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VERNIT - HORNIT N2(i) expansion systems

User manual

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PRESSCON

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Introduction

The VERNIT HORNIT expansion system monitors and controls the pressure that is present in the expansion chamber of a central heating system. It is applicable for the central heating systems in the horticulture industry. The system is comprised out of a nitrogen generator with an air compressor, a set of pressure sensors that measure the water level and pressure in a buffer tank and a control module that controls the nitrogen generator.

The central heating systems that are used in the horticulture industry store their heat in a vertical or horizontal buffer tank. The buffer tanks are not fully filled with water but have an expansion chamber above the water. When looking at a vertical buffer tank the expansion chamber is right above the water inside the tank. When looking at a horizontal buffer tank the expansion chamber is also right above the water inside the tank but it can also be located in a separate expansion vessel. The expansion chamber is intended for the water in the central heating system to expand and shrink when the water is heated up or cooled down. During this process the pressure in the expansion chamber also changes.

The VERNIT HORNIT expansion system monitors the pressure in the expansion chamber. When the pressure becomes too high then an overpressure valve relieves the extra pressure. When the pressure becomes to low then the VERNIT HORNIT expansion system will produce nitrogen in order to get the expansion chamber pressurized again. The nitrogen generator of the VERNIT HORNIT expansion system produces an air mixture with a nitrogen concentration of 99,0 vol. % N_2. The system uses nitrogen because it is an inert gas. Inert gasses have the ability to prevent the formation of rust when it is available in a high concentration. The VERNIT HORNIT expansion system makes sure that there is always a blanket of nitrogen present in the expansion chamber within the buffer tank and that it is kept at a steady overpressure.

Next to the pressure management of the nitrogen blanket, the VERNIT HORNIT expansion system also acts as a monitoring device for the water level in the buffer tank. By using pressure sensors the system determines the height of the water level. Once the water level becomes too high or too low, the VERNIT HORNIT expansion system will generate the appropriate fault or alarm messages and can also send a stop signal to other relevant devices. The water level monitoring is important for the conservation of the buffer tank. It prevents the water level from becoming too high and damaging the roof of the buffer tank.

It also prevents the water level from becoming too low, which leads to air in the heat supply spray tube and in the central heating network.

These are important features for maintaining the buffer tank and preserving the central heating system.

Important to know

The expansion systems are produced in 2 different types. Namely, the VERNIT and HORNIT systems. These 2 types have the following differences.

- VERNIT, the expansion system regulates the pressure of the nitrogen blanket in the vertical heat storage tank.
- HORNIT, the expansion system regulates the total system pressure in a horizontal heat storage tank. This is done either directly or via an external expansion vessel.

In addition to VERNIT and HORNIT, there are a few additional indications that define the function of the expansion system. These are:

2.0 – 30.0	The number in the type designation indicates the capacity of the nitrogen generator. This number represents the flow rate in m³/h that the generator can produce with a purity of 99.0 Vol%N2. The smallest capacity per generator is 2.0 m³/h and the largest possible capacity is 30.0 m³/h. Larger capacities are also possible, but several nitrogen generators have to be combined with each other.
H.P.	"High Performance" stands for the design of the PSA tube. Indicates that the PSA applied to the system was manufactured by PRESSCON. Nitrogen generators from before 2009 do not have this addition.
ECONOMY	This indicates that the generator is equipped with a valve control system designed for high output and energy efficiency.
N2i	N2i stands for direct injection of nitrogen. In this case, the expansion system will blow nitrogen directly into the heat storage tank.
N2	N2 without the "i" stands for an expansion system without direct injection. In this case, the expansion system uses a separate pressure vessel in which the nitrogen is first stored before it is blown into the heat storage tank.
A (panel)	The addition "A" indicates that the expansion system is equipped with the A-type control panel which is the most comprehensive version.
B (panel)	The addition of "B" indicates that the expansion system is equipped with the B-type control panel, which is a simpler version than the A-type panel.
DUO(panel)	DUO means that the expansion system is suitable for monitoring 2 separate heat storage tanks.
ELC	The expansion system is prepared to operate in an Equal Level Control setup. This function allows for control of the level difference in two tanks by controlling a pump. For this purpose, the expansion system will work together with 1 or more expansion systems via CAN-bus.
SLC	The expansion system is prepared to use the Switching Level Control function. This function generates a switching signal based on the level difference in two tanks. For this purpose, the expansion system will work together with 1 or more expansion systems via CAN-bus.
SLDM	Leak detection measurement that works on the basis of a 3rd pressure sensor at the bottom of the vertical buffer tank.
CLDM	Leak detection measurement that works on the basis of information that the system receives from the horticultural computer. The horticultural computer then indicates the fill level of the vertical buffer tank.

The type designations described above are compatible with each other according to the matrix below.

	VERNIT	**HORNIT**	**N2i**	**N2**	**A (panel)**	**B (panel)**	**DUO (panel)**	**ELC / SLC**	**SLDM / CLDM**
VERNIT	N/A	N/A	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
HORNIT	N/A	N/A	**Yes**	**Yes**	**Yes**	**No**	**Yes**	**No**	**No**
N2i	**Yes**	**Yes**	N/A	N/A	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
N2	**Yes**	**Yes**	N/A	N/A	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**

A (panel)	**Yes**	**Yes**	**Yes**	**Yes**	N/A	N/A	N/A	**Yes**	**Yes**
B (panel)	**Yes**	**No**	**Yes**	**Yes**	N/A	N/A	N/A	**No**	**No**
DUO (panel)	**Yes**	**Yes**	**Yes**	**Yes**	N/A	N/A	N/A	**Yes**	**Yes**
ELC / SLC	**Yes**	**No**	**Yes**	**Yes**	**Yes**	**No**	**Yes**	N/A	**Yes**
SLDM / CLDM	**Yes**	**No**	**Yes**	**Yes**	**Yes**	**No**	**Yes**	**Yes**	N/A

Touchscreen and PRESS-Display

The touchscreen and the PRESS-display are both control units that can be used for the PRESSCON nitrogen generators. Originally, the PRESS-display was conceived as a multi-purpose digital display showing the water level, nitrogen blanket pressure and any alarms. The Touchscreen also performs these functions, but offers a more visual overview of the system and more intuitive controls. The Touchscreen can also be universally used for multiple types of nitrogen generators.

- The Touchscreen is used as standard for the types VERNIT - HORNIT ECONOMY A and ECONOMY DUO. Optionally, this display can also be used with a VERNIT ECONOMY B.
- The PRESS-display is used as standard with the VERNIT ECONOMY B

If 2 or more expansion systems are connected to each other via CAN-bus, it is important that the displays within that network are all of the same type. Touchscreen and PRESS-display do not work together within a CAN-bus network. This could occur, for example, in an ELC setup.

1.1.1 Working with the safety valve

The safety valve is commonly located on the roof of the buffer tank. When working on the safety valve, the following hazards should be considered.

Symbol	Description	Applies to
	HOT PARTS, Do not touch parts with bare hands. Use heat-resistant clothing.	The housing of the safety valve and relieved nitrogen from the buffer tank. The upper layer of water can heat up the nitrogen in the safety valve. The housing can then be too hot to touch. The relieved nitrogen from the vacuum- overpressure safety valve on top of a vertical buffer tank can also contain steam with a temperature of 90°C which could cause burn injury. Vacuum safety valves on the horizontal buffer tanks do not release nitrogen.
	ATTENTION! WORKING AT HIGHTS,	Working on the roof of a vertical or horizontal buffer tank is considered working at heights. Fall protection is recommended when working on the safety valve.
	HIGH PRESSURE, Relief pressure from components before work is conducted.	The safety valves on both the vertical and horizontal buffer tanks. The safety valve on a vertical buffer tank can be depressurized by hand. The pressure is not higher than 28 mBar. The safety valve on a horizontal buffer tank can only be depressurized by relieving water pressure for the buffer tank. The pressure is not higher than 1200 mBar.

1.2 Description of hazard symbols

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

Symbol	Description	Symbol	Description
	1. OVERPRESSURE VALVE, Be aware of the sudden relief of overpressure.		7. HIGH PRESSURE, Relief pressure from components before work is conducted.
	2. DANGEROUS VOLTAGE, Forbidden to work on the system if the power is on.		8. HOT PARTS, Do not touch parts with bare hands. Use heat-resistant clothing.
	3. DANGEROUS TO INHALE GAS, Avoid the specified area or wear appropriate breathing equipment.		9. MOVING PARTS, Risk of getting stuck or injuries to limbs. Turn the machine off completely before working on it.

	4. NOISE, Wear ear protection to prevent hearing damage.		10. ROTATING FAN, Risk of getting stuck or injuries to limbs. Turn the machine off completely before working on it.
	5.MACHINE WITH AUTOMATIC START, Machine stops and starts automatically when it is operating normally. Turn off the machine completely before working on it.		11. ATTENTION, Special situation occurs, follow additional instructions.
	6. READ THE OPERATING AND MAINTENANCE INSTRUCTIONS, It is advised that the maintenance instructions are read before continuing work.		

2 System components

The PRESSCON expansion systems consist out of the following components: a nitrogen generator, compressor, safety valve and 2 or more pressure sensors. This chapter describes these components by giving an image of each device and by numbering the most important parts. The compressor is not described because different brands and types can be applied and it is delivered with its own manual.

2.1 Nitrogen generator type ECONOMY A

2 system

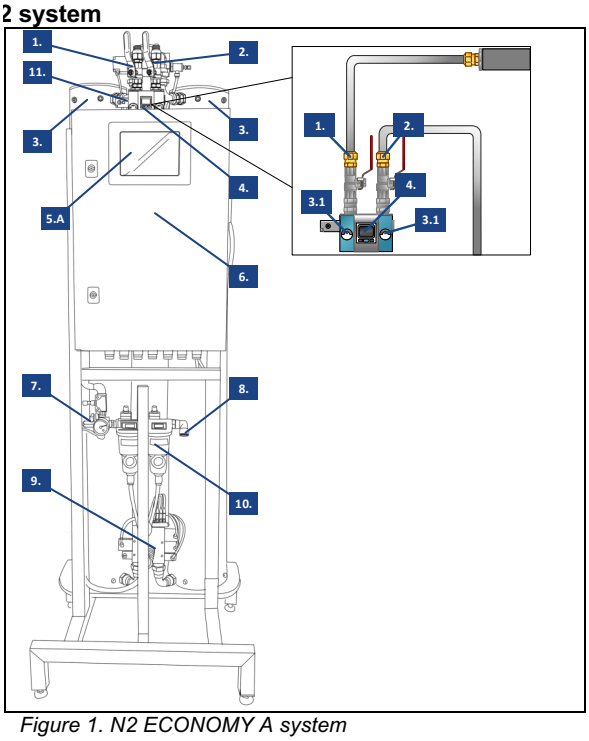


Figure 1. N2 ECONOMY A system

2i system

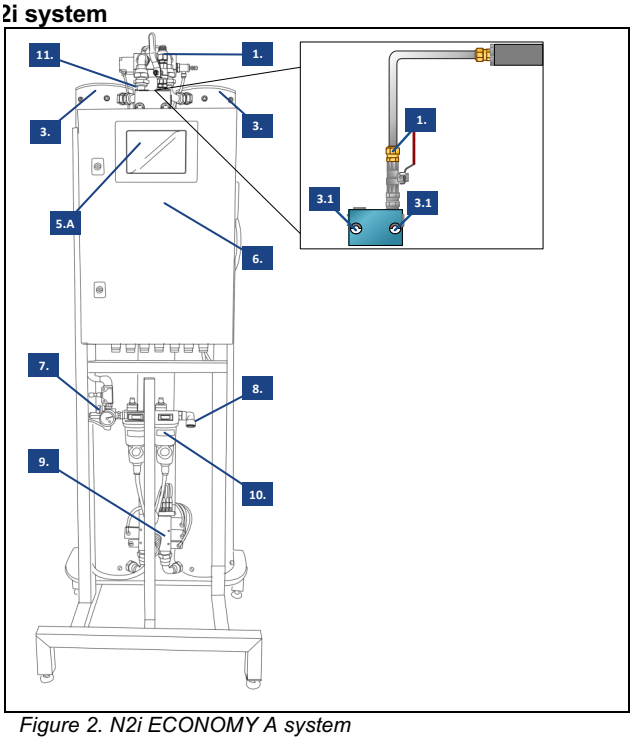


Figure 2. N2i ECONOMY A system

2.2 Nitrogen generator type ECONOMY B

2 system

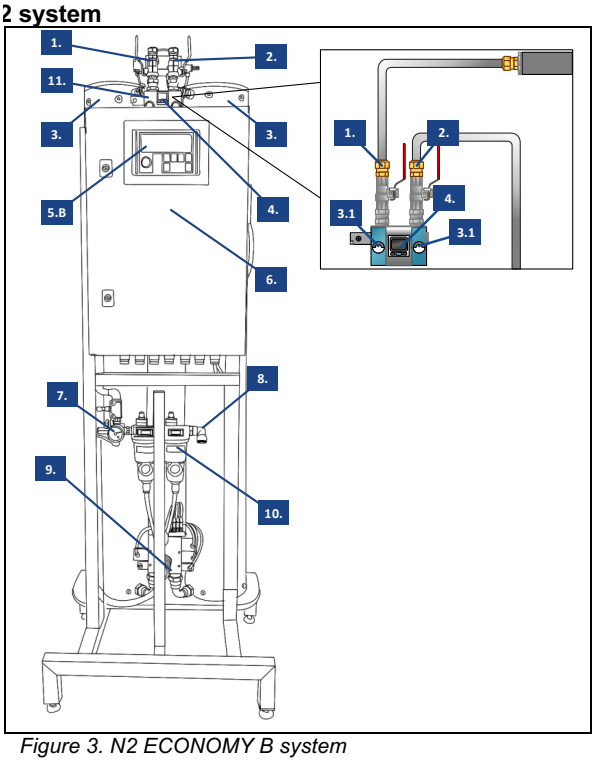


Figure 3. N2 ECONOMY B system

2i system

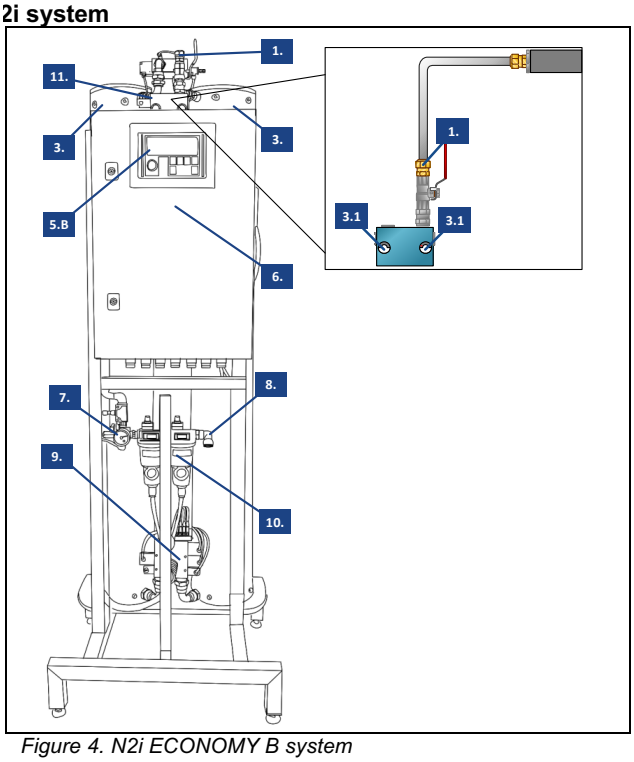


Figure 4. N2i ECONOMY B system

2.3 Nitrogen generator type ECONOMY DUO

2 system

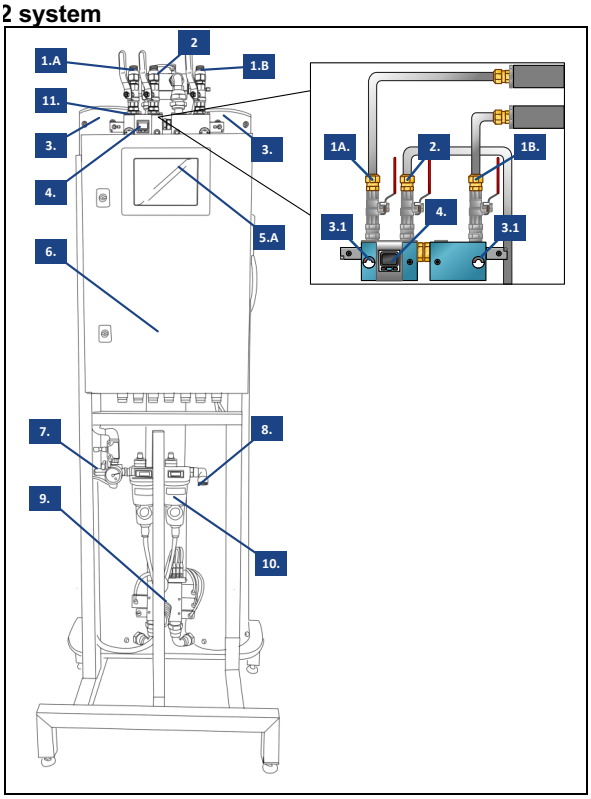


Figure 5. N2 ECONOMY DUO system

2i system

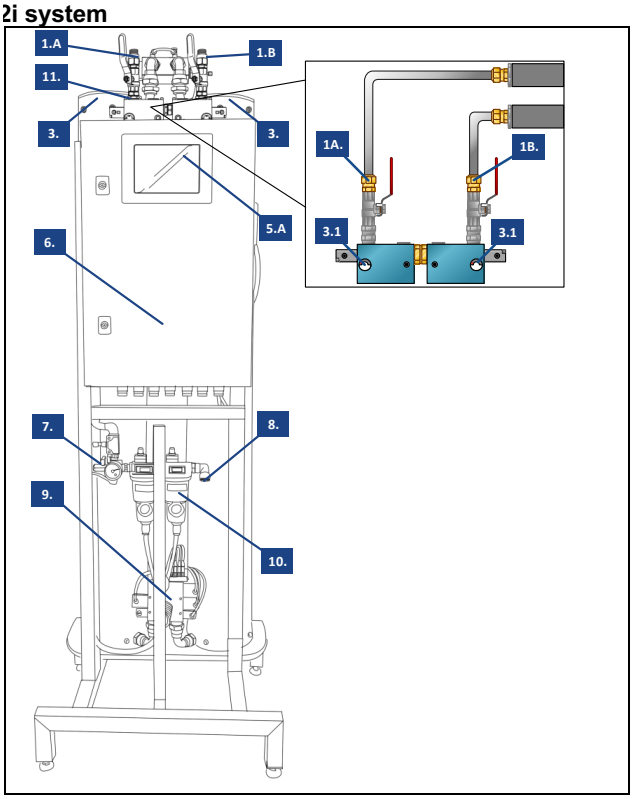


Figure 6. N2i ECONOMY DUO system

Legend

Legend for the nitrogen generator of the types: ECONOMY A, ECONOMY B, ECONOMY DUO.

