CE 1639

MD

BeaconMedaes
Medical Air Supply System – PMA

Instruction book

BeaconMedæs

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Medical Air Supply System - PMA

PMA-S1, PMA-S2, PMA-S3, PMA-S4, PMA-M1, PMA-M2, PMA-M3, PMA-L1, PMA-L2, PMA-L3, PMA-XL1,PMA-XL2

Instruction book

Original instructions

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

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www.beaconmedaes.com

Contact address:
Atlas Copco (Wuxi) Compressor Co., Ltd

No. 45 Feifeng Road, Xinwu District, Wuxi City, Jiangsu Province, China

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General precautions

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

1. Installation, operation, maintenance and repair work must only be performed by authorised, trained, specialised personnel（Requirement and training details follow HTM02-01 Part B. Chapters 4, 5, 6 and 7, ISO 7396-1 Annex G-Operational management）.
2. Portable and mobile RF communications equipment can affect the unit. They should be used no closer to any part of the unit, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter (see EN 60601).
3. A validation of the quality of the air at the outlet should be carried out before the unit is put into operation.
4. The air PMA units are designed for normal indoor use.
5. The operator must employ safe working practices and observe all related work safety requirements and regulations:
   • Wear ear protectors if applicable. People staying in environments or rooms where the sound pressure level reaches or exceeds 90 dB(A) shall wear ear protectors.
   • Never remove or tamper with the safety devices except maintenance. All regulating and safety devices shall be maintained with due care to ensure that they function properly. They may not be put out of action. Regarding safety valves, they should not be removed while the system is pressurised.
6. If any of the following statements does not comply with the applicable legislation, the stricter of the two shall apply.
7. A compressor is not considered capable of producing air of breathing quality. To obtain air of breathing quality, the compressed air must be adequately purified (for example use PMA to purify) according to the applicable legislation and standards.
8. Never play with compressed air. Do not apply the air to your skin or direct an air stream at people. Never use the air to clean dirt from your clothes. When using the air to clean equipment, do so with extreme caution and wear eye protection.
9. It is not allowed to walk or stand on the equipment or its components.

1.3 Safety precautions during installation

1. The equipment must only be lifted using suitable equipment and in accordance with the applicable safety regulations. Loose or pivoting parts must be securely fastened before lifting. It is strictly forbidden to dwell or stay in the risk zone under a lifted load. Lifting acceleration and deceleration must be kept within safe limits. Wear a safety helmet when working in the area of overhead or lifting equipment.
2. Install the equipment where the ambient air is as cool and clean as possible and within the limitations for operation. The distances to walls shall be respected. Make sure that the environment is not potentially explosive.

   Make sure that the ambient condition limits specified in the limits for operation are not exceeded during the course of the plant lifetime and that they comply with the protection class of the unit.

   Care must be taken to minimize the entry of moisture or any other impurities (e.g. internal combustion engine exhaust, vehicle parking, access areas, hospital waste and disposal systems, vacuum system exhausts, vents from medical gas pipeline systems, anesthetic gas scavenging systems, ventilation system discharges, chimney outlets and other sources of contamination) at the inlet of the compressor.

	Ensure the installation meets the HTM02-01 Part A. Chapters 2&7 or ISO 7396-1 Chapter 4 requirements.

3. Any blanking flanges, plugs, caps or desiccant bags must be removed before connecting the pipes.
4. The air, aspirated by the compressor, must be free of flammable fumes, vapors and particles (e.g.paint solvents) that can lead to internal fire or explosion.
5. Air hoses must be of correct size and suitable for the working pressure. Never use frayed, damaged or worn hoses. Distribution pipes and connections must be of the correct size and suitable for the working pressure.
6. Portable and mobile RF communications equipment can affect the unit. They should be usedno closer to any part of the unit, including cables, than the recommended separation distancecalculated from the equation applicable to the frequency of the transmitter (See EN 60601).
7. If remote control is installed, the machine must bear a clear sign stating "Danger: This machineis remotely controlled and may start without warning".

   The operator has to make sure that the machine is stopped and that the isolating switch is openand locked before any maintenance or repair. As a further safeguard, persons switching on remotely controlled machines shall take adequate precautions to ensure that there is no one checking or working on the machine. To this end, a suitable notice shall be affixed to the starting equipment.
8. Air-cooled machines must be installed in such a way that an adequate flow of cooling air is available and that the exhausted cooling air does not recirculate to the inlet.
9. Piping or other parts with a temperature in excess of 80˚C (176˚F) and which may be accidentally touched by personnel during normal operation must be guarded or insulated. Other high- temperature piping must be clearly marked.
10. No external force may be exerted on the inlet and outlet piping. The connections must be free of strain.
11. The electrical connections must be made in accordance with the applicable codes. The machines must be earthed and protected against short circuits by fuses in all phases. A lockable power isolating switch must be installed near the equipment.
12. Never remove or tamper with the safety devices, guards or insulation fitted on the machine. Every pressure vessel or auxiliary installed outside the machine to contain air above atmospheric pressure must be protected by a pressure-relieving device or devices as required.

	Also consult sections General safety precautions, Safety precautions during operation and Safety precautions during maintenance or repair..These precautions apply to machinery processing or consuming air or inert gas. Processing of any other gas requires additional safety precautions typical to the application which are not included herein. Some precautions are general and cover several machine types and equipment; hence some statements may not apply to your equipment.

1.4 Safety precautions during operation

1. Never operate the machine below or in excess of its limit ratings.
2. To safeguard correct operation of the equipment it is recommended to:
   - Monitor the outlet dew point on all occasions.
   - When possible, install a CO sensor/monitor with alarms.
   - The unit must be installed in a network which complies with the legislation Medical Devices Directive 93/42/EC and with the harmonized standard EN ISO 7396-1 and HTM 02-01.
3. Always be careful when touching any piping or components which have high surface temperatures during operation.
4. Use only the correct type and size of hose end fittings and connections. When blowing through a hose or airline, ensure that the open end is held securely. A free end will whip and may cause injury. Make sure that a hose is fully depressurized before disconnecting it.
5. Never operate the equipment in the presence of flammable or toxic fumes, vapors or particles.
6. People staying in environments or rooms where the sound pressure level reaches or exceeds 90 dB(A) shall wear ear protectors.
7. Do not remove any of, or tamper with, the sound-dampening material.
8. Never remove or tamper with the safety devices, guards or insulations fitted on the machine. Every pressure vessel or auxiliary installed outside the machine to contain air above atmospheric pressure shall be protected by a pressure-relieving device or devices as required. All regulating and safety devices shall be maintained with due care to ensure that they function properly.

