receiver	G/NPT	1"	1"	1"	1 1/4"	1 1/4"	1 1/2"	1 1/2"
Nitrogen outlet	G/NPT	3/4"	1"	1"	1"	1"	1"	1"
Exhaust connection		1 x DN 70	1 x DN 70	1 x DN 70	2 x DN 70	2 x DN 70	2 x DN 70	2 x DN 70
Exhaust connection > 3m		1 x DN100	1 x DN100	1 x DN100	2 x DN100	2 x DN100	2 x DN100	2 x DN100

Minimum piping diameters parallel installation

		PPNG 6 HE	PPNG 7 HE	PPNG 9 HE	PPNG 12 HE	PPNG 15 HE	PPNG 18 HE	PPNG 22 HE
Common air inlet		1"	1"	1"	1 1/4"	1 1/4"	1 1/2"	1 1/2"
Air inlet	G/NPT	1/2"	1/2"	1/2"	3/4"	3/4"	1"	1"
From nitrogen receiver	G/NPT	1/2"	1/2"	1/2"	3/4"	3/4"	1"	1"
To nitrogen receiver	G/NPT	1/2"	1/2"	1/2"	3/4"	3/4"	1"	1"
Nitrogen outlet	G/NPT	1/2"	1/2"	1/2"	1/2"	1/2"	3/4"	3/4"
Exhaust connection < 3m		1 x DN 70	1 x DN 70	1 x DN 70	1 x DN 70	1 x DN 70	1 x DN 70	1 x DN 70

		PPNG 6 HE	PPNG 7 HE	PPNG 9 HE	PPNG 12 HE	PPNG 15 HE	PPNG 18 HE	PPNG 22 HE
Exhaust connection > 3m		1 x DN100	1 x DN100	1 x DN100	1 x DN100	1 x DN100	1 x DN100	1 x DN100

	Purity	PPNG 28 HE	PPNG 30 HE	PPNG 37 HE	PPNG 41 HE	PPNG 50 HE	PPNG 63 HE	PPNG 68 HE
Common air inlet	G/NPT	1 1/2"	1 1/2"	1 1/2"	2"	2"	2 1/2"	2 1/2"
Air inlet	G/NPT	1"	1"	1"	1 1/4"	1 1/4"	1 1/2"	1 1/2"
From nitrogen receiver	G/NPT	1"	1"	1"	1 1/4"	1 1/4"	1 1/2"	1 1/2"
To nitrogen receiver	G/NPT	1"	1"	1"	1 1/4"	1 1/4"	1 1/2"	1 1/2"
Nitrogen outlet	G/NPT	3/4"	1"	1"	1"	1"	1"	1"
Exhaust connection < 3m		1 x DN 70	1 x DN 70	1 x DN 70	2 x DN 70	2 x DN 70	2 x DN 70	2 x DN 70
Exhaust connection > 3m		1 x DN100	1 x DN100	1 x DN100	2 x DN100	2 x DN100	2 x DN100	2 x DN100

Minimum receiver size

		PPNG 6 HE	PPNG 7 HE	PPNG 9 HE	PPNG 12 HE	PPNG 15 HE	PPNG 18 HE	PPNG 22 HE
Air receiver	l	150	150	150	280	280	500	500
Air receiver	US gal	40	40	40	74	74	132	132
Nitrogen receiver	l	150	150	150	280	280	500	500
Nitrogen receiver	US gal	40	40	40	74	74	132	132

	Purity	PPNG 28 HE	PPNG 30 HE	PPNG 37 HE	PPNG 41 HE	PPNG 50 HE	PPNG 63 HE	PPNG 68 HE
Air receiver	l	500	1000	1000	1000	1000	1500	2000
Air receiver	US gal	132	264	264	264	264	396	528
Nitrogen receiver	l	500	1000	1000	1000	1000	1500	2000
Nitrogen receiver	US gal	132	264	264	264	264	396	528

Minimum receiver size parallel installation

		PPNG 6 HE	PPNG 7 HE	PPNG 9 HE	PPNG 12 HE	PPNG 15 HE	PPNG 18 HE	PPNG 22 HE
Common air receiver	l	300	300	300	560	560	1000	1000
Common air receiver	US gal	79	79	79	148	148	264	264
Nitrogen receiver	l	150	150	150	280	280	500	500
Nitrogen receiver	US gal	40	40	40	74	74	132	132

	Purity	PPNG 28 HE	PPNG 30 HE	PPNG 37 HE	PPNG 41 HE	PPNG 50 HE	PPNG 63 HE	PPNG 68 HE
Common air receiver	l	1000	2000	2000	2000	2000	3000	4000
Common air receiver	US gal	264	528	528	528	528	792	1057
Nitrogen receiver	l	500	1000	1000	1000	1000	1500	2000
Nitrogen receiver	US gal	132	264	264	264	264	396	528

10.4 Correction factors

Correction factors

If the inlet pressure and/or ambient temperature differ from the reference data, the nominal performance figures need to be corrected with correction factors Kpc, Kpa, Ktc and Kta. The value of the correction factors differs from generator type (ppm or %): % generators deliver nitrogen with a purity from 95 % to 99.9 %, ppm generators deliver nitrogen with a purity from 99.95 % to 99.999 %.