Ref. No.	Description	Function
1.	Nitrogen output connection	Tube which puts out the nitrogen mixture that is produced by the nitrogen generator. This outlet will be connected to the piping that runs to the buffer tank. Please note that this connection is located differently when comparing the N2 and N2i systems. Also note that the N2 and DUO systems have solenoid valves in the tubing while the N2i systems do not.
1.A/B	Nitrogen inlet tank 1 and tank 2	Same connection as the standard Nitrogen output connection. Connection 1.A is used for supplying nitrogen to tank 1 and connection 1.B is used for supplying nitrogen to tank 2.
2.	Nitrogen HP vessel connection	Tube which puts out the nitrogen mixture that is produced by the nitrogen generator. This outlet is specially fitted for connecting a nitrogen HP vessel.
3.	PSA vessels	High pressure vessels with active carbon inside. The Pressure Swing Adsorption process takes place within these vessels. The ST BASIC systems also uses the nitrogen HP vessel for the Pressure Swing Adsorption process.
3.1	PSA pressure gauges	0 – 10 bar (0,0 – 1,0 MPa) pressure gauges that indicate the pressure within the PSA vessels. The left pressure gauge is for the left PSA vessel and the right pressure gauge is for the right pressure vessel.
4.	Digital nitrogen HP vessel pressure regulator.	Digital pressure switch with a start and stop setting. At default, the pressure regulator will generate a start signal below 4.0 Bar. At 6.5 Bar, the signal will turn off and the text on the display will turn green. If the pressure then drops below 4.0 Bar, the text on the display will turn red and a new start signal is generated.
5.A	Touchscreen	Standard for ECONOMY A and ECONOMY DUO systems. This is the most important monitoring device for reading the statuses and values of the system. The touchscreen is used to navigate and adjust the settings.
5.B	PRESS-display	LCD display with buttons. Standard for ECONOMY B systems. This is the most important monitoring device for reading the statuses and values of the system. The buttons are used to navigate and adjust the settings.
6.	Control cabinet	Control cabinet containing all the electronic components needed to manage the nitrogen generator, compressor and sensor measurements of 1 buffer tank. This type of control cabinet has enough space for all standard components and additional components required for any further expansion of the control cabinet.
7.	Compressed air regulator and pressure switch.	Composition of pressure control valve and pressure switch. The maximum air pressure for the nitrogen generator is manually setup by adjusting the pressure control valve. The pressure switch notifies the system if there is a pressure drop.
8.	Compressed air inlet	Push-in connection that is used for connecting the compressor to the nitrogen generator. This is commonly done with a 16mm nylon air hose.
9.	PSA control manifold	A pneumatically controlled manifold block that regulates the flow of air and nitrogen during the Pressure Swing Adsorption process.
10.	Compressed air filters	2 filters that filter out dirt and moisture that comes with the compressed air.
11.	Nitrogen inlet manifold	A pneumatically controlled manifold block that regulates the flow of nitrogen to the nitrogen storage vessel and one or two buffer tanks.

2.4 Vacuum- overpressure safety valve and vacuum safety valve

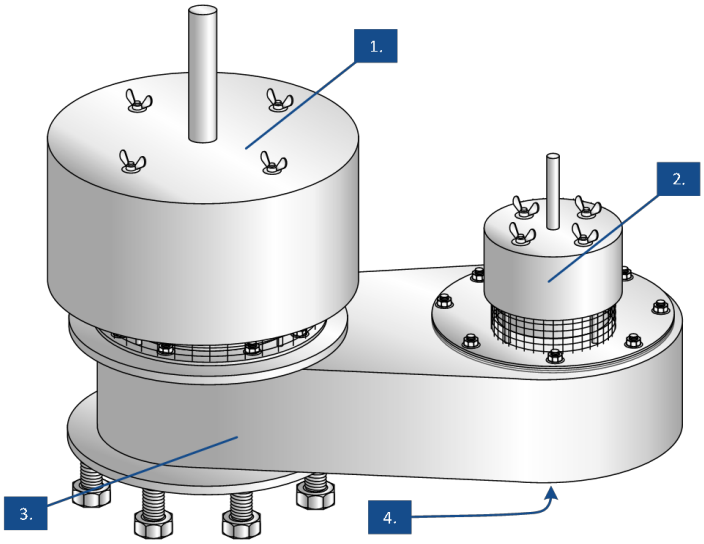


Figure 7. PV 80/25/20-2, PV 150/25/20-2, PV 200/25/20-2 (VERNIT systems)

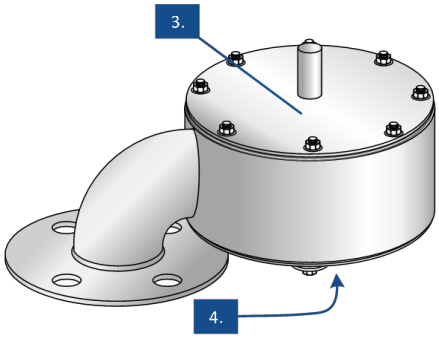


Figure 8. PV 50-2F, PV 80-2F, PV 100-2F.(HORNIT systems)

Legend

Legend for the safety valves of the types: PV 80/25/20-2, PV 150/25/20-2, PV 200/25/20-2, PV 50-2F, PV 80-2F, PV 100-2F.

Ref. No.	Description	Function
1.	Maximum overpressure valve	A mechanically operating valve plate with calibrated lead slices that relieves nitrogen at the maximum allowed pressure. It is protected with an additional cover.
2.	Operating overpressure valve	A mechanically operating valve plate with calibrated lead slices that relieves nitrogen at the maximum operating pressure. It is protected with an additional cover.
3.	Safety valve housing	Assembly housing that holds the vacuum valve and overpressure valves.
4.	Vacuum pressure valve	A mechanically operating valve plate without lead slices that is lifted when a vacuum occurs.

2.5 Vacuum- overpressure safety valve with tracing band

For cold environments it is possible to install tracing ribbon around the vacuum- overpressure safety valve to prevent it from freezing. Although the safety valve is designed to withstand a certain level of frost, the additional tracing ribbon is an optional feature that is advisable for environments with long periods of frost.

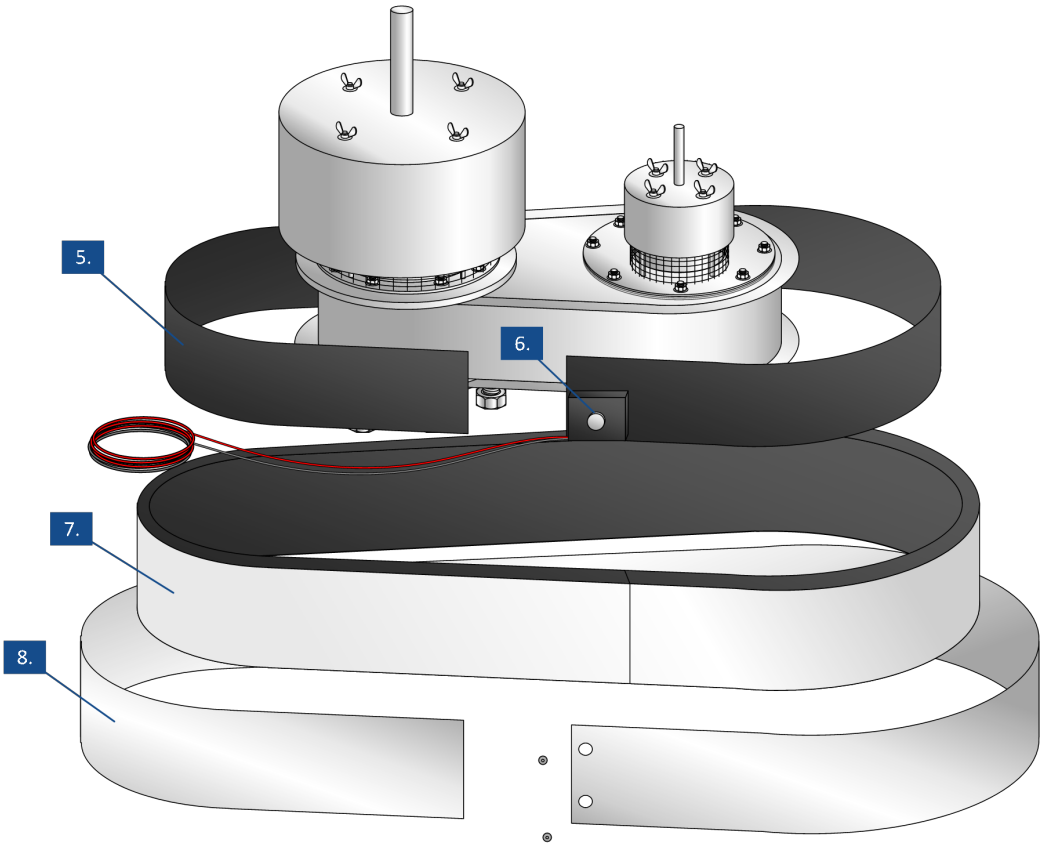


Figure 9. Vacuum- overpressure safety valve

Legend

Ref. No.	Description	Function
5.	Tracing band	Band that is heated when powered with electricity.
6.	Thermostat	Thermostat that monitors the surrounding temperature at the sensor and activates the tracing ribbon when the temperature becomes too low.
7.	Insulation material	Insulation material that prevents the loss of heat that is generated by the tracing band. By preventing loss of heat to the surrounding, more heat is induced into the safety valve.
8.	Finishing plating	Plating that keeps the tracing band and insulation material in place and protects them against external influence.

2.6 Pressure sensor

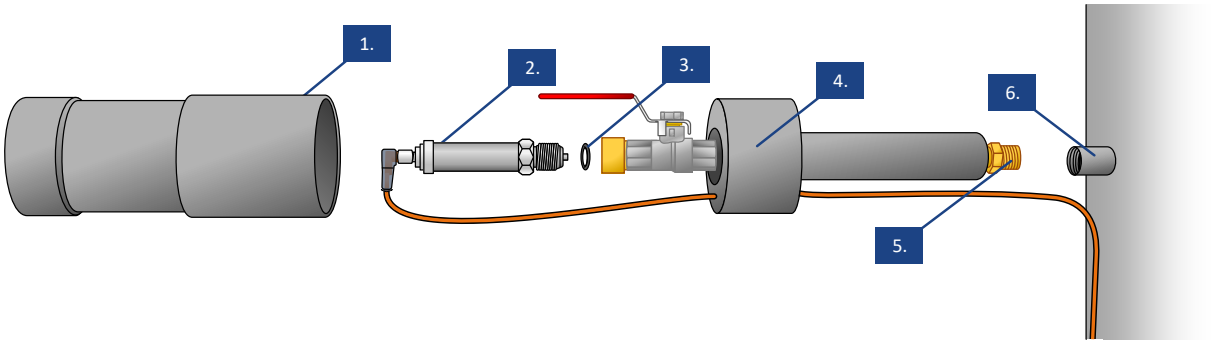


Figure 10. Sensor 0-600mBar, 0-1000mBar, 0-1500mBar, 0-1600mBar, 0-2500mBar.

Legend

Legend for the pressure sensors of the types: 0-600mBar, 0-1000mBar, 0-1600mBar, 0-2500mBar,

Ref. No.	Description	Function
1.	Protection cap cover	Plastic cover that slides over the pressure sensor. It clamps onto the protection cap sensor holder.
2.	Pressure sensor	Electrical transmitter that translates a pressure measurement into a readable 4…20mA signal over a 2 wire connection.
3.	Rubber ring	Rubber ring that seals leakage from air and water between the pressor sensor and protection cap of the sensor.
4.	Protection cap sensor holder	Plastic isolated holder with tubing that holds the pressure sensor. The sensor holder functions as additional protection against heat and moisture. It also allows the pressure sensor to be easily exchanged.
5.	Threaded end of sensor cap	1/2” threaded end through which the protection cap is fitted onto the buffertank.
6.	Welded threaded socket	1/2” Socket that is welded onto the buffertank and in which the pressure sensor protection cap is fitted. (fitted by a third party company)

2.7 Pressure sensor with tracing ribbon

For cold environments it is possible to install tracing ribbon around the sensor to prevent it from freezing. Although the protection cap of the sensor can protect the sensor against freezing to a certain level, the additional tracing ribbon is an optional feature that is advisable for environments with long periods of frost.

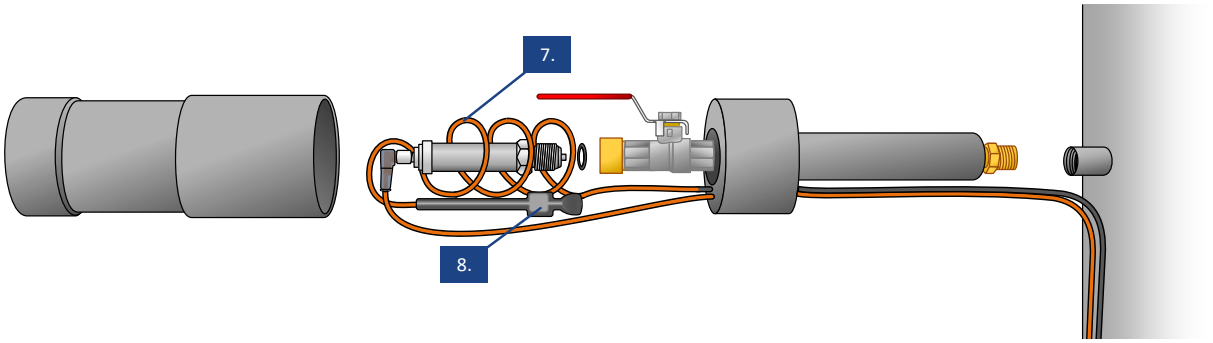


Figure 11. Sensor with tracing ribbon

Legend

Ref. No.	Description	Function
7.	Tracing ribbon	Ribbon that is heated when powered with electricity.
8.	Thermostat	Thermostat that monitors the surrounding temperature at the sensor and activates the tracing ribbon when the temperature becomes too low.

3 General operation

3.1 Operation of the expansion system

The expansion systems can be applied in two different ways. The VERNIT type systems take care of regulating the pressure of the nitrogen blanket and monitor the water level in the vertical buffer tank. It also has the capability to regulate the water level if so desired. The HORNIT type systems take care of regulating the total system pressure and monitor the water level in the horizontal buffer tank. To further explain the operation and functionality of the expansion systems, the following steps describe how these systems work.

3.1.1 Compressed air supply

Step 1. The compressor takes the air from the surrounding and compresses it to a pressure of 10 Bar. The compressor has a compressed air HP vessel that holds the compressed air and will continuously maintain the pressure. From the HP vessel, the air is fed to the nitrogen generator through a hose. At the nitrogen generator, the water and oil residue is filtered from the compressed air by two filters. This process is the same for all type of nitrogen generators that are described in this manual.

3.1.2 Nitrogen production

Step 1. The pressure sensors on the buffer tank measure the pressure of the nitrogen blanket and the height of the water level. This data is sent to the nitrogen generator control cabinet and is displayed on the Touchscreen or the PRESS-display. The VERNIT systems monitor the pressure of the nitrogen blanket, when it is too low a start command is generated and nitrogen production starts. The HORNIT systems monitor the total system pressure, which consists of both the water pressure and the nitrogen pressure. If this is too low, a start command is generated and nitrogen production starts.

Step 2. Nitrogen production starts with drawing in compressed air from the compressor. The compressed air is transported to the PSA tubes where the Pressure Swing Adsorption process takes place. The ECONOMY -A -B and - DUO systems have 2 PSA tubes for this process. Any remaining nitrogen from the Pressure Swing Adsorption process is blown back into the immediate environment. The remaining mix of oxygen and nitrogen has a purity of 99.0 vol. % N_2. The nitrogen mix is fed to the vertical or horizontal buffer tank and the pressure of the nitrogen blanket or total system pressure is increased. The nitrogen mix can be sent directly to the buffer tank if necessary. But it is also possible to first store the nitrogen in the nitrogen storage tank after which it is sent from here to the buffer tank.

Step 3. The pressure sensors on the buffer tank measure the increased pressure of the nitrogen blanket in the VERNIT system. In the case of a HORNIT system, the increased system pressure is measured. When the pressure is at the desired level according to the settings in the Touchscreen or PRESS-Display, the nitrogen production is stopped. The compressor will continuously keep the air pressure constant. When no more air pressure is being used by the nitrogen generator, the compressor will also stop.

3.1.3 Water monitoring

Step 1. The pressure sensors on the buffer tank measure the pressure of the nitrogen blanket and the height of the water level. This data is transferred to the control box of the nitrogen generator and is displayed on the Touchscreen or the PRESS-display. The water level sensor also measures the pressure of the nitrogen blanket because the blanket is on top of the water column. The measurement of the nitrogen blanket pressure is therefore used to calculate a correct water level. To monitor the water level correctly, the VERNIT HORNIT expansion system is set with multiple error and alarm limits.

Step 2. When the water in the buffer tank is heated or cooled down, the water level will increase or decrease. Under normal circumstances, the VERNIT HORNIT expansion system will do nothing and only show the corresponding water level. The error- and alarm limits are set in such a way that they are not triggered under normal circumstances.

Step 3. When the water level in the buffer tank becomes higher or lower than desired, the VERNIT HORNIT expansion system will report an error. A pre-alert is generated on the Touchscreen or PRESS-display indicating that the water level is higher or lower than it should be but that it is not yet problematic. The error message also indicates whether water should be added or released to remedy the situation.