	Also consult sections General safety precautions, Safety precautions during installation and Safety precautions during maintenance or repair. These precautions apply to machinery processing or consuming air or inert gas. Processing of any other gas requires additional safety precautions typical to the application which are not included herein. Some precautions are general and cover several machine types and equipment; hence some statements may not apply to your equipment.

1.5 Safety precautions during maintenance or repair

1.  WARNING! It is essential that only genuine BeaconMedaes spare parts are fitted during maintenance.

2. Scrupulously observe cleanliness during maintenance and repair. Keep dirt away by covering the parts and exposed openings with a clean cloth, paper or tape.
3. Whenever there is an indication or any suspicion that an internal part of a machine isoverheated, the machine shall be stopped but no inspection covers shall be opened before sufficient cooling time has elapsed; this to avoid the risk of spontaneous ignition of the oil vaporwhen air is admitted.
4. Before clearing the machine for use after maintenance or overhaul, check that operating pressures, temperatures and time settings are correct. Check that all control and shut-down devices are fitted and that they function correctly.

5. Always use the correct safety equipment (such as safety glasses, gloves, safety shoes, etc.).
6. All maintenance work shall only be undertaken when the machine has cooled down and is depressurized.
7. Before removing any pressurized component, effectively isolate the component from all sources of pressure and relieve the pressure. Before disconnecting any piping, pneumatically isolate the section and slowly bring the pressure to atmospheric pressure. Do not suddenly open any isolating valve that may cause rapid evacuation of any section that may be at high pressure. Open valves slowly and allow sufficient time for the pressure to stabilize.
8. Never use flammable solvents or carbon tetrachloride for cleaning parts. Take safety precautions against toxic vapors of cleaning liquids.
9. Never weld on, or in any way modify, pressure vessels.
10. Never use a light source with open flame for inspecting the interior of a machine, pressure vessel.
11. Make sure that no tools, loose parts or rags are left in or on the equipment.
12. All regulating and safety devices shall be maintained with due care to ensure that they function properly. They may not be put out of action.
13. The following safety precautions are stressed when handling desiccant:
    - Take precautions not to inhale desiccant dust.
    - Check that the working area is adequately ventilated; if required, use breathing protection.
    - Do not overfill the dryer when replacing desiccant.

	Also consult sections General safety precautions, Safety precautions during installation and Safety precautions during operation . These precautions apply to machinery processing or consuming air or inert gas. Processing of any other gas requires additional safety precautions typical to the application which are not included herein. Some precautions are general and cover several machine types and equipment; hence some statements may not apply to your equipment.

2 General description

2.1 Introduction

Intended use

Medical Air Supply System is used for the centralized supply of medical air, which is compressed and purified for the medical air piping system to the operating room, rescue room, Recovery room, Anesthetic room and other departments for medical use.

Description

Medical Air Supply System provides a reliable source of supply that delivers the designed flow rate of medical and surgical air. These devices are intended for use as plant within the hospital environment for the supply of medical and/or surgical air. They are not intended for direct use with any patients or groups but supply a utility to medical devices that use medical or surgical quality air. Air is fed via compressors to air receiver vessels. Here the air is stored to compensate for variable consumption and to allow a longer running period to increase energy efficiency and reduce the number of 'motor starts. The air is then fed through a 3-stage filtration system where dust particles and oil/water aerosols are separated, oil vapours and odours are absorbed, and fine particles are removed. The air delivered by the Medical Air Supply System is purified by utilising multiple filters that combine to ensure the relevant impurities are removed from the compressed air following pressurization through the systems' compressor(s). The filters are assembled within the dryer/purification module which ultimately establishes the desired output from the Medical Air Supply System. Without the purifier module the air delivered from the compressors would contain levels of impurity meaning it would be unsuitable for medicinal purposes.

Medical Air Supply System is made up of the following module:

• Air compressor.

• Reservoir (pressure vessel).

• Conditioning unit (Purifier)

The purifier module controls the specification and any related hazards of the air to the medical gas pipeline requirements. There is always a separate medical device (not within the scope of this device) between the medical gas pipeline and the patient that controls any mechanical hazards related to flow or pressure. This device therefore only protects the pipeline from any mechanical hazards, and only protects the patient from contamination hazards. The compressors and pressure vessels only influence mechanical hazards to the purification system, they neither influence hazards to the pipeline or patient.

High quality air is of vital importance to many industries, but nowhere as literally as in the medical sector. The purity of the compressed air for certain hospital applications is crucial. The air drawn from our environment however, especially in cities or industrial areas, is rarely of a sufficient quality for medical purposes.

For this application, BeaconMedæs has designed the PMA (purifier) range. The PMA takes air from any regular compressor and treats it to become ultra clean. It consists of a number of components, which together, after the commissioning certification, produce air with a quality matching the Pharmacopoeia legislation.

The PMA is primarily aimed at the health care sector where applications like breathing air inoperating theatres and surgical air to drive surgical tools demand high quality air.

- A PMA consists of 2 independent air treatment units, each consisting of following stages ofcleaning: A water separator (WSD) to eliminate free water from the compressed air, thus ensuring good operation of the desiccant dryer.
- A coalescing filter (UD+ filter) to remove contaminating particles and oil droplets.
- A desiccant dryer to lower the dew point (ADP) to -46 ˚C, eliminating the risk of condensation and strongly reducing water-related problems like bacteria growth, and also can remove the CO2.
- The QD+ filter reduces hydrocarbons like oil vapour and smells to harmless levels and the HOC filter (option) converts excessive concentrations of CO into CO2.
- A particle filter (PDp+ filter) to eliminate particles that may have migrated out of the desiccant dryer.

Both units are controlled by a central controller (ES-MED). This central controller activates one unit and will switch to the other one after a certain amount of time has elapsed. This guarantees a constant delivery of purified air and also ensures service can be performed on one unit whilst the system is still operating. At all times an indication of dew point and pressure can be retrieved from the display.

HTM 02-01

Compressor-driven medical air systems

Primary supply	Secondary supply	Reserve supply (Third source of supply)
Duplex compressor system.	Automatic manifold system. To come on-line automatically in the event of plant failure. Number of cylinders based on ability to provide 4 hours' supply at average use.	Automatic manifold system. May be sited to support high dependency areas or whole site OR Locally-based integral valved cylinders with regulators/flow meters attached.
Two compressors of a triplex compressor system.	Third compressor of a triplex system.	Automatic manifold system. To support whole site.
Two compressors of a quadruplex system.	Other two compressors of a quadruplex system.	Automatic manifold system. To support whole site.