Pressure correction factors

	Capacity (Qout)		Air ratio	
	Kpc		Kpa	
Pressure (bar)	%	ppm	%	ppm
4	0.56	0.52	1.09	1.11
4.5	0.63	0.60	1.08	1.08
5	0.71	0.67	1.06	1.05
5.5	0.77	0.75	1.04	1.03
6	0.85	0.83	1.01	1.02
6.5	0.93	0.91	1.00	1.00
7	1.00	1.00	1.00	1.00
7.5	1.07	1.04	1.01	1.02
8	1.13	1.09	1.02	1.04
8.5	1.19	1.11	1.02	1.06
9	1.25	1.13	1.03	1.07
9.5	1.30	1.15	1.03	1.10
10	1.35	1.16	1.03	1.13
10.5	1.40	1.17	1.04	1.16
11	1.45	1.18	1.04	1.19
11.5	1.50	1.20	1.05	1.21
12	1.54	1.21	1.05	1.24
12.5	1.58	1.23	1.05	1.26
13	1.61	1.25	1.06	1.28

Temperature correction factors

	Capacity (Qout)		Air ratio	
	Ktc		Kta	
Temperature (°C)	**%**	**ppm**	**%**	**ppm**
5	1.00	1.02	0.98	0.98
10	1.00	1.02	0.98	0.98
15	1.00	1.00	1.00	1.00
20	1.00	1.00	1.00	1.00
25	0.98	0.96	1.02	1.05
30	0.95	0.93	1.04	1.10
35	0.92	0.88	1.08	1.17
40	0.88	0.83	1.11	1.24
45	0.83	0.78	1.16	1.33
50	0.78	0.72	1.21	1.42
55	0.72	0.67	1.27	1.51
60	0.66	0.62	1.33	1.60

Due to the relatively slow air speeds in the receivers, the temperature of the molecular sieve material (CMS) will be equal to the ambient temperature.

Outlet flow calculation

$Q_{OUT\_ACT} = Q_{OUT\_NOM} \times Kpc \times Ktc$

With

Q_{OUT_ACT} : actual outlet flow

Q_{OUT_NOM} : nominal outlet flow at reference conditions

Kpc : inlet pressure correction factor for capacity

Ktc : ambient temperature correction factor for capacity

Inlet flow calculation

1. **Air ratio calculation**
   $AR_{ACT} = AR_{NOM} \times Kpa \times Kta$
   With
   AR_{ACT} : actual air ratio
   AR_{NOM} : nominal air ratio at reference conditions
   Kpa : inlet pressure correction factor for air ratio
   Kta : ambient temperature correction factor for air ratio
2. **Inlet flow calculation**
   $Q_{IN\_ACT} = Q_{OUT\_ACT} \times AR_{ACT}$
   Where:
   Q_{IN_ACT} : actual inlet flow
   Q_{OUT_ACT} : actual outlet flow
   AR_{ACT} : actual air ratio

Calculation example

Machine : PPNG 18 HE

Purity : 99.50%

Qout_nom : 24.7 Nm³/h

Air ratio : 2.59

Qin_nom : 64.2 Nm³/h

Inlet pressure : 10 bar

Max. ambient temperature : 40°C

Correction factors from tables:

Kpc : 1.35

Ktc : 0.88

Kpa : 1.03

Kta : 1.11

Calculation

1. Actual outlet flow
   $Q_{OUT\_ACT} = Q_{OUT\_NOM}$ x Kpc x Ktc = 24.7 Nm³/h x 1.35 x 0.88 = 29.3 Nm³/h
   The actual nitrogen outlet flow will be 29.3 Nm³/h at 10 bar and 40°C.
2. Air ratio
   $AR_{ACT} = AR_{NOM}$ x Kpa x Kta = 2.59 x 1.03 x 1.11 = 2.96
   The actual air ratio will be 2.96 at 10 bar and 40°C.
3. Actual inlet flow
   $Q_{IN\_ACT} = Q_{OUT\_ACT}$ x AR_{ACT} = 29.3 Nm³/h x 2.96 = 86.73 Nm³/h
   The actual compressed air inlet flow will be 86.73 Nm³/h at 10 bar and 40°C.