It is important to note that these pre-alerts could indicate that the buffer tank is overfilled or that water is leaking from the system.

If the water level in the buffer tank continues to fall or rise after the pre-warning is given, the VERNIT HORNIT expansion system will sound an alarm for a too high or too low water level. This indicates that the water level has risen or fallen to a problematic level and should not be allowed to rise or fall any further. If it were to rise or fall further, the buffer tank could be damaged or air could enter the supply spray tube of the central heating network. The VERNIT HORNIT expansion system will now stop nitrogen production and also generate a stop signal for all relevant devices such as the boiler. Please note that the relevant devices connected to the stop signal are different in each individual system and depend on the preferences of the system owner.

3.1.4 Systems that also regulate the water level (optional)

The PRESSCON expansion system of the ECONOMY –A and –DUO types has the possibility to regulate the water level automatically. This is an optional function that can be used to automatically replenish or drain water from the buffer tank when needed.

Step 1. The pressure sensors on the buffer tank measure the height of the water level. This data is sent to the control box of the nitrogen generator and is displayed on the Touchscreen or the PRESS-display. When the water level is below the minimum height, an electric start signal is generated that turns on an external water pump.

Step 2. The water pump adds water directly to the buffer tank, increasing the water level.

Step 3. The pressure sensors on the buffer tank measure the increased water level. When the water has reached the minimum height, in accordance with the settings of the Touch Screen or the PRESS-display, the water pump stops.

The water level regulate function can disguise a water leakage in the central heating system. This should always be considered when this function is applied.

3.1.5 Protection against overpressure and vacuum with VERNIT systems

These steps only apply to the VERNIT type systems. These systems operate on a pressure of 10 mBar to 28 mBar at which the overpressure protection can be regulated with a mechanical safety valve.

Step 1. If the pressure of the nitrogen blanket in the buffer tank is at the desired nominal pressure, the nitrogen generator stops and the vacuum- overpressure safety valve is closed. Under influence of heat, water expands and the pressure of the nitrogen blanket increases. When the pressure of the nitrogen blanket is at its maximum operating pressure, the operating overpressure valve will open. The nitrogen is relieved until the water in the storage tank is not heated any more.

Step 2. If the pressure of the nitrogen blanket is at its maximum operating pressure it is still possible that the pressure can further increase under special circumstances. It can increase to the maximum allowed pressure. If this happens, the maximum overpressure valve will open in addition to the operating overpressure valve. With both valves open, the pressure is relieved with the maximum flow that the safety valve can handle. This will prevent that the pressure increases any further.

Step 3. If water in the buffer tank is not heated anymore and cools then the pressure of the nitrogen blanket also drops. It is possible that the pressure drops below 0 Bar and turns into a vacuum. The vacuum pressure valve will open and will let surrounding air into the tank. This will undo the vacuum.

3.1.6 Protection against vacuum with HORNIT systems

These steps only apply to the HORNIT systems. These systems operate at a pressure between 800 mbar and 1000mbar, the overpressure can only be regulated by using an electrical valve.

Step 1. When the total system pressure in the heat storage tank is at the desired level, the nitrogen generator stops. Under the influence of heat, the water expands and the total system pressure increases. When the pressure of the nitrogen blanket is at its maximum working pressure, the nitrogen generator will activate a solenoid valve. The nitrogen is vented from the buffer tank until the desired nominal pressure is reached.

Step 2. If water in the buffer tank is not further heated up and cools down then the total system pressure also drops. It is possible that the pressure drops below 0 Bar and turns into a vacuum. The vacuum safety valve will open and will let surrounding air into the tank. This will undo the vacuum.

3.1.7 Leak detection measurement (SLDM or CLDM) for VERNIT systems (optional)

These steps only apply to VERNIT systems with a type A or DUO panel. Leak detection is not possible with a type B panel. It is possible to detect leaking water by using a 3rd pressure sensor at the bottom of the buffer tank.

Step 1. The 3rd pressure sensor at the bottom of the buffer tank measures the total mass of the water column. This data is transferred to the control cabinet of the nitrogen generator. With the use of the other pressure sensors the pressure of the nitrogen blanket is excluded from the measurement.

Step 2. Once the water in the buffer tank is heated or cooled, the volume of the water expands or shrinks. Because of this the water level will increase or decrease. The mass of the water will remain the same since only the density of the water is altered and no water is added or released from the tank.

Step 3. Once a water leakage occurs, the mass of the water will decrease. Once the mass of the water column gets below the setting 'Buffer press minimal' a water leakage alarm message is generated.

Step 4. The Leak detection measurement also protects the buffer tank from being overfilled with water. This will be indicated with an alarm message once the mass of the water column gets too high and goes above the setting 'Buffer press maximal'.

3.1.8 Heating tape at the pressure sensors and vacuum overpressure relief valve (optional)

These steps apply to the vacuum overpressure relief valve and the pressure sensors with a protective cap, which are placed in the open air. The heating tape is an optional feature that can be used when the outdoor environment has long freezing periods.

Step 1. The trace ribbon is featured with a thermostat that is directly located against the pressure sensor or the safety valve. The thermostat reacts to the surrounding temperature at the component and switches at 3°C.

Step 2. Once the temperature around the sensor or safety valve gets below 3°C the thermostat switches the trace ribbon on. The trace ribbon is electrically heated and warms up the sensor or safety valve to prevent it from freezing.

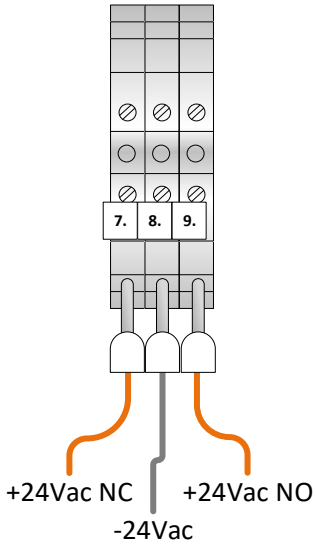
Step 3. Once the temperature around the sensor or safety valve gets above 3°C the thermostat switches the trace ribbon off.

3.1.9 Manual operation of the return valve (optional)

The ECONOMY A and DUO switch panels have the option of being equipped with a manual control for the return valve. In this case, the control panel is equipped with a 3-position switch under the Touch Screen or the PRESS-display. The controller of the return valve can be set in 3 different positions.

Position	Explanation
AUT	Automatic The check valve is automatically controlled and responds to fatal errors in the expansion system.
OPEN	Open manually The check valve is permanently open.
CLOSED	Manually closed The check valve is permanently closed.

For this switch there is an extra relay and extra connect terminals build in the switch panel. The connect terminals take care of a normally open and a normally closed signal with +24Vac for the check valve. The 3-position switch then determines if these contacts react automatically or open permanent in the normally or close permanent in the normally. By connecting the check valve it is important to know how the contacts of the connect terminals react. See the overview below.



Position	Fuse clip 7. (+24Vac NC)	Fuse clip 9. (+24Vac NO)
AUT	Automatic on fatal alarms: Incase fatal alarm: 0Vac Incase no fatal alarm: +24Vac	Automatic on fatal alarms: Incase fatal alarm: +24Vac Incase no fatal alarm: 0Vac
OPEN	Permanent: +24Vac	Permanent: 0Vac
CLOSED	Permanent: 0Vac	Permanent: +24Vac

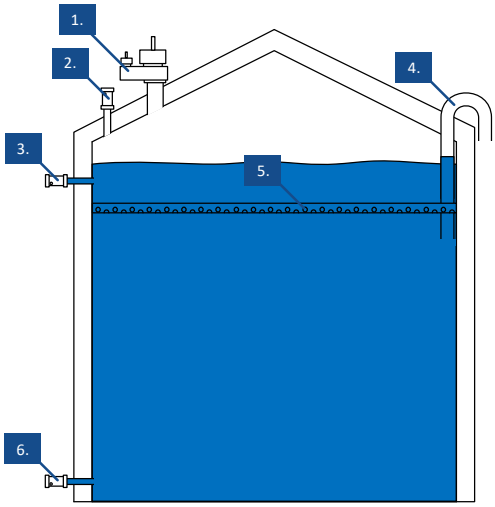
Attention! Always consult the electrical diagram before connecting the check valve or making a change to the switch. The switch for the manual operation of the check valve can be performed in both 24Vac and 230Vac. This does not change the function of the 3-position switch and the connection terminals, but the power supply of the switch is different.

3.2 Assembly of components on the buffer tank

To be able to measure and regulate the water level and the pressure of the nitrogen blanket there are several components that are needed on the buffer tank for the Presscon expansion system. To get a clear understanding of this, the function and location of the important components are described.

3.2.1 Vertical buffer tank

On the vertical buffer tank are the following components installed.



Ref. no.	Description	Function
1.	Vacuum- overpressure safety valve	Mechanical valve that protects the tank against overpressure and vacuum.
2.	Pressure sensor 1 (0-600 mBar)	Electronic transmitter that measures the pressure of the nitrogen blanket at the top of the tank.
3.	Pressure sensor 2 (0-600 mBar)	Electronic transmitter that measures the pressure of the layer of water that is above the sensor including the pressure of the nitrogen blanket.
4.	Water overflow tube*	Tube through which water is spilled out of the tank when the water level has become too high.
5.	Spray feed*	Pipe that is perforated at the underside through which heated water is injected into the buffer tank. The pressure sensor on the side of the buffer tank is always above the center of the injection pipe.
6.	Pressure sensor 5/6 (0-1600 mBar / 0-2500 mBar)	Electronic transmitter that measures the pressure of the water column above the sensor including the pressure of the nitrogen blanket. It can optionally be installed for expansion systems with a type A panel. The sensor is used for leak detection measurements or ELC configurations in combination with additional buffer tanks.

This component is part of the buffer tank and is not provided nor installed by PRESSCON.

Water overflow tube

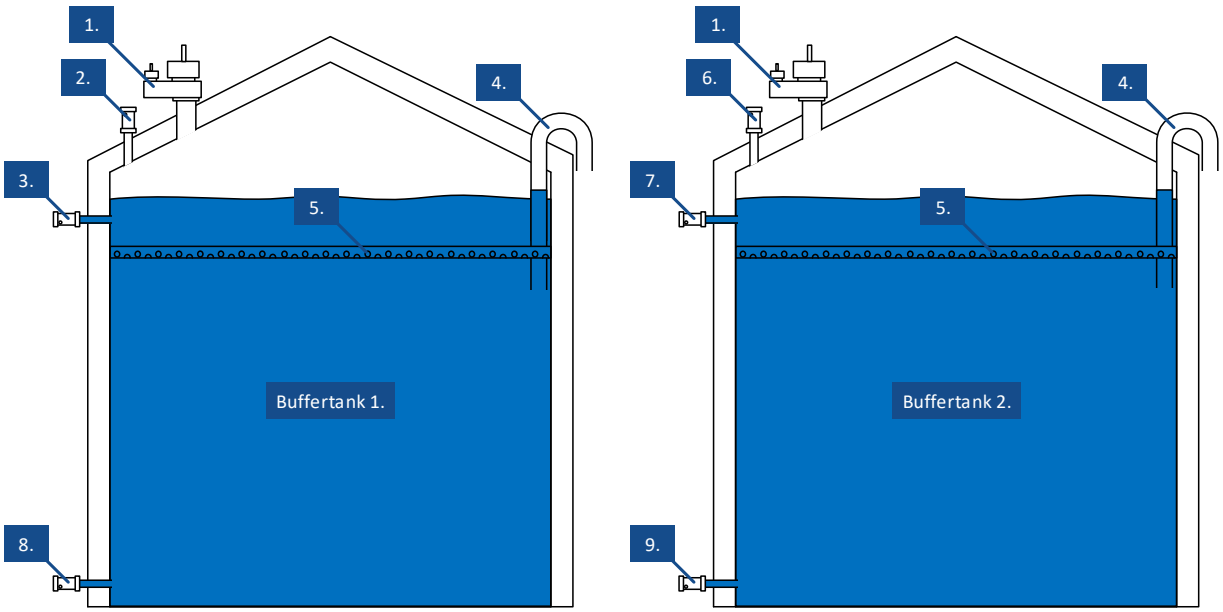
It is important to note that the vertical buffer tank must always have a water overflow tube. It should be incorporated within the design of the buffer tank. It acts as a final safety measure for preventing damage to the buffer tank in case the water level gets to high. Although the Presscon expansion systems monitors and regulates the water level actively, it cannot fully protect the buffer tank without the water overflow tube. Therefore the water overflow tube is a mandatory feature for each vertical buffer tank if it is to be fully protected against a high water level.

Optional: sensor for leak detection measurement

In addition to the default components on the vertical buffer tank it is optional to feature it with a 3rd pressure sensor at the bottom of the tank. This pressure sensor can be used for setting up the leak detection measurement. Since the leak detection measurement is an optional feature it is not mandatory to install it the 3rd pressure sensor. The 3rd pressure sensor is always located at the lowest point on the buffer tank.

3.2.2 Vertical buffer tank in a DUO setup

The following components are installed on the vertical buffertanks, that are arranged in a DUO setup.



Ref. no.	Description	Function
1.	Vacuum- overpressure safety valve	Mechanical valve that protects the tank against overpressure and vacuum.
2.	Pressure sensor 1 (0-600 mBar)	Electronic transmitter that measures the pressure of the nitrogen blanket at the top of buffertank 1.
3.	Pressure sensor 2 (0-600 mBar)	Electronic transmitter that measures the pressure of the layer of water above the sensor including the pressure of the nitrogen blanket in buffertank 1.
4.	Water overflow tube*	Tube through which water is spilled out of the tank when the water level has become too high.
5.	Spray feed*	Pipe that is perforated at the underside through which heated water is injected into the buffertank. The pressure sensor on the side of the buffertank is always above the center of the injection pipe.
6.	Pressure sensor 3 (0-600 mBar)	Electronic transmitter that measures the pressure of the nitrogen blanket at the top of buffertank 2.
7.	Pressure sensor 4 (0-600 mBar)	Electronic transmitter that measures the pressure of the layer of water above the sensor including the pressure of the nitrogen blanket in buffertank 2.
8.	Pressure sensor 5 (0-1600 mBar / 0-2500 mBar)	Optional installed electronic transmitter for buffertank 1 that measures the pressure of the water column above the sensor including the pressure of the nitrogen blanket. Sensor is used for leak detection measurements or ELC configurations in combination with additional buffer tanks.
9.	Pressure sensor 6 (0-1600 mBar / 0-2500 mBar)	Optional installed electronic transmitter for buffertank 2 that measures the pressure of the water column above the sensor including the pressure of the nitrogen blanket. Sensor is used for

		leak detection measurements or ELC configurations in combination with additional buffer tanks.

This component is part of the buffer tank and is not provided nor installed by PRESSCON.

3.2.3 Horizontal buffer tank

The following components are installed on the horizontal buffertank by default. Please note that the horizontal buffertank can be installed in 3 different setups.

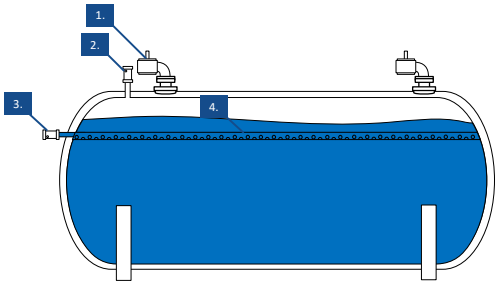


Figure 12. Components on a single horizontal buffertank

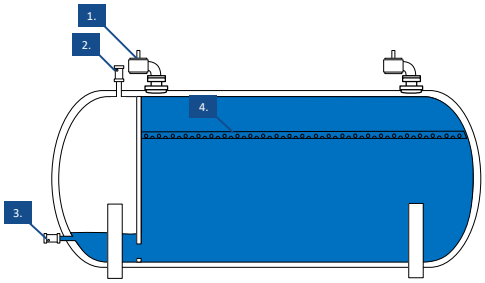


Figure 13. Components on a single horizontal buffertank with a partition wall

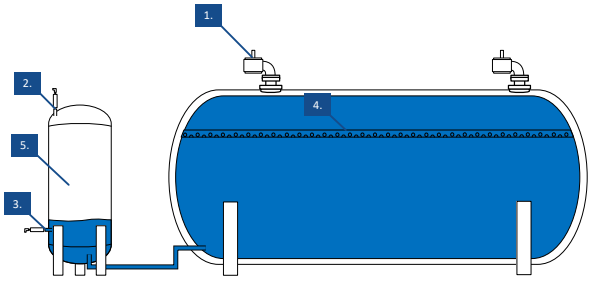


Figure 14. Components on a single horizontal buffertank with a separate expansion vessel.

Ref. no.	Description	Function
1.	Vacuum safety valve	Mechanical valve the protects the tank against vacuum.
2.	Pressure sensor 1 (0-1000 mBar / 0-1600 mBar / 0-2500 mBar)**	Electronic transmitter that measures the pressure of the nitrogen blanket at the top of the tank.
3.	Pressure sensor 2 (0-1000 mBar / 0-1600 mBar / 0-2500 mBar)**	Electronic transmitter that measures the pressure of the layer of water above the sensor including the pressure of the nitrogen blanket.

4.	Spray feed*	Pipe that is perforated at the underside through which heated water is injected into the buffertank. The pressure sensor on the side of the buffertank is always above the center of the injection pipe.
5.	Separate expansion vessel	Separate vessel in which the water from the buffertank can expand.

This component is part of the buffer tank and is not provided nor installed by PRESSCON.

****The applied measuring range depends on the setup of the buffertank.***

3.2.4 Horizontal buffertank in a DUO setup

The following components are installed on the horizontal buffertanks, that are arranged in a DUO setup, by default. The different configurations described in chapter 3.2.3 can also be installed in a DUO setup and follow the same principles as the examples below.