Compressor-driven surgical air systems

Primary supply	Secondary supply	Reserve supply (Third source of supply)
Simplex compressor unit.	Automatic manifold system. To come on-line in the event of plant failure. Number of cylinders based on ability to provide 4 hours' supply at average use.	Locally based integral valved cylinders with regulators/flow meters attached.
One compressor of a duplex compressor system.	Second compressor of a duplex compressor system.	Automatic manifold system.

Combined medical/surgical air plant

Primary supply	Secondary supply	Reserve supply (Third source of supply)
Duplex compressor system.	Two automatic manifold systems: • one dedicated to support medical air (MA) system; • one dedicated to support surgical air (SA) system. All to come on-line in the event of plant failure. Number of cylinders on each based on ability to provide 4 hours' supply at average use	Automatic manifold system. May be sited to support high dependency areas or whole site OR Locally-based integral valved cylinders with regulators/flow meters attached.
Two compressors of a triplex compressor system.	Third compressor of a triplex system.	Automatic manifold system. To support whole site.
Two compressors of a quadruplex system.	Other two compressors of a quadruplex system.	Automatic manifold system. To support whole site.

ISO 7396-1

Except for air or nitrogen for driving surgical tools, each supply system shall comprise at least

three independent sources of supply which may be a combination of the following:

a) gas in cylinders, cylinder bundles or high-pressure reservoir(s);

b) non-cryogenic liquid in cylinders;

c) cryogenic or non-cryogenic liquid in mobile vessels;

d) cryogenic or non-cryogenic liquid in stationary vessels;

e) an air compressor unit;

f) a proportioning unit;

g) an oxygen concentrator unit.

	Both HTM 02-01 and ISO 7396-1 propose that all medical air supplies should comprise three sources of supply identified as “primary”, “secondary” and “reserve”, although the latter is more commonly referred to as a third means of supply. PMA unit can be a part of Medical Gas Pipeline System (part of primary/secondary supply for HTM 02-01, or part of 3 sources of supply for ISO 7396). It is the responsibility of the hospital and/or the contractor to design and install Medical Gas Pipeline System in compliance with HTM 02-01 or EN ISO 7396-1.

Key qualities

- Pharmacopoeia compliant:
- The European Pharmacopoeia legislation accurately defines the required quality for breathing air in hospitals, medical theatres and ambulatory centers. BeaconMedæs has adopted this quality level for the PMA range.
- Company certification according to EN ISO 13485:
  Hospital equipment with an influence on patient health must be certified to the Medical Devices Regulation (MDR 2017/745). This requires that the manufacturer is certified accordingto EN ISO 13485 and organizes strict product follow-up once in the field.

Important

	Always consult the local legislation on this topic, since the specifications of the air quality can be different. For Europe country, the air quality should meet European Pharmacopoeia.
	A PMA unit is considered as an active medical device, relying on a source of electrical energy for its operation.

General views

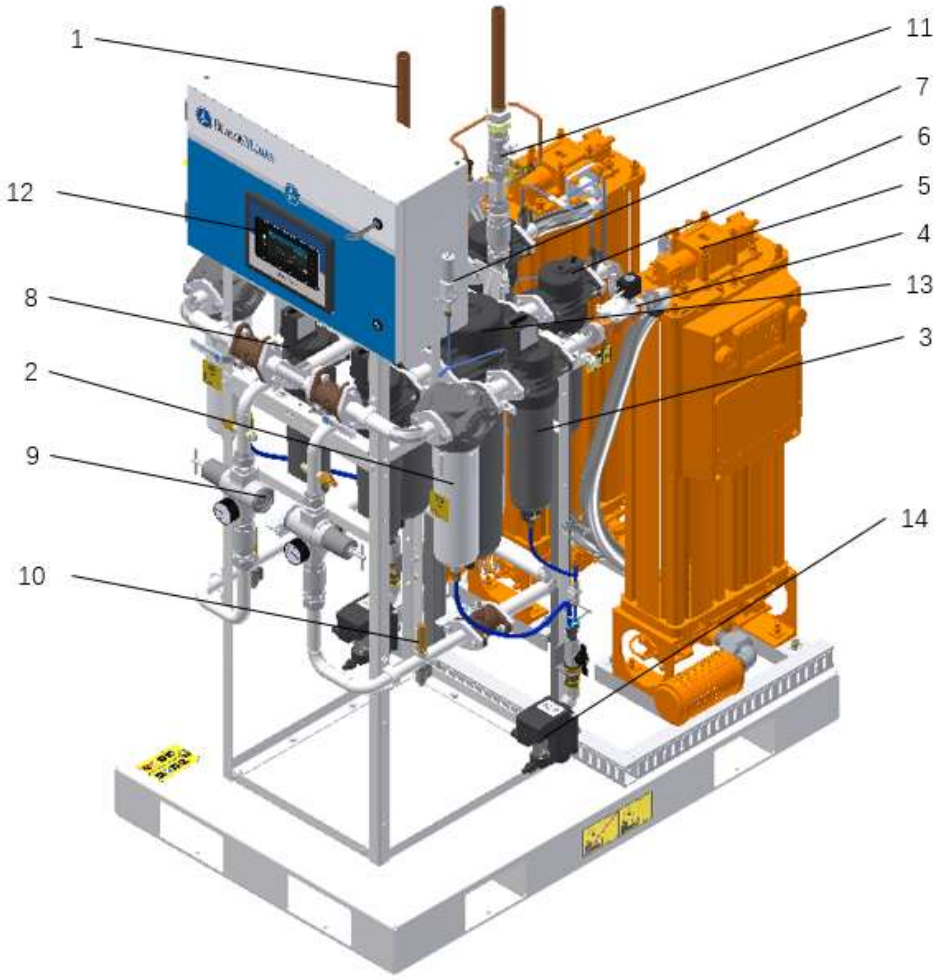
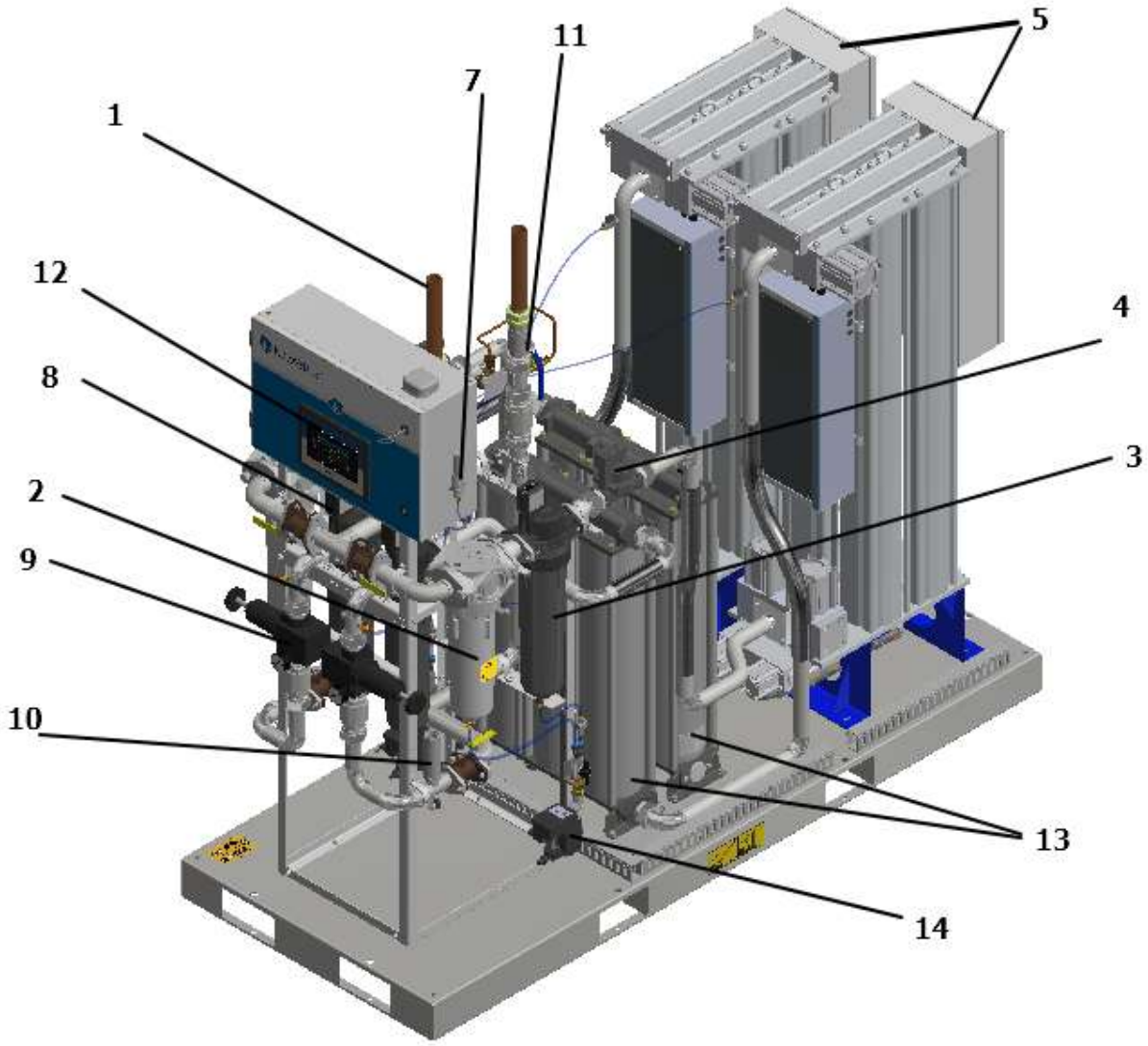