11 Pressure Equipment Directives

Components subject to Pressure Equipment Directive 97/23/EC (until 20/07/2016) or 2014/68/EU (from 20/07/2016 onwards)

Parts of article 3.3 of 97/23/EC are subject to Sound Engineering Practice (SEP).

Parts of category I according to 97/23/EC are integrated into the machine and fall under the exclusion of article I, section 3.6.

The following tables A and B contain the necessary information for the inspection of all pressure equipment of category I according Pressure Equipment Directive 97/23/EC and all pressure equipment according the Simple Pressure Vessel Directive 2009/4105/EC.

Design criteria for pressure equipment:

Table A

Type	Vessel type	Design pressure [bar]	Vessel diameter [mm]	Vessel volume [L]	PED category
PPNG 6 HE	small	14.5	150	19.5	I
PPNG 7 HE	medium	14.5	150	24.7	I
PPNG 9 HE	large	14.5	150	30	I
PPNG 12 HE	small	14.5	150	19.5	I
PPNG 15 HE	medium	14.5	150	24.7	I
PPNG 18 HE	large	14.5	150	30	I
PPNG 22 HE	medium	14.5	150	24.7	I
PPNG 28 HE	large	14.5	150	30	I
PPNG 30 HE	medium	14.5	150	24.7	I
PPNG 37 HE	large	14.5	150	30	I
PPNG 41 HE	medium	14.5	150	24.7	I
PPNG 50 HE	large	14.5	150	30	I
PPNG 63 HE	large	14.5	150	30	I
PPNG 68 HE	large	14.5	150	30	I

Table B

Generator	Min. design temperature [°C]	Max. design temperature [°C]	Number of cycles (1)	Wall thickness [mm]
PPNG 6 HE	0	60	4730400	5
PPNG 7 HE	0	60	4730400	5
PPNG 9 HE	0	60	4730400	5
PPNG 12 HE	0	60	4730400	5
PPNG 15 HE	0	60	4730400	5
PPNG 18 HE	0	60	4730400	5
PPNG 22 HE	0	60	4730400	5
PPNG 28 HE	0	60	4730400	5
PPNG 30 HE	0	60	4730400	5
PPNG 37 HE	0	60	4730400	5

Generator	Min. design temperature [°C]	Max. design temperature [°C]	Number of cycles (1)	Wall thickness [mm]
PPNG 41 HE	0	60	4730400	5
PPNG 50 HE	0	60	4730400	5
PPNG 63 HE	0	60	4730400	5
PPNG 68 HE	0	60	4730400	5

(1): The number of cycles refers to the number of cycles from 0 bar(g) to maximum pressure

(2): The minimum wall thickness refers to the minimum required thickness according design calculations.

Recommendation of the manufacturer for the re-inspection time

Following actions are to be executed by authorised service personnel, unless stated differently in the applicable legislation. The stated time interval has as reference the day of start-up of the unit.

- Every 6 months: visual check of the vessel (tank) material on the outside (exposed) for traces of strong corrosion. Consult the service department of your supplier if necessary.
- Further re-inspection of the pressurized components should be carried out according to the local regulations. Contact your Notified Body for more information.

12 Declaration of conformity

Insert logo here

EU DECLARATION OF CONFORMITY

We, (1) declare under our sole responsibility, that the product
Machine name :
Machine type :
Serial number :

Which falls under the provisions of article 12.2 of the EC Directive 2006/42/EC on the approximation of the laws of the Member States relating to machinery, is in conformity with the relevant Essential Health and Safety Requirements of this directive.

The machinery complies also with the requirements of the following directives and their amendments as indicated.

	Directive on the approximation of laws of the Member States relating to		Harmonized and/or Technical Standards used		Att' mnt
a.	(2)		(3)		
b.					X
c.					
d.					X
e.					
f.					
g.					X

The harmonized and the technical standards used are identified in the attachments hereafter

<1> is authorized to compile the technical file.

	Conformity of the specification to the directives	Conformity of the product to the specification and by implication to the directives
Issued by	Engineering	Manufacturing
Name		
Signature		
Date		
Place		

84560D

Typical example of a Declaration of Conformity document

(1): Contact address:

International Compressor Distribution NV

Boomsesteenweg 957

B-2610 Wilrijk (Antwerp)

Belgium

(2): Applicable directives

(3): Standards used

On the Declaration of Conformity / Declaration by the Manufacturer, the harmonized and/or other standards that have been used for the design are shown and/or referred to.

The Declaration of Conformity / Declaration by the Manufacturer is part of the documentation that is supplied with this device.

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