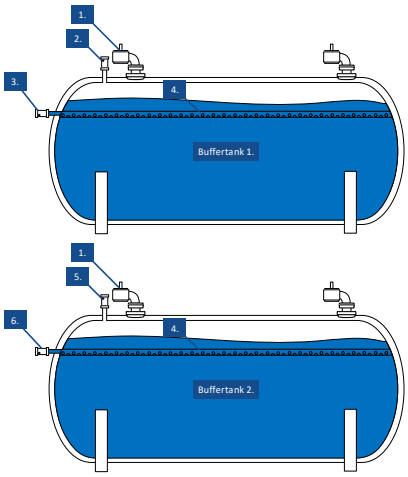


Figure 15. Default components on the horizontal buffertank in a DUO setup

Ref. no.	Description	Function
1.	Vacuum safety valve	Mechanical valve that protects the tank against vacuum.
2.	Pressure sensor 1 (0-1000 mBar / 0-1600 mBar / 0-2500 mBar)**	Electronic transmitter that measures the pressure of the nitrogen blanket at the top of buffertank 1.
3.	Pressure sensor 2 (0-1000 mBar / 0-1600 mBar / 0-2500 mBar)**	Electronic transmitter that measures the pressure of the layer of water above the sensor including the pressure of the nitrogen blanket in buffertank 1.
4.	Spray feed*	Pipe that is perforated at the underside through which heated water is injected into the buffertank. The pressure sensor on the side of the buffertank is always above the center of the injection pipe.
5.	Pressure sensor 3 (0-1000 mBar / 0-1600 mBar / 0-2500 mBar)**	Electronic transmitter that measures the pressure of the nitrogen blanket at the top of buffertank 2.
6.	Pressure sensor 4 (0-1000 mBar / 0-1600 mBar / 0-2500 mBar)**	Electronic transmitter that measures the pressure of the layer of water above the sensor including the pressure of the nitrogen blanket in buffertank 2.

This component is part of the buffer tank and is not provided nor installed by PRESSCON.

****The applied measuring range depends on the setup of the buffertank.***

3.2.5 DUO system for a High and low temperature networks

It is possible to combine a vertical and horizontal buffer tank in a DUO setup. The horizontal buffer tank accommodates the expansion of the low temperature water network and the vertical tank accommodates the expansion of the high temperature water network. The Presscon expansion system will then be built as a HORNIT N2 / N2i ECONOMY DUO type.

3.3 Schematic overview of the expansion system

Figure to Figure give a schematic overview of the VERNIT and HORNIT expansion systems. They show how all the components within the system are communicating with each other. They also give an indication of what roll the expansion system has in combination with the central heating system.

3.3.1 VERNIT 2.0 -30.0 N2(i) system

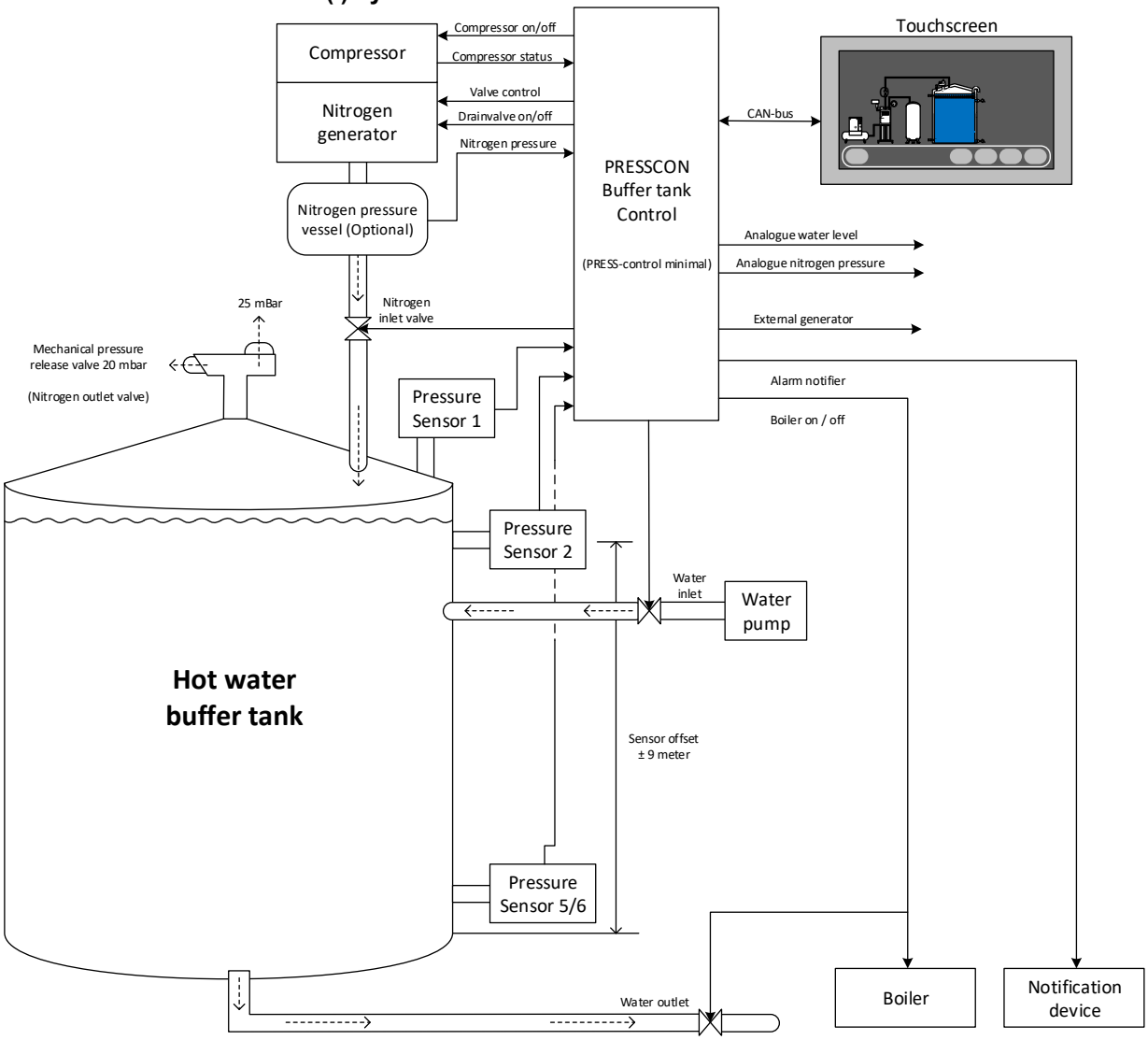


Figure 16. VERNIT 2.0 – 30.0 N2(i) system overview

3.3.2 HORNIT 2.0 -30.0 N2(i) system

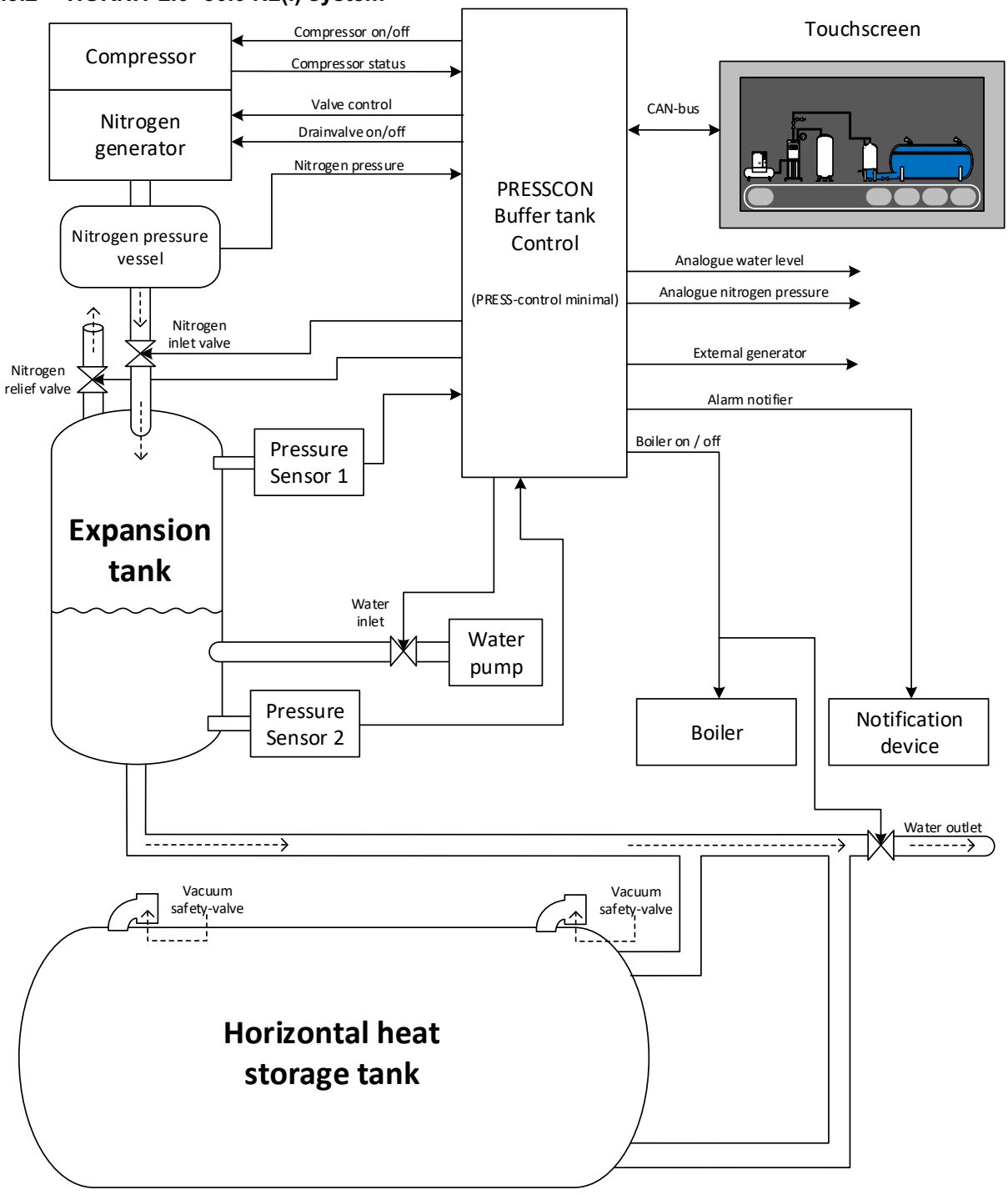


Figure 17. HORNIT 2.0 – 30.0 N2(i) system overview

3.3.3 VERNIT 2.0 -30.0 N2(i) DUO system

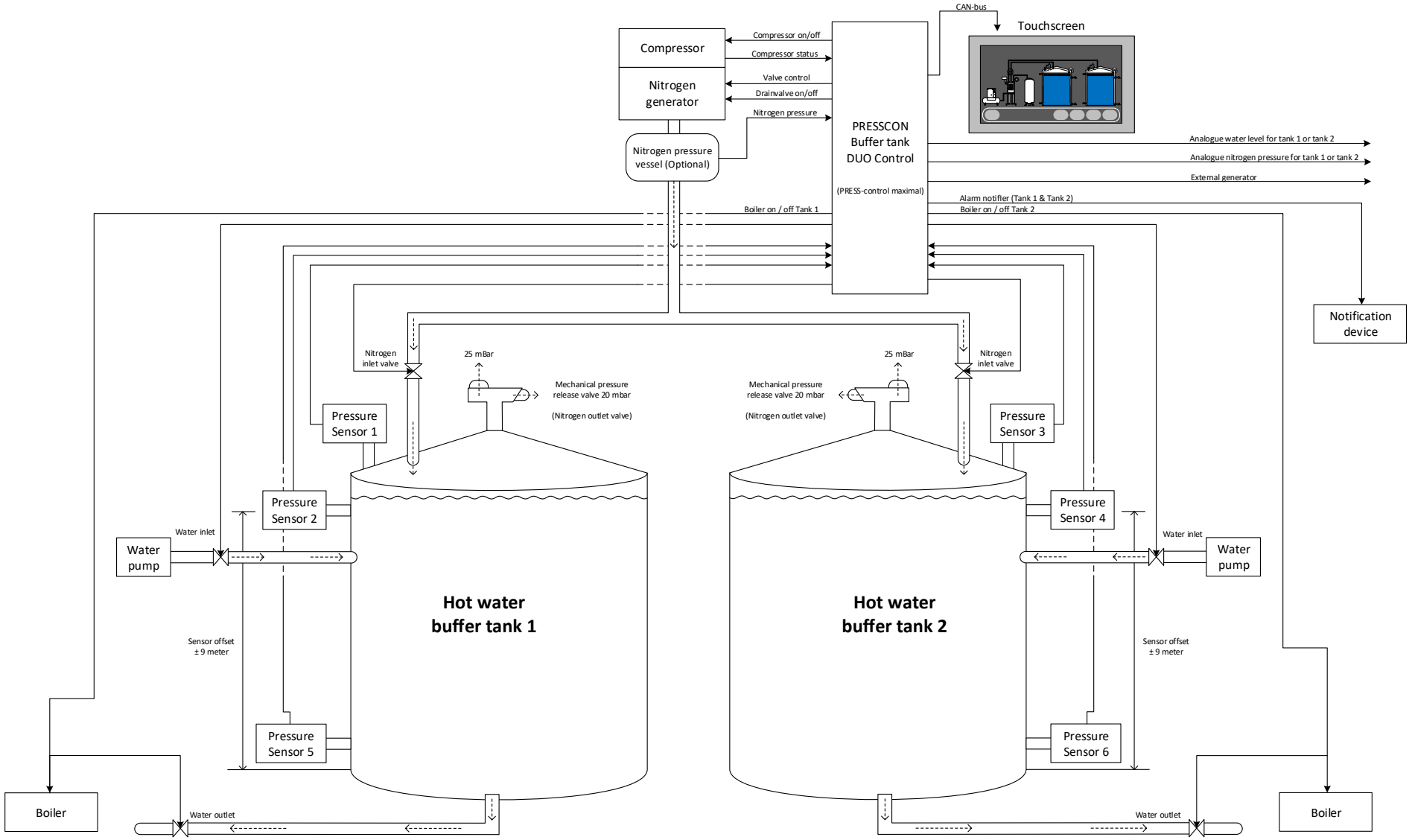


Figure 18. VERNIT 2.0 -30.0 N2(i) DUO system overview

3.3.4 HORNIT 2.0 -30.0 N2(i) DUO system

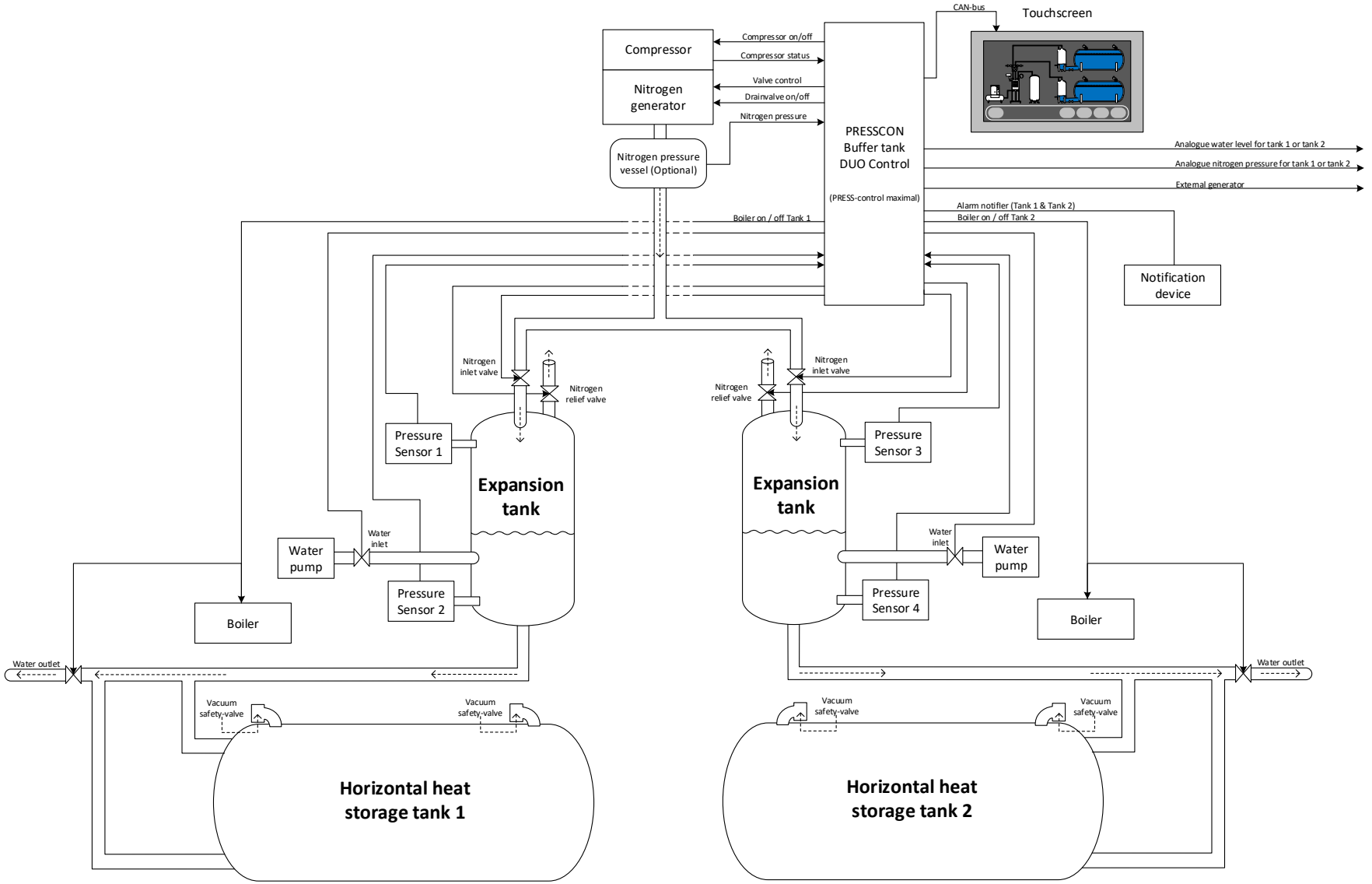


Figure 19. HORNIT 2.0 -30.0 N2(i) DUO system overview

4 Touchscreen

The touchscreen is the most important control device for reading the statuses and values of the system. The touchscreen has no physical buttons, but only digital buttons on the screen. Touching the buttons and the images on the screen can be used to navigate and adjust the settings. The table below shows the buttons of the touchscreen.

4.1 Main screen of the Touchscreen

Every button has a different function, some of them have several functions. The following table describes which function each button has.