Figure 1 PMA S~XL1

1	Air inlet	8	PDp+ filter
2	Water separator (WSD)	9	Regulator
3	UD+ filter	10	Relief valve
4	Inlet Solenoid valve	11	Air outlet valve
5	Desiccant dryer	12	ES-MED controller
6	QD+ filter	13	HOC filter (option, only for PMA S~L)
7	Dew point sensor	14	Intelligent Water Drain (IWD)

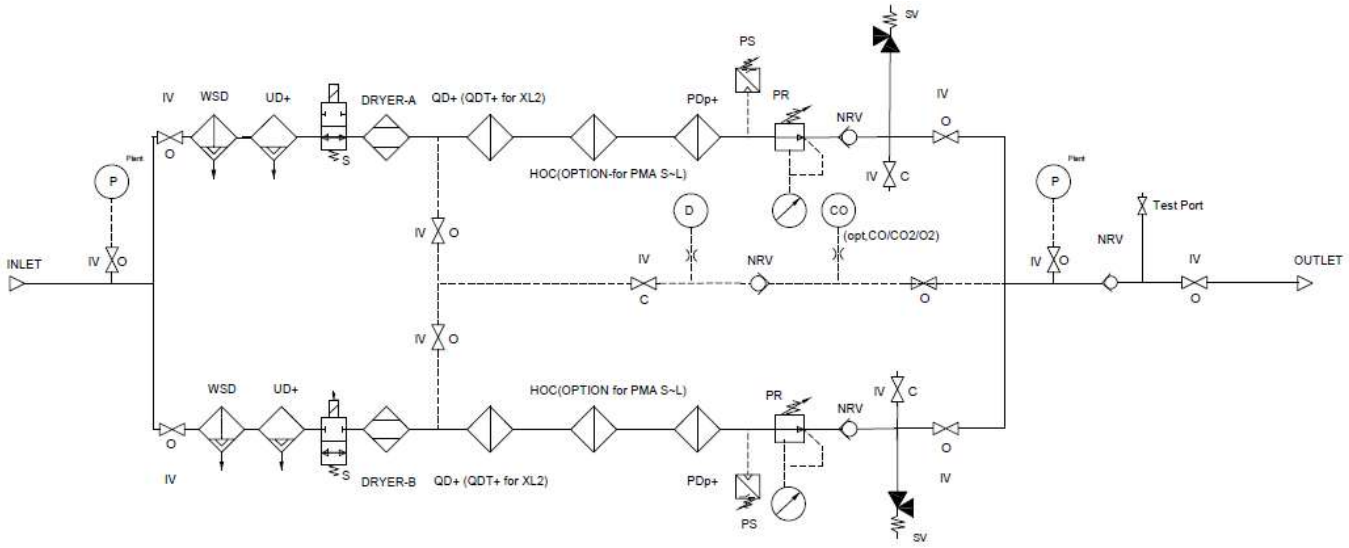


PMA XL2

1	Air inlet	8	PDp+ filter
2	Water separator (WSD)	9	Regulator
3	UD+ filter	10	Relief valve
4	Inlet Solenoid valve	11	Air outlet valve
5	Desiccant dryer	12	ES-MED controller
6	QD+ filter	13	QDT+(only for PMA XL2)
7	Dew point sensor	14	Intelligent Water Drain (IWD)