Button	Description
Menu	This button is only displayed in the main menu and guides you to the following functions: • User : User menu • Service : Service menu • Factory : Factory menu
Alarm	• Press the button to view the current fault and alarm messages. • Press the button for more than 3 seconds to view the alarm log.
Info	• Pressing this button calls up the information screen. Specific information is displayed in here for each component as well as the current status. • The same menu for a specific component can also be accessed by pressing the relevant icon in the menu screen.
Esc	• This button is in every menu and returns you tot he previous menu.

When the “menu” option is pressed, the following menu’s can be selected.

Button	Description
User	• The user menu is accessible to everyone. • This contains setting which the user can change.
Service	• The service menu is only accessible via a code.. • Service information can be requested via this menu..
Factory	• The service menu is only accessible via a code.. • Factory settings can be entered from this menu.

4.1.1 Main screen lay-out VERNIT

The structure of the menu is based on the type of system the user has. Press the icons to find out the status of this system.

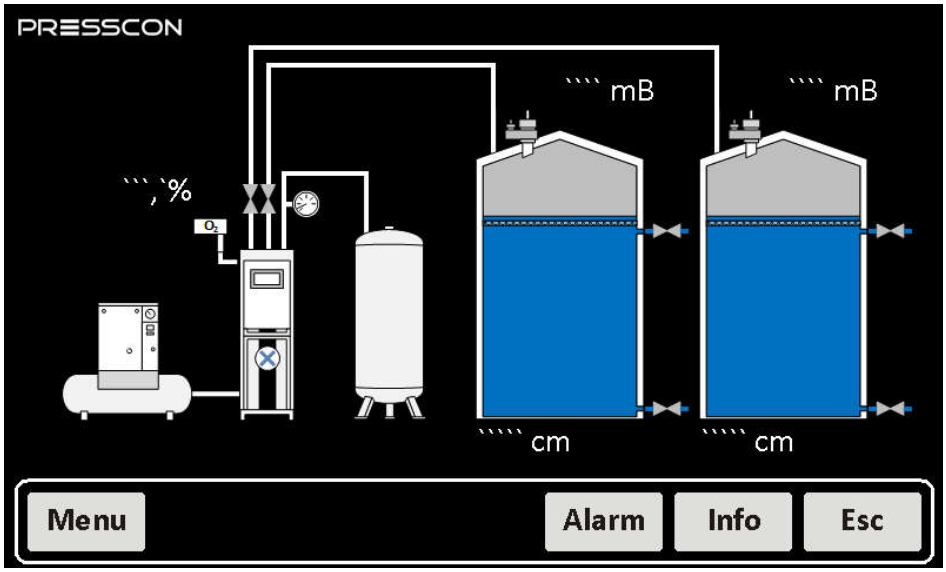


Figure 20. VERNIT 2.0 – 30.0 N2(i) DUO system overview (Only when the VERNIT is installed)

4.1.2 Main screen lay-out HORNIT

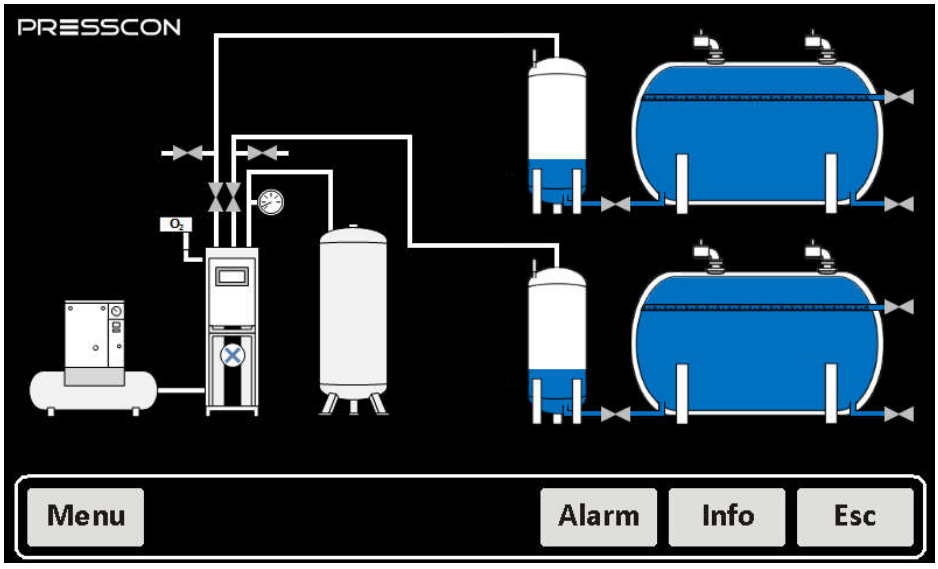
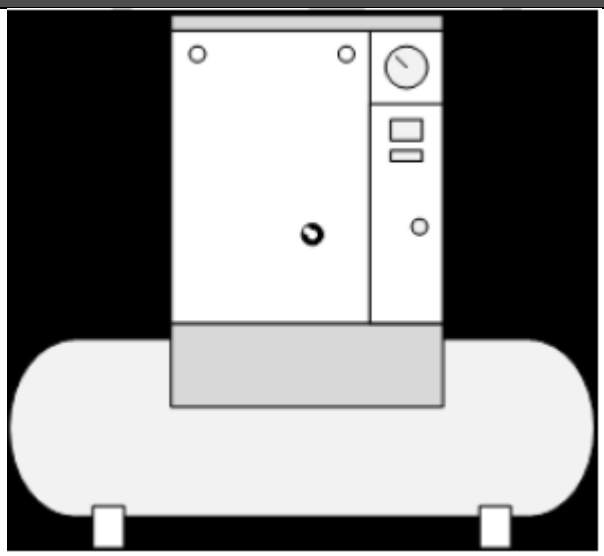
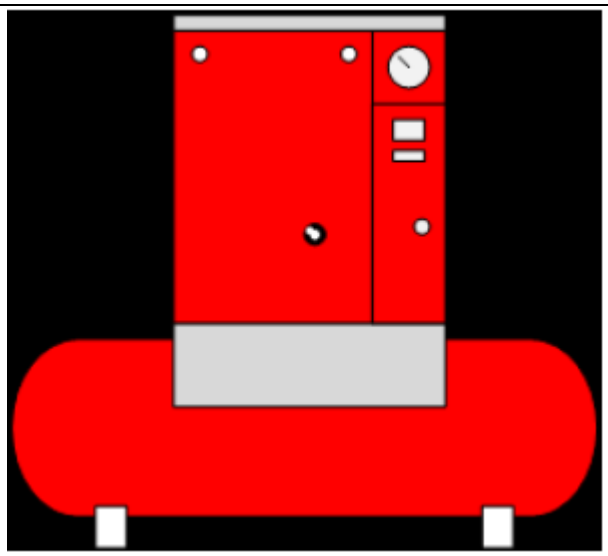


Figure 21. HORNIT 2.0 – 30.0 N2(i) DUO system overview (Only when the HORNIT is installed)

4.2 Icons on the main screen

4.2.1 Compressor

The compressor supplies compressed air to the system. The status of the compressor is forwarded to the PressControl.

Compressor	Description/status
	• The compressor supplies the compressed air to the system. • When it is colored white, de compressor is working properly.
	• If the compressor turns red, there is a malfunction. • Press the compressor to go to the fault menu.

4.2.2 PSA generator

The PSA generator produces nitrogen for the system. The status of the PSA generator is forwarded to the PressControl.

PSA generator	Description/status	PSA generator	Description/status
	• The circle with the cross, will start running when the PSA generator is activated. • When it is colored white, de compressor is working properly.		• If the system turns red, there is a malfunction. • Press the system to go to the fault menu .

4.2.3 Oxygen sensor

The oxygen sensor measures the value of the oxygen which remains after generation the nitrogen from the PSA generator. The status of the oxygen sensor is forwarded to the PressControl.

Oxygen sensor	Description/status
	• The current value of the oxygen is displayed above the sensor. • When it is colored white, the oxygen sensor is functioning properly.
	• When the oxygen sensor is colored red, there is a malfunction. • Press the oxygen sensor to go to the fault menu.

4.2.4 Valves

The vertical valves above the PSA generator represent the nitrogen blow-in valves for both tanks.

Vertical valves	Description/status
	• When the valve turns white, it means the status of the valve is yet unknown .

	• When the valve turns red, it means the valve is closed.
	• When the valve turns green, it means the valve is open.

The horizontal valves next tot he tank, regulate the water discharge and supply. The top valve shows the water supply. The lower valve shows the water return. The status of the valves is forwarded to the PressControl.

Horizontal kleppen	Description/status
	• When the valve turns white, it means the status of the valve is yet unknown.
	• When the valve turns red, it means the valve is closed.
	• When the valve turns green, it means the valve is open.

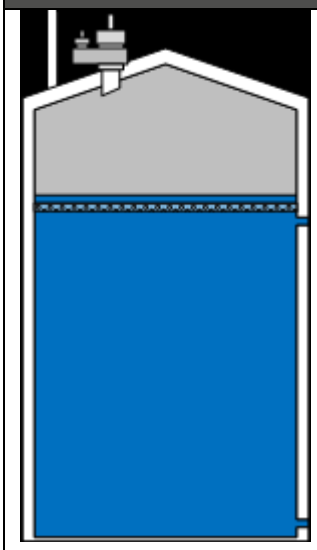
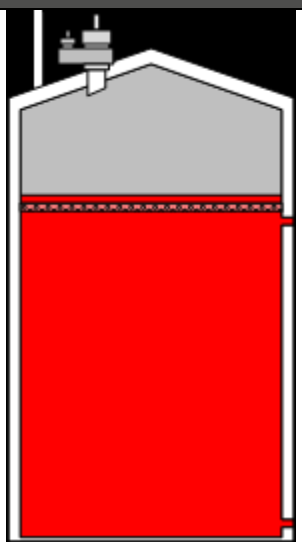
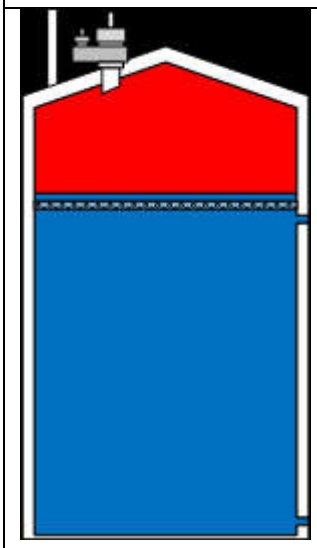
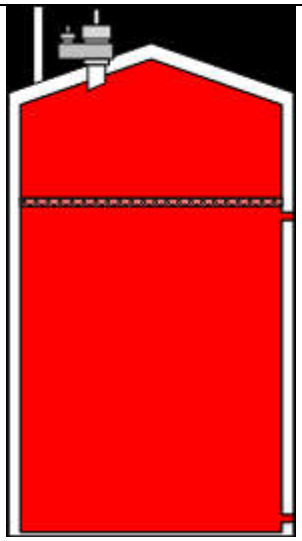
4.2.5 Overpressure safety relief

The overpressure safety reliefs are on top of the tank. (These protection devices are only visible with VERNIT systems with a vertical tank. The status of the overpressure safety relief is forwarded to the PressControl.

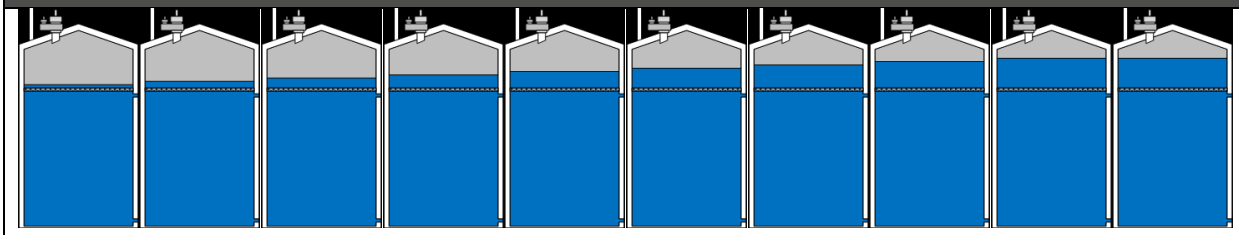
Overpressure safety relief	Description/status
	• When the tank is blowing off nitrogen, this is indicated by clouds above the tanks overpressure relief. • Alternately, 4 different symbols can be displayed as shown in the left figure . The number of depicted clouds, represents the amount of nitrogen.

4.2.6 VERNIT tank malfunction status

The status of the tank is represented by the color of the tank.

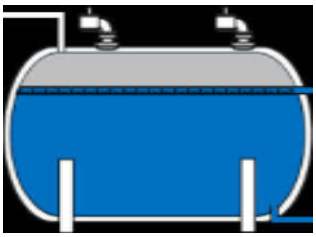
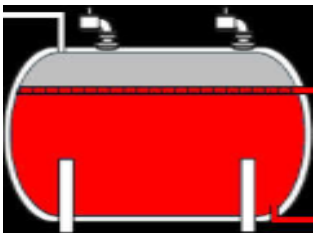
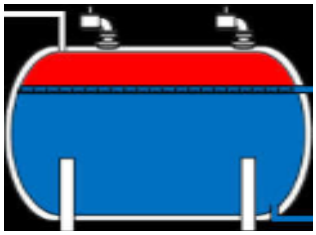
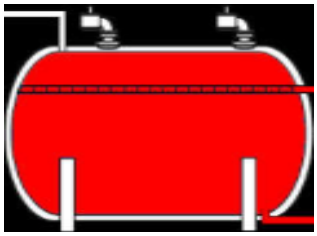
Tank	Description/status	Tank	Description/Status
	• When the tank is represented like this, the tank is functioning properly.		• When the tank is represented like this, the tank has a water level failure.
	• When the tank is represented like this, the tank has a system pressure failure. • Press the tank to go to the fault menu.		• When the tank is represented like this, the tank has system pressure failure and water level failure. • Press the tank to go to the fault menu.

4.2.7 VERNIT tank water level status

Water level

• The water level is globally represented by the height of the blue part in the tank. The range is calculated between the ‘water level maximum’ and ‘water level ‘minimum’ settings. This range is divided in 10 parts. Next, the current water level is checked at which part it is. The water level under the tank is also shown.

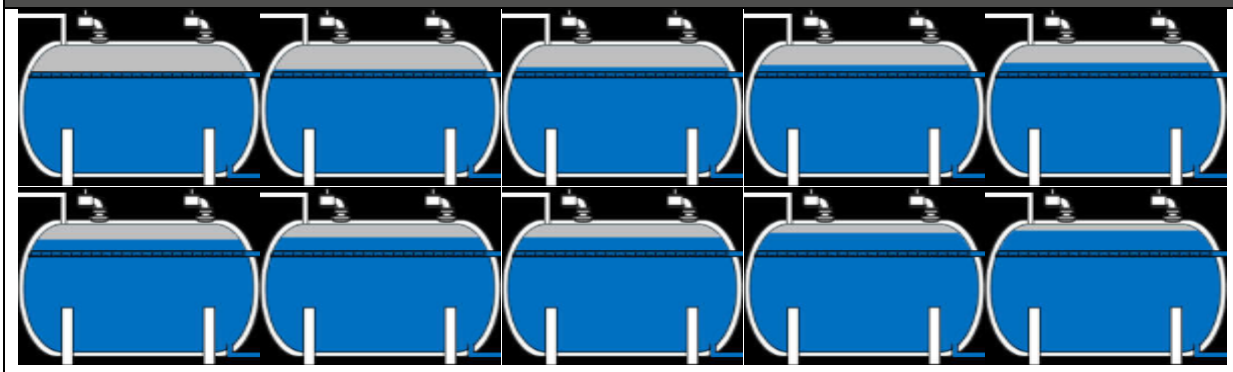
4.2.8 HORNIT tank malfunction status

The status of the tank is represented by the color of the tank.

Tank	Description/status	Tank	Description/Status
	• The water level is represented by the blue part in the tank. The water level is also displayed next to the tank. • When the tank is represented like this, the tank is functioning properly.		• When the tank is represented like this, the tank has a water level failure. • Press the tank to go to the fault menu.
	• When the tank is represented like this, the tank has a system pressure failure. • Press the tank to go to the fault menu.		• When the tank is represented like this, the tank has system pressure failure and water level failure. • Press the tank to go to the fault menu.

4.2.9 HORNIT tank water level status

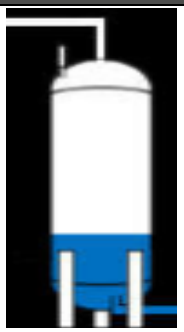
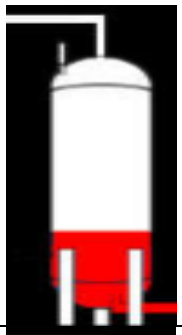
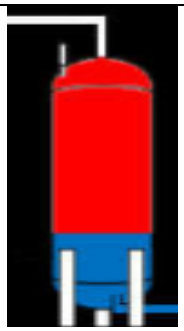
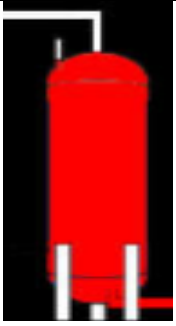
Waterhoogte



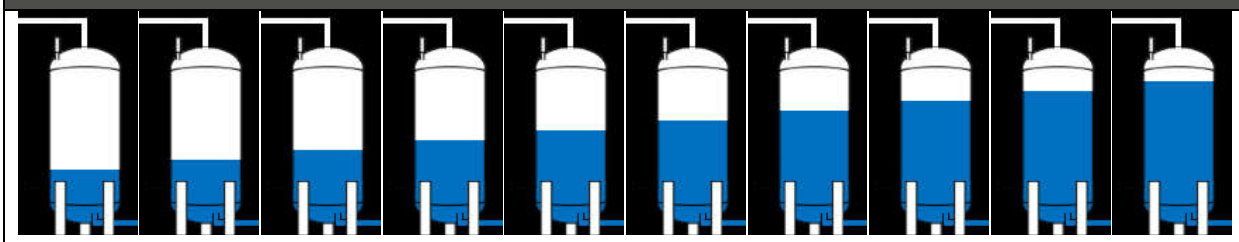
- The water level is globally represented by the height of the blue part in the tank.
  The range is calculated between the ‘water level maximum’ and ‘water level ‘minimum’ settings.
  This range is divided in 10 parts. Next, the current water level is checked at which part it is. The water level under the tank is also shown.