2.2 Air flow

Flow diagram



NAME	DESIGNATION
NRV	NON RETURN VALVE
SV	SAFETY VALVE
IV	ISOLATION VALVE
S	SOLENOID VALVE
PR	PRESSURE REGULATOR
PDp+	DUST FILTER
HOC	HOC FILTER
QD+	ACTIVATED CARBON FILTER
PS	PRESSURE SWITCH
UD+	OIL FILTER
WSD	WATER SEPARATOR
D	PRESSURE DEW POINT SENSOR
P	PRESSURE SENSOR
CO	CARBON MONOXIDE SENSOR
QDT+	ACTIVATED CARBON FILTER & CATALYST

Remark:
1.C: normally closed
2.O:normally open

Figure 2

Description

Compressed air enters water trap (WSD), eliminating liquid water from the air. Next, the air flows through UD+ filter, removing contaminating particles and oil mist. The air then enters the dryer, eliminating water damp and producing dry air with dryness below -46 ˚C. Next is the QD+ filter where oil vapor and smells of the dried airare reduced (active carbon) and then HOC filter (option) where convert CO into CO2. Finally the air flows through the PDp+ filter, hereby eliminating remaining dust particles for absolute purity.

Specifications of the outlet air can be found in section Reference conditions and limitations.

2.3 Water separator and filters

Overview

Figure 3

Water separator with drain (WSD) (2)

WSD's are general purpose water separators for removal of free water from compressed air.

Centrifugal force created in the cyclone throws free water (droplets) to the wall, from where it flowsdown to the bottom of the bowl. The water is automatically discharged when a given level is reached. A drain valve is provided for manual draining of the bowl.

UD+ filter (3)

The UD+ filter combines two filtration steps into one, removing oil aerosols to 0.01 mg/m^3 (0.01 ppm) and particles down to 0.01 micron. The filter is equipped with a drain. Typical pressure dropsover filter is 0.08 bar (1.16 psi) when dry and 0.2 bar (2.9 psi) when saturated.

The air flow is from inside to outside the filter element.

PDp+ filter (8)

The PDp+ is a high efficiency particle filter for dust protection, removing particles down to 0.01micron. Pressure drop over filter is 0.08 bar (1.16 psi) when dry.

The air flow is from outside to inside the filter element.

QD+ filter (6)

The QD+ filter effectively reduces hydrocarbons, oduor and oil vapors in compressed air to protect User's assets, equipment and processes. The micro-porous structure of activated carbon can reduce the residual oil content by adsorption Less than 0.003mg/m³ and maintain a low pressure drop over the filter life.

	The UD+ and PDp+ filters are equipped with a differential pressure gauge, indicating the pressure drop over the filter. An electronic water drain (IWD) on the water separator and UD+.

QDT+ filter (13)

The dried compressed air enters the QDT+ filter

A QDT+ filter contains active carbon, reducing volatile organic compounds (VOC) and hydrocarbons (odours, oil vapours) to harmless levels, and as an option a catalyst material, converting excessive concentrations of CO into CO2.

Depending on the size of the unit, the QDT+ filter consists of one, two or three cylinders.

Intelligent Electronic Water drain (IWD)

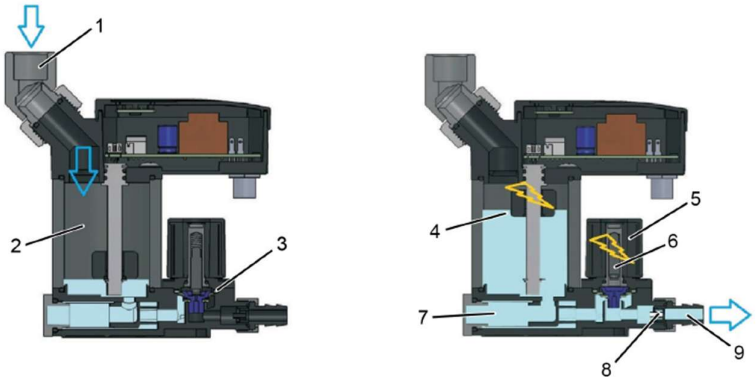


Figure 4

The electronic drain is on the WSD and the UD+ filter.
The drain is connected at the point the elimination of the condensate is required (tank, filter, dryer, etc.), by means of the connection supplied (1).

The accumulation tank (2) collects the condensation and the diaphragm (3) keeps the drainage hole closed thanks to the pressure exerted on its surface.

As the liquid level rises the float (4) rises and, as soon as it has reached the maximum filling level, the solenoid (5) is triggered by means of the logic control circuit, to open the pilot valve (6).

As compensation is lacking, the diaphragm is lifted allowing the discharge of water to bring the level in the tank back to a minimum (3), to then close the passage of the discharge without letting air escape.

The product is also equipped with two components that are very useful for ensuring functionality and reliability.

An integrated filter cup (7) and a flow regulator (8) inserted into the hose holder (9). The first is used to retain the impurities contained in the condensate, so as to ensure a perfect operation of the valve

even in the most critical applications. The second instead is used to control the discharge flow, slowing the purging so as to avoid an additional oil emulsion that, in most cases, is present in the condensate water.

By pressing the test button it is also possible to manually actuate the discharge in order to control the functionality; it can be also useful for unblocking in the event of faulty operation.

Electrical connections

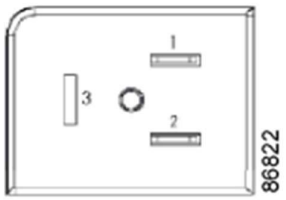
Contact	2 poles, phase and neutral with either polarity. Connect with insulated cable, minimum 2 x 0.5 mm².
View, condensate drain side	
Pin-out, condensate drain side	1= Phase/neutral any polarity
	2 = Neutral/phase any polarity
	3 = Not connected
Connector	Industrial form connector of type B/ISO 6952 11mm standard EN 175301-803 (ex DIN 43650). The connector is supplied as an accessory.
View, connector side	
Pin-out, connector side	

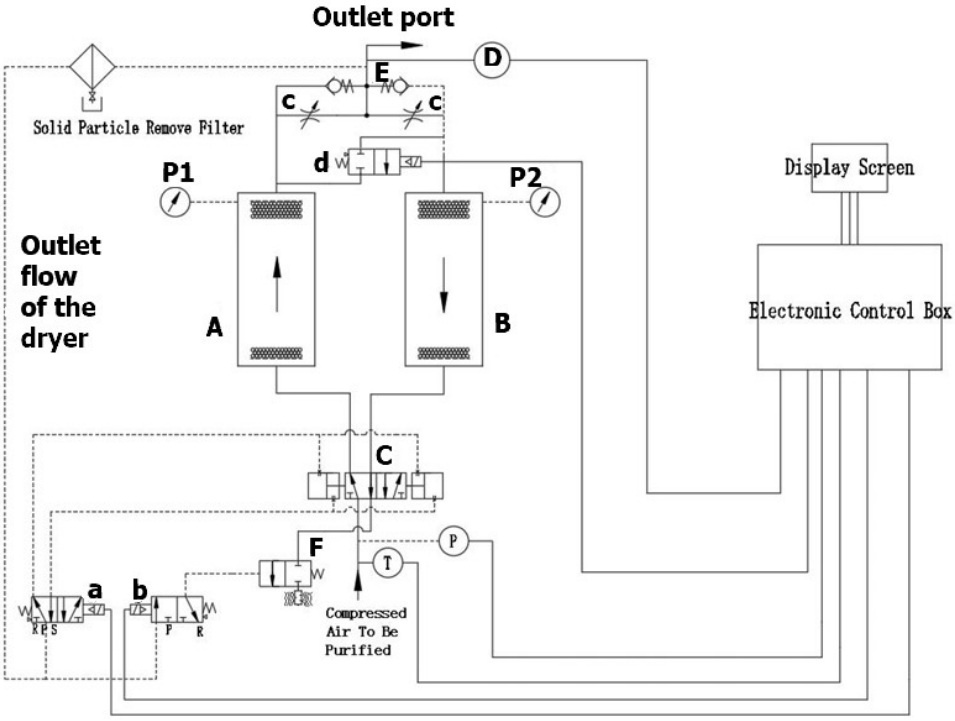
Table 1: Connection of the power supply

Note: Mount the connector seal and tighten the fastening screw with the recommended tightening torque.

	Always remove the manual or automatic drain of the water separator (WSD) or the filter (UD+) when installing an IWD. For detailed installation instructions, consult the Instruction Book of the IWD.

2.4 Dryer

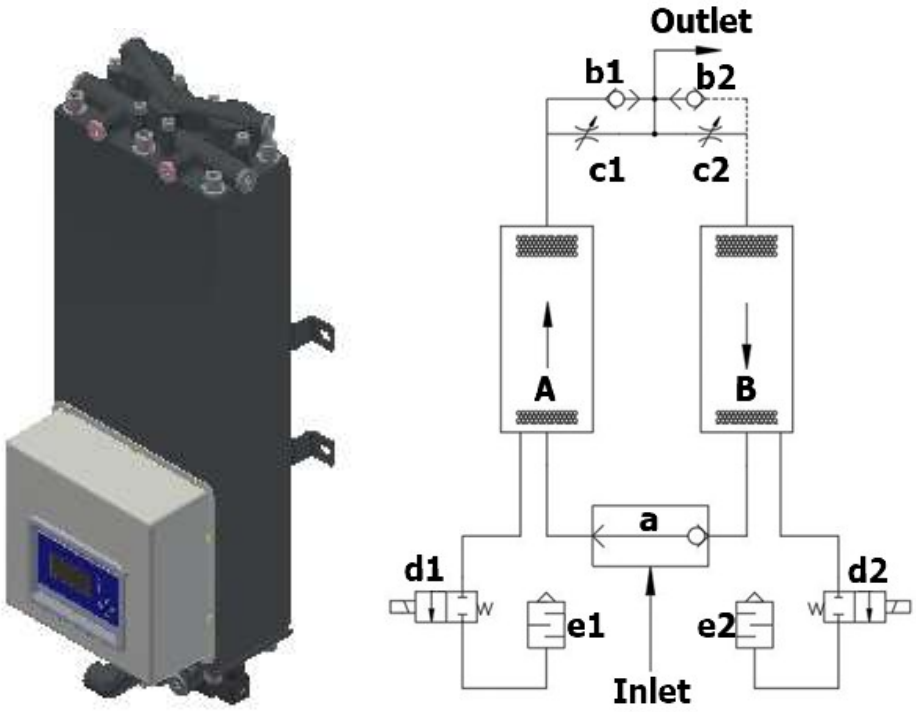
Description



The construction of the air dryer is simple, reliable and easy to service. A dryer basically consists of two groups of vertical cylinders (towers), containing the adsorption material (desiccant). This desiccant is able to adsorb large amounts of water vapour.

E	Check valve	a	Two-position five-way solenoid valve
C	Intake solenoid valve	b	Two position three-way solenoid valve
d	Fast pressure charge solenoid valve (only for L1~L3)	F	Blow off valve
P1	Pressure gauge 1	c	Nozzle
P2	Pressure gauge 2	A	Left desiccant tower
B	Right desiccant tower		

Figure 5 SD dryer and Flow diagram For PMA S4&PMA M1~3&PMA L1~3



b1，b2	Check valve	a	Shuttle valve
c1，c2	Nozzle	d1	Two position two-way solenoid valve
A	Left desiccant tower	d2	Two position two-way solenoid valve
B	Right desiccant tower	e1, e2	Blow off silencer

Figure 6 MD dryer and Flow diagram For PMA S1~3

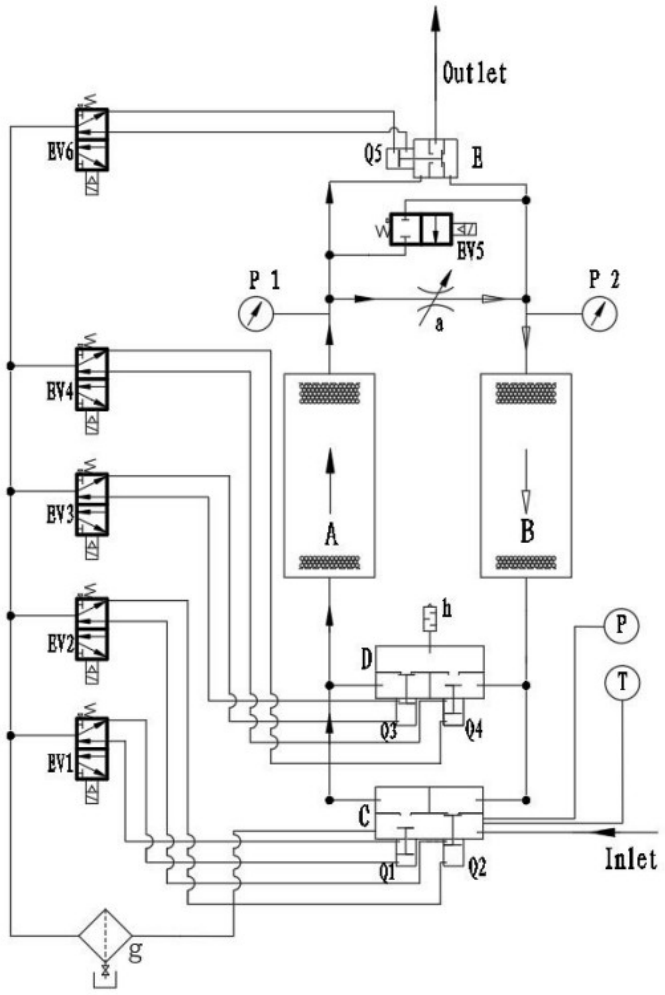


Fig.4. Schematic diagram of the working principle of the dryer (Part Name: C-Intake Valve; D-Drain valve; E outlet valve; A, B - cavity; g-Control filter; Q1,Q2-intake cylinder; Q3,Q4-Discharge cylinder; Q5-outlet cylinder; a-Regenerative throttle valve;EV1, EV2, EV3, EV4, EV6 - two-position five-way solenoid valve, EV5 - fast charging valve; h-Vent Silencer)