4.2.10 HORNIT pressure tank failure status

The status of the tank is represented by the color of the tank.

Tank	Description/status	Tank	Description/Status
	• When it is colored white, it is functioning properly.		• When the tank is represented like this, the tank has a water level failure. • Press the tank to go to the fault menu.
	• When the tank is represented like this, the tank has a system pressure failure. • Press the tank to go to the fault menu.		• When the tank is represented like this, the tank has system pressure failure and water level failure. • Press the tank to go to the fault menu.

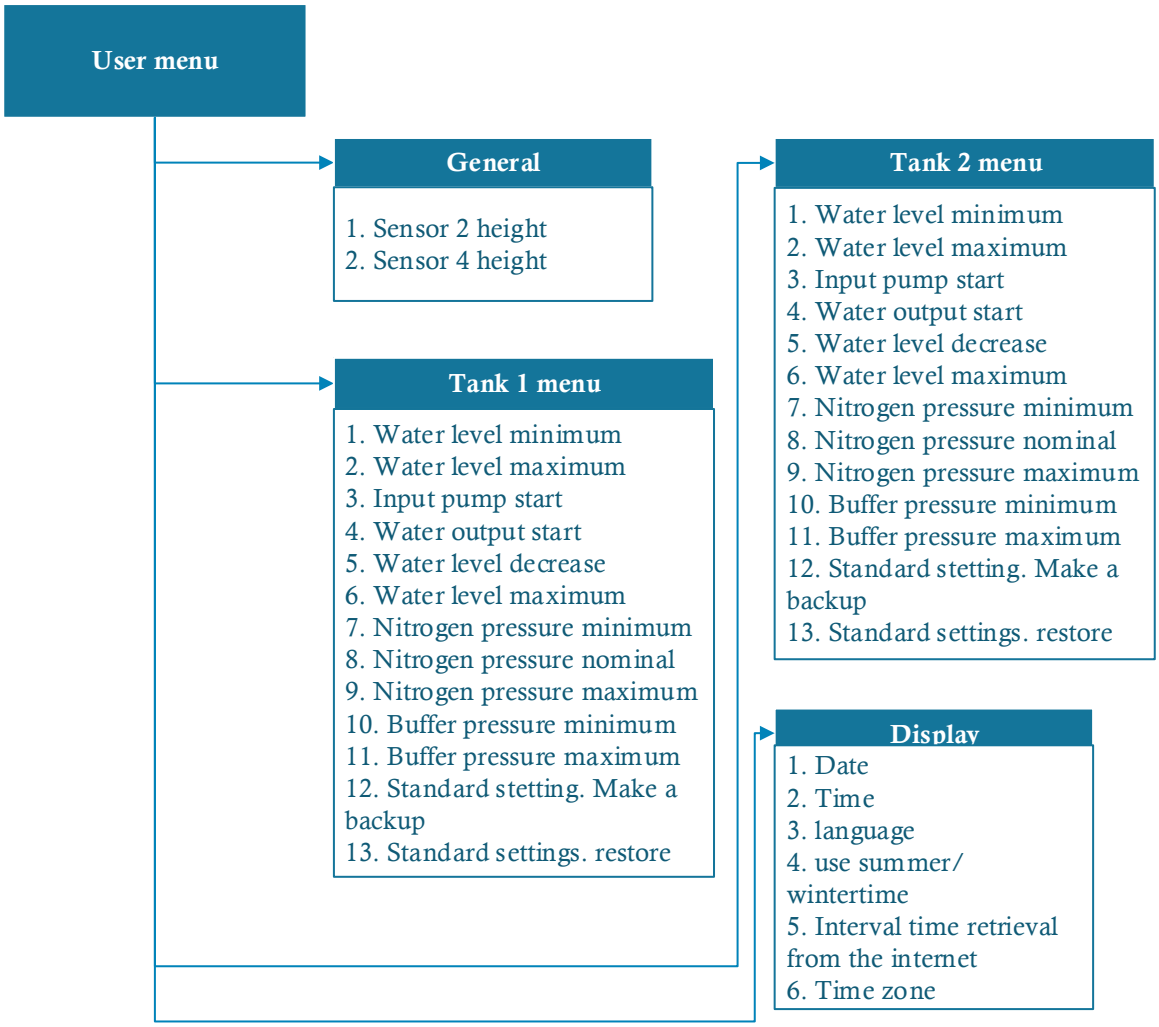
4.2.11 HORNIT druktank waterhoogte status

Waterhoogte

• The water level is globally represented by the height of the blue part in the tank. The range is calculated between the 'water level maximum' and 'water level 'minimum' settings. This range is divided in 10 parts. Next, the current water level is checked at which part it is. The water level under the tank is also shown.

4.3 User menu

The User menu contains the basic settings fort he expansion system. In this menu, the user can setup the values such as: Start value, stop value, alarm thresholds for the pressure of the nitrogen blanket, total system pressure and the height of the water level. The user menu also has settings for the language and back-up.

4.3.1 User menu schematic for Touchscreen type (ECONOMY A and ECONOMY DUO)



Figuur 22. Structure of the user menu

4.4 Service menu

The service menu contains more advanced settings fort he expansion system. This menu is intended for the service engineer, when the system is put into service or to make adjustments during maintenance. The service menu can be accessed by pressing the "service" button once when the touchscreen is on the main menu screen. The software will then ask for the access code of the menu. This code is only available for the service engineer.

4.5 Factory menu

The factory menu contains the critical software and hardware settings for the operation of the PRESS-control motherboard and the touchscreen. This menu is meant for setting the nitrogen generator when tested in the factory. The factory menu can be approached by pressing the “factory” button once when the touchscreen is on the main menu screen. The software wil then ask fort he access code of the factory menu. This code is only available for the service engineer.

4.6 Standby

When the touchscreen is in operation, it can go into standby mode to reduce the energy consumption and the wear of the hardware. The touchscreen enters standby mode when no buttons are pressed on the touchscreen for a period of 14,5 minutes and when there are no alarms or error messages. In standby mode the display turns itself off until the screen is pressed again.

5. PRESS-display

The PRESS-display is the monitoring device for reading the statuses and measured values of the system. The buttons are used to navigate and adjust the settings. Figure 23. Below shows a schematic view of the PRESS-display.

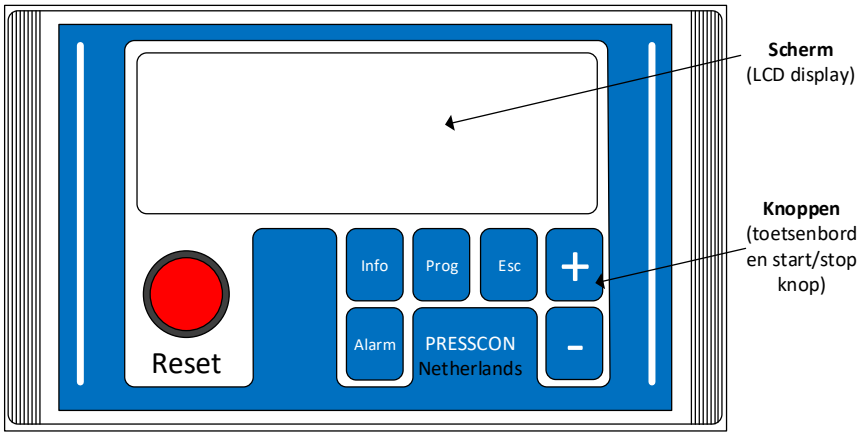
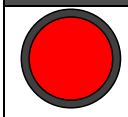


Figure 23. Schematic view of Press-display

5.1 Buttons on the PRESS-display

Each button has a different function, some have more than one. The following table describes which function each button has.

Button	Description
 Reset	This button has a light beneath it, when it lights up, this means the following: Light on : An error or alarm has been detected; Light flashes: There is a new error or a new alarm. With this button, you can reset an error or alarm message as soon as the problem that caused the message has been solved.
 Alarm	Press the button once to view the current errors and alarm messages. Press and hold for 3 seconds to view the error and alarm log.
 Prog	From the main screen: Press the button once to enter the Service menu. An access code is required. Press and hold for 3 seconds to view the factory menu. An access code is required. Adjusting a setting in one of the menus: In the user menu: press and hold this button for 3 seconds. The setting will flash and is then adjustable. In the service menu and factory menu: press this button once briefly. The setting will flash and is then adjustable.
 Info	Press this button once briefly to view the service information screen. Press and hold for 3 seconds to view the factory information screen.
 Esc	Press this button once briefly, in one of the menus or information screens, to go back one screen and then return to the main screen. Press this button once briefly while adjusting a setting. The adjustment will be cancelled.
 +	Press this button once briefly in one of the menus to select the next screen. Press this button when setting a value to increase the value.
 -	Press this button once briefly in one of the menus to select the previous screen. Press this button when setting a value to decrease the value.

5.1 Menu structure and access

The PRESS-display software has a specific structure that is described in this chapter. The structure consists of 3 levels and a set of menus for each level. The levels in the software are like user levels. The levels are called: user menu, service menu and factory menu. In addition to these menus, there are also information screens, i.e.: main screen, alarm screen and information screen. The structure of the levels, menus and information screens are shown in the image below. This image also shows how to reach each menu or screen. This is applicable for the ECONOMY B systems.

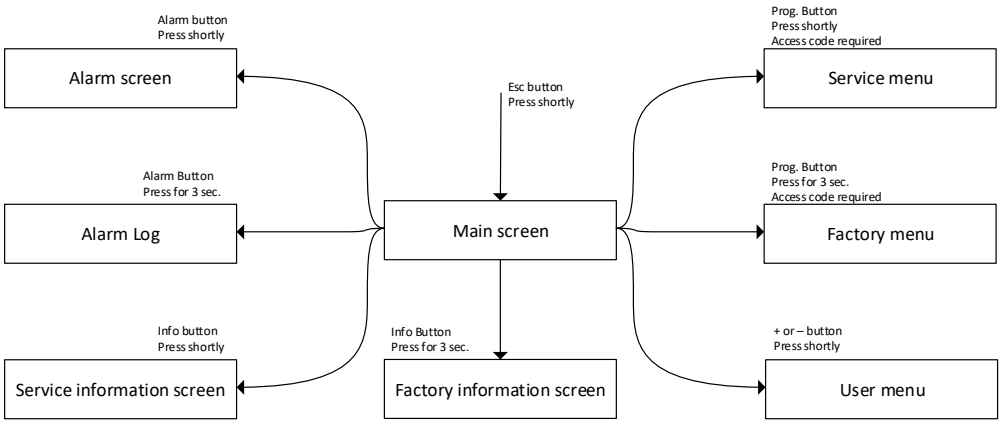


Figure 1. Menu structure of PRESS-display software

5.2 User Menu

The user menu contains all the basic settings for the expansion system. In this menu, the user can set values such as; start values, stop values, alarm values for nitrogen blanket pressure, total system pressure and water level. The user menu also contains language and backup settings. There are some differences in the software between the types of PRESS-controls and PRESS-displays, so the user menus will also be different. Only the User Menu of the ECONOMY B systems is described here.

5.3.1 User menu for the VERNIT ECONOMY B systems

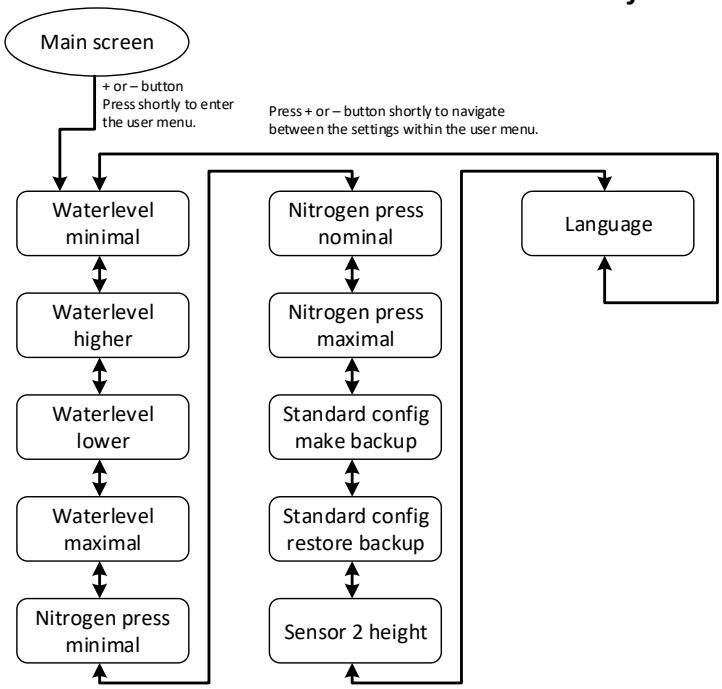


Figure 25. Structure of user menu of Vernit Economy B system

Description of user menu settings

	Tekst	Description
1	Minimum water level	If the water level drops below this value, the software will generate the alarm message ''F14 minimum water level''.
2	Increase water level	If the water level drops below this value, the software will generate the error message ''F17 increase water level''.
3	Reduce water level	If the water level is higher than this value, the software will generate the error message ''F16 reduce water level''.
4	Water level maximum	If the water level is higher than this value, the software will generate the error message ''F15 maximum water level''.
5	Nitrogen pressure minimum	If the nitrogen pressure is higher than this value, the software will generate the error message ''F18 Nitrogen pressure Min.''.
6	Nitrogen pressure nominal	This setting sets the target value for the pressure of the nitrogen blanket. The pressure is increased or decreased if it deviates too much from the nominal value.
7	Nitrogen pressure maximum	If the nitrogen pressure is higher than this value, the software will generate the error message ''F19 Nitrogen pressure Max.''
8	Backup of default settings	With this setting, the software backs up all of the configured memory.
9	Restore backup of default settings	With this setting, the software restores the configured memory that was stored as a backup.
10	Sensor 2 Height	This setting sets the height of sensor 2. This sensor is located on the side of buffer tank 1 and measures the water level.
11	Language	This setting allows you to set the language of the PRESS-display.

5.4 Service Information screen

This information screen contains the directly measured values from the sensors of the VERNIT or HORNIT expansion system. These are the values to which the VERNIT or HORNIT expansion system responds. These measurements can be viewed in real-time via the Service Information screen. There are no settings available in the Service Information screen that can be changed. There are differences between the PRESS-controls and PRESS-displays types, so there is also differences in the Service information screen. Only the Service Information screen of the ECONOMY B systems is described here.

5.4.1 Service information screen for the VERNIT ECONOMY B

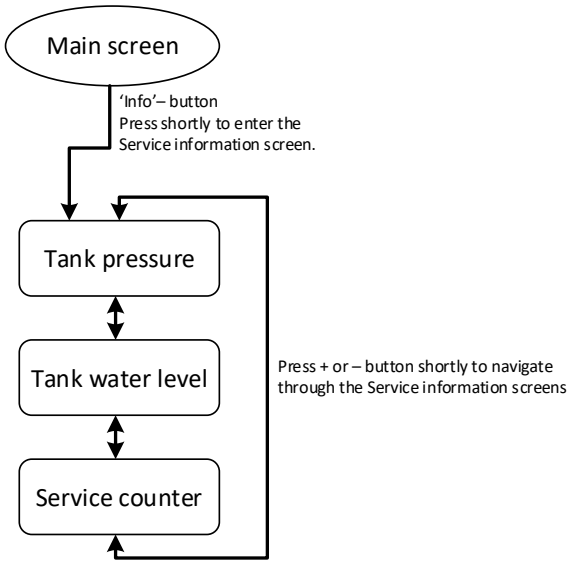


Figure 2. Structure of the service information screens for t he VERNIT ECONOMY B

Description of the service information screen

	Tekst	Description
1.	Tank pressure	This screen shows which measured values are used to determine the pressure of the nitrogen blanket or the total system pressure. This can be a directly measured value from sensor A or B. Or it can be a calculated value based on both sensor A and sensor B depending on the factory settings.
2.	Water level in tank	This screen shows which measured values are used to determine the water level in the buffer tank. This can be a directly measured value from sensor A or B. Or it can be a calculated value based on both sensor A and sensor B depending on the factory settings.
3.	Service counter	This screen shows the current system maintenance interval counter.

5.5 Factory information screen

The factory information screen displays the status of all input and output signals of the PRESS-control. It indicates, for example, if a sensor measurement has been received, if an output is active, if an input is active and if nitrogen is being produced or not. There are some differences between the different types of PRESS-controls and PRESS-displays in the software, so there are also differences in the factory information screen. Only the Factory information screen of the ECONOMY B systems is described here.

5.5.1 Factory information screen for the VERNIT ECONOMY B

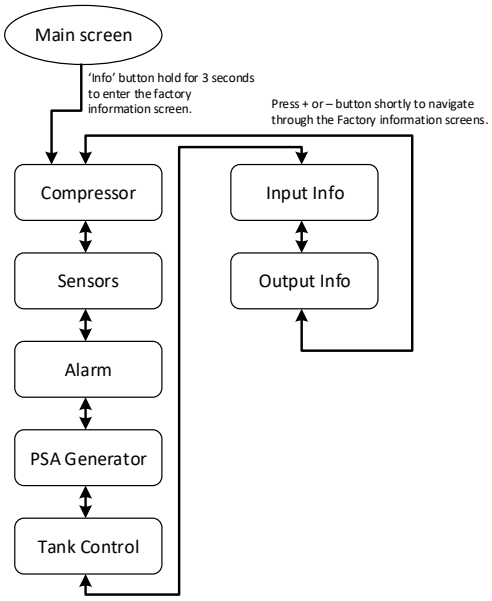


Figure 3.Structure of factory information screen of VERNIT ECONOMY-B

Description of factory information screen for VERNIT ECONOMY B

	Tekst	Descriptions
1.	Compressor	This screen displays the current time and date. It shows the amount of time that the compressor has been active.
2.	Sensors	This screen shows what each pressure sensor measures. It contains the measurements from 2 sensors.
3.	Alarm	This screen shows the status of the boiler protection. It indicates whether a signal from the 'Switch B' button on the PCB of the PRESS-control is being received and it indicates how many days the boiler protection has been switched off. It also shows the status of the alarm relay.
4.	PSA Generator	This screen indicates whether the valves for the production of nitrogen are activated. It includes the 3 different solenoid valves for the Pressure Swing Adsorption process, the compressor activation signal and the status of the sluice valve.
5.	Tank controls	This screen shows the status of the nitrogen blanket pressure control and total system pressure control. It indicates which mode is active, such as; N2 in, N2 out, Boiler and Alarm.
6.	Input info.	This screen gives an overview of all the input signals available on the PRESS-control PCB. The status of each signal is indicated by a "0" or "1".
7.	Output info.	This screen gives an overview of all the output signals available on the PRESS-control PCB. The status of each relay is indicated by a "0" or "1".