Flow diagram For PMA XL

Operation principle for PMA S4&PMA M1~3&PMA L1~3

(1) Drying Process:
When the compressed air goes through the Chamber A, the moisture in the compressed air is adsorbed by the desiccant, so that the compressed air gets to be dried. The majority of dried compressed air goes through the outlet valve E into the downstream devices, while a small amount of dried air goes into the Chamber B through the regeneration throttling valve c to regenerate the desiccant.

(2) Regeneration Process:
When the small amount of dry air goes through regeneration throttling valve c into Chamber B to regenerate the desiccant, the desorbed water will be discharged through the exhausting valve with the regeneration air.

(3) Pressurization Process:
After the completion of the regeneration process in Chamber B, the exhaust pilot solenoid valve b is closed and lead to the close of exhaust valve F, a small amount of dried air goes into the Chamber B through the valve c (For the pressure charging not enough machine, when close the exhaust pilot

solenoid valve b, open the fast pressurization solenoid valve d (This step is only for L1~L3), this will make compressed air rapidly go into Chamber B), thus the pressures of both chambers A&B will gradually reach to equilibrium, and get ready for the drying process of Chamber B.

(4) Cycle:
The drying, regeneration and pressurization processes above are going circularly between the chambers A and B, so that the compressed air entering into the dryer can be continuously dried. During the process, the operation of inlet exchange pilot solenoid valve, exhaust pilot solenoid valve and fast charging pressure solenoid valve are controlled by the output program signal of the control box, the operation of inlet exhaust combination valve is controlled by inlet exchange pilot solenoid valve to order inlet valve C to turn on/off relevant channels, so that to exchange the inlet air of Chamber A & B, the exhaust pilot solenoid valve to order the exhaust valve F to turn on or off by airflow. The operation of outlet valve is given order from the internal pressure verification of Chamber.

Operation principle for PMA S1~3

(1) Drying Process:
The compressed air enters the A chamber of the dryer through the inlet shuttle valve a. The moisture in the compressed air is absorbed by the adsorbent. This allows the compressed air to dry. Most of the dry air is discharged through the outlet shuttle valve b1 into the downstream equipment. A small amount of dry air enters the B chamber through the regenerative throttle c2 to regenerate the adsorbent.

(2) Regeneration Process:
A small amount of dry compressed air enters the right chamber through the regenerative throttle c2 to regenerate the adsorbent. Moisture carrying recycled air through the right discharge solenoid valve d2. Right discharge silencer e2 discharge. In the above process, the left discharge solenoid valve d1 is in the closed state, and the right discharge solenoid valve d2 is in the open state.

(3) Pressurization Process:
After the regeneration of the B cavity is completed, close right discharge solenoid valve d1, a small amount of dry compressed air enters the B chamber through c2. Make the A and B cavity pressure gradually balance, Prepare the right chamber for drying.

(4) Cycle:
the above process of drying, regeneration and charging is carried out alternately between A and B cavities, so that the compressed air entering the dryer can be continuously dried.

Operation principle for PMA XL

(1) Drying process: compressed air enters dryer A cavity through inlet valve C, and the moisture in the compressed air is adsorbed by the desiccant, so that the compressed air can be dried, and most of the dry air is discharged into the downstream equipment through the outlet valve E, and a small amount of dry air enters the B chamber through the regeneration throttle valve A to regenerate the desiccant.

(2) Regeneration process: a small amount of dry compressed air enters chamber B through the regeneration throttle valve a to regenerate the desiccant, and the regenerated air carrying moisture is discharged through the discharge valve D and the discharge muffler h.

(3) Pressure Equalization process: After the regeneration process of chamber B is completed, the discharge valve B is closed, and the pressure of chamber B gradually rises from 0 to the working pressure, at this time, the fast stamping valve EV5 is opened, and the pressure of chamber A and B is gradually balanced, so as to prepare for the drying process of the right chamber.

(4) Cycle: The above drying, regeneration and pressurization processes are carried out alternately between chambers A and B, so that the compressed air entering the dryer can be continuously dried.

Electromagnetic valve action sequence

	A Chamber Working	Pressure Equalization	B Chamber Working	Pressure Equalization	…
EV1	1	1	0	0	…
EV2	0	0	1	1	…

EV3	0	0	1	0	…
EV4	1	0	0	0	…
EV5	0	1	0	1	…
EV6	1	1	0	0	…

Purge control

The dryer is equipped with a dew point sensor, extending the drying time and saving compressed air. The regeneration time remains timer controlled.

Operation principle:

The sensor constantly measures the atmospheric dew point of the air leaving the drying tower. While the dew point is measured below the purge saver set point the dryer will continue to supply dry air, but the purging of the regenerating tower will be de-active, this phase lasts for 4 cycles, then quit the Energy saving mode and force to run 3 cycles.

Next the sensor will measure the atmospheric dew point, if the dew point rises above the set point the purge cycling function will become active, if not, the purging of the regenerating tower will be de-active and get into Energy saving mode again.

2.5 Medical Gas Terminal Units

Figure 7 Gas Terminal Units

Description

BeaconMedæs Gem Medical gas terminal units are designed to fully comply with BS EN ISO9170- 1 and accept probes to BS5682:1998. Installation fully satisfies the United Kingdom Health Technical Memorandums HTM2022 and HTM02-01. Gem terminal units are used as a sampling point for checking the air quality.

Operation of the terminal units is as follows:

Medical Air, Surgical Air:

To obtain a gas flow, the correct Medical gas probe is inserted into the terminal unit. For BS type a horizontally mounted terminal unit, the slot in the probe index collar must be uppermost to engage with the anti-rotation pin. A slight push on the probe inwards completes engagement and locks the probe into position.