5.6 Service menu

The service menu contains more advanced settings for the expansion system. This menu is intended for the service technician, when the system is being commissioned or to make adjustments during maintenance. The service menu can be accessed by pressing the Prog button once when the PRESS-display is on the main screen. The software will then ask for the menu access code. This code is only available to the service technician.

5.7 Factory menu

The factory menu contains the critical software and hardware settings for the operation of the PRESS-control motherboard and the PRESS-display. This menu is for setting up the nitrogen generator when it is tested at the factory.

The factory menu can be accessed by pressing the Prog button for 3 seconds when the PRESS-display is on the main menu. The software will then ask for a factory menu access code. This code is only available to the service technician.

5.8 Standby

When the PRESS-display is in operation, it can go into standby mode to reduce power consumption and wear and tear on the hardware. The PRESS-display goes into standby mode when no buttons are pressed on the PRESS-display for a period of 5 minutes and there are no alarms or error messages. In standby mode, the display will automatically return to the main screen.

6 PRESS-control

The PRESS-control is the mainboard that controls the complete expansion system. It processes the measurements of the water level and the pressure of the nitrogen blanket. By means of the measurements, the PRESS-control generates the appropriate output signals to control the nitrogen generator. The PRESS-control is also featured with additional connection terminals for items such as alarm contacts, inputs for several switches or sensors and an analogue output signal with 4…20mA.

6.1 Types of PRESS-control

Depending on the type of control cabinet, there are also different types of PRESS-control Printed circuit boards (PCB's). The following pictures show the different type of PRESS-control PCB's and give a brief description of their application.

PRESS-control maximal

This PRESS-control PCB is used for systems of the type: VERNIT and HORNIT 2.0 - 30.0 N2(i) ECONOMY A and DUO.

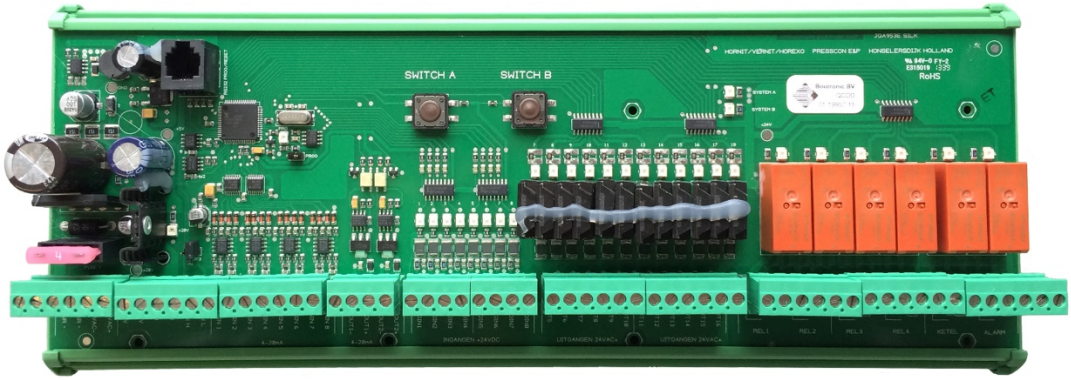


Figure 28. PRESS-control maximal

PRESS-Basic control

This PRESS-control PCB is used for the systems of the type VERNIT 2.0 – 30.0 N2(i) ECONOMY B and VERNIT 2.0 N2i ST BASIC.

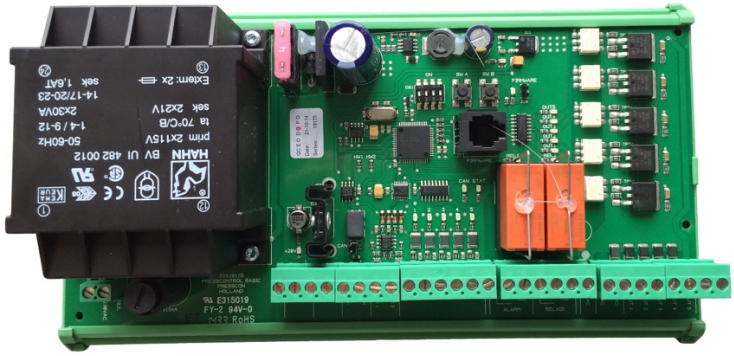


Figure 29. PRESS-Basic contol

7 Alarms and error handling

7.1 Faults and alarms

The Touchscreen software, the PRESS-display and the PRESS-control can generate error messages and alarms when something is wrong with the system. The difference between an error and an alarm is the seriousness of the problem. An error message is considered to be less serious than an alarm message. An alarm message is mainly about critical problems in the expansion system. For example, a sensor malfunction or when the water level has exceeded the maximum or minimum height. An error message is mainly about less critical errors in the system, or an early warning for an alarm.

When a fault message or an alarm message occurs, the PRESS-control will always activate its collect alarm relay. This relay is potential free. The collect alarm relay is used for connecting a warning signal to any type of device that notifies the user. For example: the collect alarm signal can be send to the main computer or SCADA system to indicate that there is a problem with the expansion system. The collect alarm relay reacts to all faults and alarms.

When an alarm message appears, the PRESS-control will also activate the boiler alarm relay. This relay is potential free. The boiler alarm relay can be used to connect blocking signals to devices that have to stop in case of a critical problem in the expansion system. For example: if the water level in the heat storage tank is higher than the setting "lowering the water level" and "maximum water level", the water will press against the roof of the tank and may therefore not expand further. With the boiler alarm relay, a signal can then be sent to the boiler to stop the heating of the water. This prevents further expansion.

The faults and alarms can also be regarded to as two different alarm levels. The following image further clarifies this.

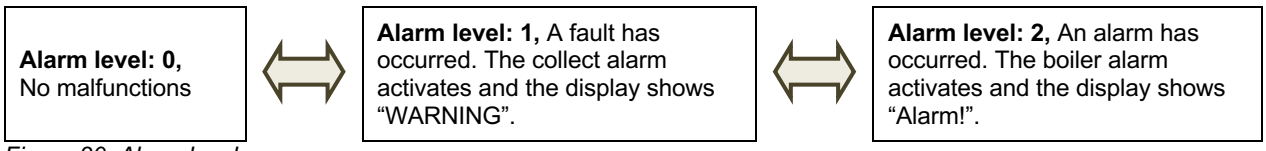


Figure 30. Alarm levels

The description of the alarm levels as shown above is based on the operation of the PRESS-display. The Touchscreen handles the alarms in the same way as the PRESS-display but shows it to the user in a different way. Should an error or alarm message occur, the component to which the message refers will turn red. By pressing the red component, the Touchscreen displays the error and alarm information with an error code. See also chapter 4.2

7.2 Overriding the boiler alarm relay

If the boiler alarm relay is active and blocks one or more devices, such as the boiler, there are scenarios in which this is not desirable. For example: if the boiler still has to heat the central heating system of the greenhouse while the water level sensor on the buffer tank causes an alarm message. In such scenarios it is possible to bypass the boiler alarm relay. While bypassing the boiler alarm, the alarm messages on the Touchscreen and the PRESS-display remain unchanged, but the boiler alarm relay on the PCB will be switched off. So the blocking signal to another device will also be disabled.

ATTENTION! Overriding the boiler alarm is not without any risks. It is strongly recommended to consult the technical support of PRESSCON on forehand. If used in an inappropriate situation, damage to the buffer tank and central heating systems cannot be prevented.

The PRESS-controls of the type PRESS-control minimal and PRESS-control maximal have two buttons on the PCB. The button with the designation “SWITCH B” is programmed to override the boiler alarm relay. The button should be pressed and held for 3 seconds to activate the override. The PRESS-display will then give 2 bleeps and the message ‘BOILER PROTECTION OFF” will be shown on the main screen. To deactivate the override, the ‘SWITCH B’ button should be pressed and held again for 3 seconds.

For switch panels with a Touchscreen the activation and deactivation of the boiler alarm bypass works the same as for panels with a PRESS-display. However, the Touchscreen does not show the message "BOILER SAFETY OFF" on the screen but instead the icon of the nitrogen generator will turn red. Selecting the nitrogen generator on the Touchscreen will display the alarm menu showing the alarm "F34 Boiler Safety off".

The button is located at the center of the PCB. The following image shows what the switch looks like.

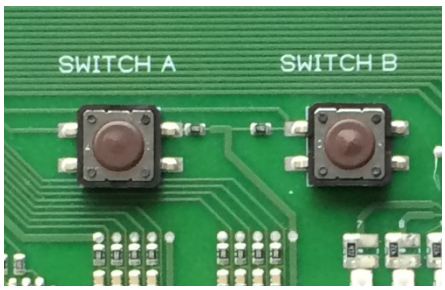


Figure 31. Switch A and B on the PCB of the PRESS-control

The “SWITCH B” button is not available on the PRESS-Basic control PCB which is applied in the ECONOMY B and ST BASIC systems. These systems do not have the ability to override the boiler alarm relay. The boiler alarm override will automatically deactivate after 48 hours.

7.3 Faults and alarm messages

The following tables show the most important error and alarm messages that may appear on the Touchscreen and PRESS-display. A description is given for each message. The table also indicates for each message whether it is an error and/or an alarm.

7.3.1 Fault and alarm messages for the PressControl (ECONOMY A and ECONOMY DUO)

This table of faults and alarms is based on software version: PRESSCONTROL 5.0

Error	Display	Fault	Alarm	Description	Problem
F01	Eeprom addresss	X		Read/write error in the permanent settings memory (EEPROM)	During reading or writing a setting something went wrong. Check the settings
F02	Eeprom R/W	X			
F03	Eeprom adr0	X			
F04	Configuration	X		Checksum error	
F05	CAN TxBuffer	X		CAN-bus send buffer full	Check CAN-bus and adjust the macro interval if needed.
F06	CAN RxBuffer	X		CAN-bus recieve buffer full	
F07	Config base	X		Base value does not correspond.	The software is new, first boot. Else, the Eeprom memory has nog been written properly.
F08	x	X		X	
F09	First boot	X		First boot, new configuration.	
F10	x	X		x	
F11	CAN-bus halt	X		CAN-bus halt detected.	One of the devices on the bus has a fatal CAN error or has rebooted.
F12	WaterIn timeout	X		Feedpump controlled to long.	Problem with the automatic fill/relief installation.
F13	WaterOut timeout	X		Water output controlled to long.	
F14	Waterlevel min	X	X	Water below minimum level.	Add water
F15	Waterlevel max	X	X	Water above maximal level.	Drain water
F16	Waterlvl lower	X		Water above water lower level	Drain water
F17	Waterlvl higher	X		Water below water lower level	Add water
F18	Nit pressure min	X	X	System pressure below minimum level	System pressure not in order. Call service technician.
F19	Nit pressure max	X	X	System pressure above maximum level.	
F20	N2 in timeout	X		Blow in valve controlled to long.	
F21	N2 out timeout	X		Relief valve controlled to long.	
F22	Main power error	X		System rebooted.	x
F23	Compr. Thermic	X		Compressor thermic error	Compressor error: Check compressor Call service technician
F24	Compr. Temp	X		Compressor temperature error	
F25	Compr ox empty	X		Compressor low air pressure	
F26	Compr. Drivetime	X		Compressor controlled to long.	
F27	N2srv connection	X		N2 server connection error.	Check CAN-bus ext. device
F28	Uart1 rxFifo	X		UART receive buffer full	Too much debug information send or noise on the line.
F29	Uart1 txFifo	X		UART send buffer full	
F30	RTC comm.	X		Internal clock defective	Send board in for repair.
F31	Set date time	X		Internal clock is not set	Set up the clock via service menu.
F32	PressControl N/A	X		PressController not available.	Check the SW version of the CAN-bus.

Error	Display	Fault	Alarm	Description	Problem
F33	Software ver.	X		Software version difference between PressDisplay and the PressControll	Perform a software update.
F34	Boiler prot off	X		Boiler protection switched off	Press the B button if you wish to switch it back on.
F35	Span config	X		Span high is lower than Span low.	Check settings
F36	Ext. AD Converter	X	X	A/D converter defect.	Send board in for repair
F37	ELC Sensor Tank1	X	X	ELC sensor Tank X defect	Check (ext) pressure sensor (wiring, sensor connector)
F38	ELC Sensor Tank2	X	X	ELC sensor Tank Y defect	
F39	LCD button	X		Button pressed during boot	Laat de knop los en herstart
F40	Degasser lvl min	X		x	
F41	Press sensor 1	X	X	Pressure sensor 1 defect	Check pressure sensor (cables, sensor, connection)
F42	Press sensor 2	X	X	Pressure sensor 2 defect	
F43	Press sensor 3	X	X	Pressure sensor 3 defect	
F44	Press sensor 4	X	X	Pressure sensor 4 defect	
F45	Press sensor 5	X	X	Pressure sensor 5 defect	
F46	Press sensor 6	X	X	Pressure sensor 6 defect	
F47	Press sensor 7	X	X	Pressure sensor 7 defect	
F48	Press sensor 8	X	X	Pressure sensor 8 defect	
F49	ElcT1 connection	X	X	ELC tank X connection error	PressControler can not find external device; Check CAN-bus and external PressController
F50	ElcT2 connection	X	X	ELC tank Y connection error	
F51	SlcT1 connection	X	X	SLC tank X connection error	
F52	SlcT2 connection	X	X	SLC tank Y connection error	
F53	SLC Sensor Tank1	X	X	SLC sensor Tank X defect	Check (ext) pressure sensor (cables, sensor, connection)
F54	SLC Sensor Tank2	X	X	SLC sensor Tank Y defect	
F55	Taskfifo	X		Internal error	
F56	ElcT1 fatal error	X		External tank1 has a fatal alarm	The (external) PressControl has a fatal tank1/tank2 error. Correct the error at the other controller and press the reset button.
F57	ElcT2 fatal error	X		External tank2 has a fatal alarm	
F58	SlcT1 fatal error	X		External tank1 has a fatal alarm	
F59	SlcT2 fatal error	X		External tank2 has a fatal alarm	
F60	Tank1 lvl conn.	X	X	The external connection of the level control for tank 1 has not retrieved any value for 15 seconds.	PressControler can not find external device; Check CAN-bus and external PressController
F61	Tank2 lvl conn.	X	X	The external connection of the level control for tank 2 has not retrieved any value for 15 seconds.	
F62	Tank1 waterLvl sens	X	X	Sensor Tank1 control defect	Controleer (ext) druksensor (bekabeling, sensor, aansluiting)
F63	Tank2 waterLvl sens	X	X	Sensor Tank2 control defect	
F64	Oxygen min	X		Oxygen level PSA generator below minimum level	Check (ext) pressure sensor (cables, sensor, connection)
F65	Oxygen max	X		Oxygen level PSA generator above maximum level	

Error	Display	Fault	Alarm	Description	Problem
F66	Double devNr (d)	X		There are two devices in the network with the same number.	Change de device numbers so each device is unique.
F67	Service <14 days	X		This system operates for only 14 days. Make sure that maintenance is conducted within two weeks.	Call service technician
F68	Service expired	X		No maintenance has been conducted, system is switched off.	Call service technician
F69	Double devNr (c)	X		There are two devices in the network with the same number.	Adjust the device number so that every device is unique
F70	Tank1 press conn	X		The connection of the pressure measurement control for tank 1 has not retrieved any values for 15 seconds.	PressController can not find the external device; Check CAN-bus, and external PressControl.
F71	Tank2 press conn	X		The connection of the pressure measurement control for tank 2 has not retrieved any values for 15 seconds.	
F72	Tank1 press sens	X		An (external) pressure sensor for the tank 1 control has an error.	
F73	Tank2 press sens	X		An (external) pressure sensor for the tank 2 control has an error.	
F74	Buffer connect	X		The connection of the buffer pressure measurement has a timeout fault.	
F75	BufferPress min	X		Buffer pressure below minimal value.	Can a service technician
F76	BufferPress max	X		Buffer pressure above maximal value.	
F77	Bufferdr. Sensor	X		An (external) pressure sensor of the buffer pressure measurement has a fault.	

7.3.2 Fault and alarm messages for the Touchscreen

This table of faults and alarms is based on software version: PRESSCONTROL 5.0

Error	Display	Fault	Alarm	Description	Problem
F01	Eeprom address	X		Read/write error in the permanent settings memory (EEPROM)	During reading or writing a setting something went wrong. Check the settings.
F02	Eeprom R/W	X			
F03	Eeprom 0x0000	X			
F04	Configuration	X		Checksum error	
F05	CAN TxBuffer	X		CAN-bus send buffer full	Check CAN-bus and adjust the macro interval if needed.
F06	CAN RxBuffer	X		CAN-bus receive buffer full	
F07	Config base	X		Base value does not correspond.	The software is new, first boot. Else, Eeprom memory has not been written properly.
F08	Configuration	X		Check value configuration not correct	
F09	First boot	X		First boot, new configuration.	
F10	X	X		X	

Error	Display	Fault	Alarm	Description	Problem
F11	CAN-bus halt	X		CAN-bus halt detected.	One of the devices on the bus has a fatal CAN error or has rebooted.
F12					
F13					
F14					
F15					
F16					
F17					
F18					
F19					
F20	RTC comm.	X		Communication with RTC not correct	Call a service technician
F21					
F22	Main power error	X		Display was rebooted	Check power supply
F23	Software vers.	X		Software version does not correspond	Check the software versions of the PressControl [JGA953] and ColorPressDisplay [JGA1085]
F24	PressControl N/A	X		No connection with PressControl	Check the CAN-bus connection to the PressControl [JGA953]
F25					
F26					
F27					
F28	Uart rxFifo	X		UART receive buffer full	Too much debug information send, or noise on the connection.
F29	Uart txFifo	X		UART send buffer full	
F30					
F31					
F32					
F33					
F34					
F35					
F36					
F37					
F38					
F39					
F40					
F41					
F42					
F43	Uart rx data	X		Communication error	Call a service technician
F44	Uart rxFifo	X			
F45	Uart frame length	X			
F46	Uart frame BCC	X			
F47					
F48					
F49					
F50	IP-conflict	X		There is a device in the computer network wit the same IP-address	Check network settings
F51	MAC-address	X		MAC address error	Call a service technician
F52	W5500 cmd	X		Factory error message	
F53	NTP connection	X		Connection to the timeserver could not be established.	Check access to the internet / time server
F54					
F55	Timer handler	X		Factory error message	Call a service technician
F56					

Error	Display	Fault	Alarm	Description	Problem
F57	MAC-address	X		MAC address error	Call a service technician
F58					
F59					
F60	TCP Tx buffer	X			
F61					
F62					
F63	TCP Rx buffer	X			
F64					
F65					
F66					
F67	Double devNr(d)	X		Double device number detected.	Check device number on the CAN-bus
F68					
F69					
F70					
F71					
F72					
F73					
F73	Display error	X		Display has an error	Call a service technician
F74	Test error	X		Test error message for testing purposes.	

7.3.3 Fault and alarm messages for the PRESS-Basic control(ECONOMY B)

This table of error and alarm messages is based on software version: BasicPControl V2.0

Alarm no.	Display message	Fault	Alarm	Description	Cause of problem
F01	Eeprom address	X		Read/write error in the	An error occurred while trying to read 1 or
F02	Eeprom R/W	X		permanent eeprom	Writing a setting; check the configuration
F03	Eeprom address0	X		Memory settings	
F04	Configuration	X		Checksum error.	
F05	CAN TxBuffer	X		CAN-bus send buffer is full.	Check CAN-bus. Adjust macro interval.
F06	CAN RxBuffer	X		CAN-bus receive buffer is full.	When necessary
F07	Config base	X		Base values do not match.	New software or first time starting
F08					program memory may be faulty
F09	First boot	X		First time starting, new cfg.	
F10					
F11	CAN-bus halt			CAN-bus stop detected.	One of the devices on the bus had a fatal CAN error, or has been restarted
F12	x				
F13	x				
F14	Waterlevel min	X	X	Water below minimum level	Insufficient water in the heat storage tank
F15	Waterlevel max	X	X	Water above maximum level	Drain off water
F16	Water lower	X		Water above reduce level	Drain off water
F17	Water raise	X		Water below reduce level	Add water
F18	Systempress min	X	X	System pressure below minimum level.	System pressure not correct; call service technician
F19	Systempress max	X	X	System pressure above maximum level.	there is a leakage on the system or
F20					
F21					
F22	Main power			The system has restarted	
F23	Comp thermic	X	X	Compressor thermal error	Compressor error: Check
F24					compressor; call service technician
F25	Comp air low	X	X	Compressor pressure too low	
F26					
F27					
F28	Uart1 rxFifo	X		UART1 receive buffer is full	Too much debut information sent or line noise

Alarm no.	Display message	Fault	Alarm	Description	Cause of problem
F29	Uart1 txFifo	X		UART1 send buffer is full	distortion on info bus
F30					
F31					
F32	BasicPControl N/A	X		BasicPController not available	Check software version and CAN-bus connection
F33	Software ver.	X		Software version between PressDisplay and BasicPControll is different.	Update the software of the display and controller.
F34	Boiler prot off	X		Boiler alarm is switched off	Press button 'B' to switch on the boiler alarm again
F35	Span config	X	X	Span high is lower than Span low.	Check configuration
F36	External ADC	X	X	A/D converter defect.	Send the controller to the dealer for repair
F37					
F38					
F39	Lcd button	X		Button was pressed during startup	Release the button and restart the system
F40					
F41	Sensor 1	X	X	pressure sensor 1 defect.	Check pressure sensor (cable, sensor, connection)
F42	Sensor 2	X	X	pressure sensor 2 defect.	
F43					
F44					
F45					
F46					
F47					
F48					
F49					
F50					
F51					
F52					
F53					
F54					
F55	Taskfifo	X		Internal error.	
F56					

Alarm no.	Display message	Fault	Alarm	Description	Cause of problem
F57					
F58					
F59					
F60					
F61					
F62	Regel niv sensor	X	X	level sensor error.	Check (ext) pressure sensor (cable, sensor, connection)
F63					
F64					
F65					
F66	Double dev Nr(d)	X	X	Two devices have the same network number	Change device number to a unique number.
F67	Service <14 days			This system has been operating for 14 days. Make sure that a maintenance service has been carried out within two weeks.	Call service technician
F68	Service expir.			No maintenance service carried out, system will shut down.	Call service technician
F69	Double dev Nr(c)	X	X	Two devices have the same network number	Change the device number to a unique number
F70					
F71					
F72	Press contr sens	X	X	Pressure sensor error.	
F73					
F74	Reserved	X		Reserved error message	
F75	Reserved	X		Reserved error message	
F76	Reserved	X		Reserved error message	
F77	Reserved	X		Reserved error message	

8 Maintenance and service

8.1 Expansion system maintenance

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

Activity	To be done by	Weekly	Each year or every 2.000 hours	Every 2 years or every 4.000 hours	Every 2 years.
Nitrogen generator					
Visual inspection	Owner	X			
Tightening PSA spindles	Service engineer		X		
Clean dirt catcher	Service engineer		X		
Check compressed air filters	Service engineer		X		
Check output flow and purity	Service engineer		X		
Replace compressed air filters	Service engineer			X	
Sensors					
Check water level	Service engineer		X		
Check pressure measurement	Service engineer		X		
Check sensor covers	Service engineer		X		
Vacuum- overpressure safety valve (VERNIT systems)					
Check safety valve(s)	Service engineer		X		
Revision safety valve	Service engineer				X
Vacuum safety valve (HORNIT systems)					
Check safety valve(s)	Service engineer		X		
Revision safety valve	Mechanic/Factory*				X

**The revision of the vacuum safety valve for HORNIT systems should be performed at the factory of PRESSCON. The used safety valve can be exchanged directly with a revised safety valve. Replacing the vacuum safety valve on the horizontal buffer tank should be performed by an approved installer who can safely relief the pressure from the tank and the safety valve.*

8.2 Compressor maintenance

Although the expansion system is generally provided with a dedicated compressor, the maintenance instructions are different for each type and brand of machine. The maintenance instructions of the compressor are described in the user manual that is delivered as a separate document along with the compressor.

9 Warranty

PRESSCON provides a warranty of 1 year on the components of the expansion system, assuming that the following conditions are met:

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

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

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

10 Appendix

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

Appendix ID	Description	Version
-	-	-

11 Document history

Version **1.0** to **2.0** indicates : **Modification**, in lay-out, structure or other major modifications;

Version **1.0** to **1.1** indicates : **Supplement**, a chapter of paragraph has been added to the document;

Revision **_R01** to **_R02** indicates : **Correction**, an image, language error or text error has been corrected.

Version	Date	Modification
3.0_R01	22-10-2015	- Manual revised to current state of technology.
3.0_R02	23-10-2015	Chapter 1.1 The phrase BREATHE AIR replaced by INHALE GAS. Chapter 2.4 Title adjusted to TYPES instead of TYPE. Chapter 2.5 Title adjusted to TYPES instead of TYPE. Chapter 3.1.1. Step 1 about the compressor placed into a separate paragraph. Grammar in text adjusted. Chapter 4.1 the phrase FAILURE replaced by FAULT OR ALARM. Redirection to other paragraphs fixed. The phrase ONE TIME SHORTLY replaced by ONCE. Chapter 4.3 Text supplemented with return to main screen. Chapter 6.2 Grammar in text adjusted. Chapter 6.3 Columns added about fault and alarm dividing.
3.0_R03	30-10-2015	Introduction The phrase 'In check' adjusted to the term 'maintaining'. Chapter 1.1 the phrase 'Dangerous to inhale gas' adjusted to 'dangerous gas to inhale'. Chapter 2 introduction text adjusted grammatically. Chapter 3.1 introduction text adjusted grammatically. Chapter 1.1.2 table margin adjusted. Chapter 6.2 The phrase 'overwrite' replaced by 'override'.

3.1_R01	11-01-2016	Introduction supplemented with text about the HORNIT systems and ST BASIC systems. Chapter 2.4 Nitrogen generator ST BASIC added to the document. History of images supplemented with the relevant documents. Chapter 2.5 -2F vacuum valves added to description of the safety valve.
	12-01-2016	Chapter 3.5 till chapter 3.1.5. Text added about the operation of the HORNIT system and the ST BASIC system. Chapter 3.2.1. added. Includes an overview of the functionality of the HORNIT system. Chapter 4. Renewed the PRESS-display image. Chapter 4.5 added, overview and description of the service information screen; Chapter 4.6 added, overview and description of the factory information screen. Chapter 6.1 Text adjusted. Example for an alarm situation described as applicable to a vertical tank. Chapter 7. Added the vacuum safety valve for the HORNIT system to the maintenance overview.
	13-01-2016	Chapter 1.1, 1.1.1, 1.1.2, 1.1.3. various texts adjusted. Chapter 2.0 Text adjusted to better suit the described units. Chapter 2.0 legend, Text adjusted. Chapter 2.5 PV 50-2F added to description of safety valves. Chapter 2.6 title adjusted Chapter 3, 3.1 Text added about the HORNIT systems and total pressure measurement. Chapter 3.2, 3.3, Images adjusted to better suit the descriptions. Chapter 4.3, 4.4 text adjusted. Chapter 4.5.1., 4.5.2. Text adjusted in both images of the service information screen. Chapter 4.6.1, 4.6.2. Text adjusted in both images of the Factory information screen. Chapter 5.1 text adjusted in the description of all 3 pictures. Chapter 6.2 Text adjusted Chapter 6.3.1. Display messages translated to English Chapter 7.1 Description of the system adjusted. Chapter 9. Declaration of conformity adjusted to 2016.
3.1_R02	19-01-2016	Table of content, skipped one line for better alignment to page; Chapter 4 grammar adjusted; Chapter 4.1 at the lines of the + and – button, grammar adjusted.

		Chapter 6.2 par. 1. Grammar adjusted.
	20-01-2016	Adjusted blue colored tables and styling.
	21-01-2016	Grammar adjusted in the following chapters: Introduction, chapter 1.1, 1.1.1, 1.1.2, 1.1.3, Chapter 2.0, 2.0 legend, Chapter 3.1.2, 3.1.3, 3.2, Chapter 4.1, 4.2, 4.4, 4.5.2, 4.6.1, Chapter 5.1, Chapter 6.1, 6.3.1, Chapter 7.1, Chapter 8. Chapter 9 Declaration of Conformity adjusted to new standard 2014/68/EU
3.2_R01	15-06-2016	Chapter 3.2 added about the assembly of the components on the buffer tank.
3.3_R01	25-11-2016	Replaced text in introduction.
3.4_R01	28-03-2017	Chapter 4. replaced figure 13. For image with white font on buttons. Chapter 4.1. replaced images of buttons with images that have white fonts. Chapter 4.7. replaced image of button with image of that has white font. Chapter 4.8. replaced image of button with image of that has white font. Chapter 3.1.6. added description about the Leak Detection Measurement. Chapter 3.2.1. Revised the image about the vertical tank and added numbers for the heat injection pipe and 3rd pressure sensor. Adjusted introduction text of chapter. Description of heat injection pipe also added. Added paragraph for the leak detection measurement. Adjusted size of function column in description table. Chapter 3.2.2. added chapter about the Vertical buffer tank in a DUO setup. Chapter 3.2.2. about the Horizontal buffer tank has become 3.2.3. Supplemented the setup of the buffer tank with the 3 different possibilities of setup. Chapter 3.2.4. Added chapter about the Horizontal buffertank in a DUO setup. Chapter 3.2.5. Added chapter about combining the vernit and hornit systems. Chapter 3.3.1. Adjusted image which now includes pressure sensor 5/6. And different description of PRESS-Control. Chapter 3.3.2. Adjusted image with different description of PRESS-Control. Chapter 3.3.3. Added chapter about the schematic overview of a VERNIT DUO system. Chapter 3.3.4. Added chapter about the schematic overview of a HORNIT DUO system. Chapter 4.4.3. Supplemented the description at point 10 and 11 with designation about the leak detection measurement. Chapter 2.7 replaced image with new version including 3 more designations. Chapter 2.8 added chapter about the optional tracing ribbon around the sensor. Chapter 3.1.7. Added chapter about how the optional tracing ribbon operates.

		Chapter 2.5. renewed images about the vacuum- overpressure safety valve and vacuum safety valve. Corrected grammar in title of chapter. Chapter 2.6. added chapter about the optional tracing band around the safety valve.
3.4_R01	04-04-2017	Introduction text supplemented with description of system functionality. Chapter 2. Corrected grammar in introduction text. Chapter 2.4. Corrected grammar in Legend at red. No. 4.B. Chapter 3.1.1. Step 2. Corrected grammar and adjusted value from 99 to 99,0. Chapter 3.1.3. Chapter added about the water monitoring. Chapter 3.1.5. step 1. Supplemented description of water expansion. Chapter 3.1.6. step 1. Supplemented description of water expansion. Chapter 3.1.7. Adjusted grammar in the introduction. Step 2. Grammar adjusted. Chapter 3.1.8. step 1. Adjusted description of pressure sensor. Chapter 3.2.1. Added legend with remark on components that PRESSCON does not install. Chapter 3.2.2. Added legend with remark on components that PRESSCON does not install. Chapter 3.2.3. Added legend with remark on components that PRESSCON does not install. Adjusted buffertank description. Chapter 3.2.4. Added legend with remark on components that PRESSCON does not install. Chapter 3.2.5. adjusted the title of chapter. Chapter 3.3.1. renewed image. Chapter 3.3.2. renewed image. Chapter 3.3.3. renewed image. Chapter 3.3.4. renewed image. Chapter 4.1. Deleted unclear redirection. Adjusted the description of the Prog button. Chapter 4.3. Corrected grammar. Chapter 4.4.3. In description at row 4. Adjusted grammar. Chapter 4.5.2. Supplemented descriptions under row 1 and 2. Chapter 4.6. Adjusted service information screen description. Chapter 4.6.2. Adjusted description at row 2. Sensors. Chapter 4.7. Adjusted grammar Chapter 4.8. Adjusted grammar

		Chapter 6.2. Relocated the ATTENTION block between de first 2 paragraphs. Chapter 9. Adjusted year of signature to 2017. Chapter 4.4 to chapter 4.6 Checked structure of menu's and info screens with the following software versions: - PressControl_V4_0i_R0. / PressDisplay_v4_0i_ENNL_R0. - BasicPControl_v2_0g_R0 / BasicPDisplay2_v2_0G_R0 Complete document: Adjusted descriptions of tanks to: Buffer tank, Separate expansion vessel, Compressed air HP vessel, Nitrogen HP vessel.
	05-04-2017	Chapter 6.3.1. renewed alarm table to match with software version: - PressControl_V4_0i_R0. / PressDisplay_v4_0i_ENNL_R0
	13-04-2017	Introduction. Adjusted grammar in introduction text. Adjusted grammar under "VERNIT 2.0 – 30.0 N2(i) ECONOMY B. Chapter 1.1. Grammar adjusted. Chapter 1.1.1. Grammar adjusted. Chapter 1.1.2. Grammar adjusted. Chapter 1.1.3. Grammar adjusted. Chapter 1.2 Grammar adjusted. Chapter 2. Grammar adjusted. Chapter 2.2 Grammar adjusted in legend. Chapter 2.5. Adjusted description of overpressure valves. Adjusted grammar Chapter 2.6. Grammar adjusted. Chapter 2.8. Grammar adjusted. Chapter 3.1.2. Grammar adjusted. Chapter 3.1.3. Grammar adjusted. Chapter 3.1.5. Grammar adjusted. Chapter 3.1.6. Grammar adjusted. Chapter 3.1.7. Grammar adjusted in title. Chapter 3.1.8. Grammar adjusted. Chapter 3.2. Grammar adjusted in title. Chapter 3.2.1. Grammar adjusted in title and legend. Chapter 3.2.2. Grammar adjusted in legend. Chapter 3.2.3. Grammar adjusted in legend. Chapter 3.2.4. Grammar adjusted in legend. Chapter 3.2.5. Grammar adjusted. Chapter 4. Grammar adjusted.

		Chapter 4.1. Grammar adjusted in text and under descriptions. Chapter 4.3. Grammar adjusted. Chapter 4.4.3. Grammar adjusted in descriptions under 12. Chapter 4.6.1. Grammar adjusted in descriptions under 7. Chapter 4.6.2. Grammar adjusted in descriptions under 6 and 7. Chapter 6.2. Grammar adjusted in warning text. Chapter 6.3. Grammar adjusted Chapter 6.3.1. Grammar adjusted in descriptions.
	18-04-2017	Chapter 3.2.1. Added measuring range of sensors in legend. Chapter 3.2.2. Added measuring range of sensors in legend. Chapter 3.2.3. Added measuring range of sensors in legend. Chapter 3.2.4. Added measuring range of sensors in legend.
	19-04-2017	Chapter 7.1. Grammar adjusted in text and in table about maintenance Chapter 9. Adjusted description of quality management system.
3.5_R00	27-10-2017	2.1 Images supplemented with references. 2.2 Images supplemented with references. 2.3 Images supplemented with references. Supplemented legend with description about the pressure gauges at punt 3.1.
3.5_R01	07-03-2018	Introduction – ST Basic name adjusted from 2.0 – 30.0 to 2.0. Chapter 5.1. – ST Basic name adjusted from 2.0 – 30.0 to 2.0.
4.1_R00	20-3-2019	Chapter 4 changed from press display into Touchscreen. Chapter 3.1.9 added manual operation of the check valve. Chapter 6.3 renewed the fault and alarm descriptions. According to Version 5.0I.
4.1_R01	02-04-2019	Chapter 6.3 corrected the fault and alarm table.

12 To conclude

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

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