Fully engaging the probe opens the check valve to permit the specified gas flow. To remove the probe, hold the probe between the middle finger and palm, ease the probe inwards to reduce the load on the roller pins and press the terminal unit fascia ring with thumb and index finger. The probe is ejected from the terminal unit and the check valve closes to seal the gas flow.

⚠	Voltage-free outputs may only be used to control or monitor functional systems. They should NOT be used to control, switch or interrupt safety related circuits. Check the maximum allowed load on the label.

2.6 HOC filter(option)

Air flow

Figure 8

Reference	Name
A	Air inlet
B	Air outlet
1	Catalyst

Description

The dried compressed air enters the HOC filter.

A HOC filter contains a catalyst material,converting excessive concentrations of CO into CO_2.

2.7 Electrical diagrams

The service diagram can be found in the unit's cubicle box. For electrical diagram please see the document in the machine.

2.8 Optional equipment

Precautions

	1. Make sure that all electrical wiring is installed in compliance with the applicable regulations. 2. Installation must always be performed by a qualified technician. 3. Installation must be carried out in compliance with the circuit diagrams and connection drawings provided. Some precautions are general and may not apply to your optional equipment. All responsibility for any damage or injury resulting from neglecting these precautions, or non-observance of the normal caution and care required for installation, operation, maintenance and repair, even if not expressly stated, will be disclaimed by the manufacturer.

Available options

Figure 9 Gas Sensor

- **CO sensor**

  The CO sensor is connected to the PMA's controller and will trigger an alarm when the CO level exceeds 5 ppm.

- **CO/CO2 sensor**

  The CO/CO_2 sensor is connected to the PMA's controller and will trigger an alarm when the CO level exceeds 5 ppm or CO2 level exceeds 500 ppm.

- **CO/CO2/O2 sensor**

  The CO/CO2/O2 sensor is connected to the PMA's controller and will trigger an alarm when the CO level exceeds 5 ppm or CO2 level exceeds 500 ppm or oxygen concentration ≥ 20,4 % (volume fraction) and ≤ 21,4 % (volume fraction)

- **HOC filter with CO catalyst**

  A catalyst that converts CO into CO_2 is available as option (HOC filter). This option is strongly recommended in polluted areas and makes sure that the air quality will always comply with the Pharmacopoeia.

- **OSC condensate treatment**

  If the oil in compressor condensate is not removed before it enters the sewage system, it can cause significant environmental damage. Therefore, condensate treatment is not only the responsible thing to do; in most countries it's the law. Thanks to its multistage filtration, Atlas Copco's OSC removes oil from your compressor's condensate with unmatched precision to achieve an oil content of 10 ppm at outlet. In addition, the OSC offers zero-hassle maintenance thanks to its easily removable filter bags and cartridges.

3 PMA main controller

3.1 Controller

The central control system provides an intelligent human machine interface incorporating on board flash memory and real-time clock for recording operational parameters in the in-built event log. The central control system operates at low voltage and include Building Management System (BMS) connection for plant fault, plant emergency, reserve fault and pressure fault. Visualisation of plant inputs, outputs, and status is provided through a web browser, using an Ethernet connection. The central control unit incorporates a user friendly 5.7” high definition colour display with clear pictograms and LED indicators, providing easy access to system operational information. The central control system employs automatic rotation of the lead compressor & dryer to maximize life and ensure even wear. The compressors & dryers are designed with their own individual controller, providing a back-up in case of a central controller malfunction, ensuring continued operation.

On the main screen the status of the air plant is shown. This means the most important measurements of the compressed air at the outlet (pressure level and atmospheric dew point) and any possible alarms are shown. On the figures below the different statuses/alarms can be seen: Normal operation, operating alarm triggered and emergency operating triggered (ISO standard); Or plant fault and plant emergency triggered (HTM standard).

Figure 19 Normal operation

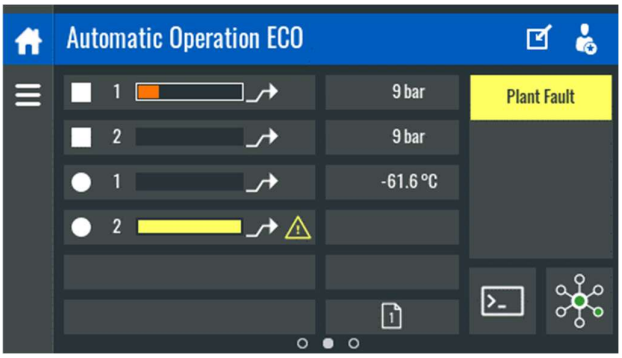


Figure 20 Plant fault (HTM standard)

Figure 21 Plant emergency (HTM standard)

Figure 22 Operating alarm (ISO standard)

Figure 23 Emergency operating alarm (ISO standard)

The alarm indications are described accordingly:

HTM alarm:

Plant fault:

This alarm indicates something in the system is not right and should be looked at (Warning – action required but not immediate). A Plant Fault is caused by the following:

- Control circuit failed
- Failing transducer (dew point or pressure)
- Failed dryer
- Failed compressor (General warning)
  - motor tripped
  - after-cooler temperature high
  - compressor temperature high

  - compressor failed to go on load
  - compressor emergency force to local
- Compressor communication error
- All compressors in load (LAG alarm)

Plant emergency:

This alarm indicates an unwanted situation which should be rectified as quickly as possible. It is caused by the dew point, which is measured at the outlet, being too high.
And also caused by the receiver pressure (inlet pressure) as below situation:

- receiver pressure 0.5 bar below the standby cut-in pressure.
- receiver pressure 0.5 bar above cut-out pressure.
- dryness above –46°C at atmospheric pressure.

Pressure fault:

This alarm indicates an unwanted situation which should be rectified as quickly as possible.

- low pipeline pressure;
- high pipeline pressure;

ISO alarm:

operating alarm:

Operating alarms notify the technical staff that one or more sources of supply within a supply system are no longer available for use and it is essential that action be taken.

An Operating Alarm is caused by the following:

- Control circuit failed
- Carbon Monoxide level high (exceed 10ppm)
- Malfunctioning of compressor (General warning)
  - motor tripped
  - compressor temperature high
  - compressor emergency force to local
- Dew point fault
- All compressors in load (LAG alarm)
- Dryer failure

Emergency operating alarm:

Emergency operating alarms indicate abnormal pressure within a pipeline or gas quality out of range and could require immediate response by the technical staff.

- Carbon Monoxide level too high (exceed 25ppm)
- Temperature of any air compressor too high
- Pipeline pressure downstream of main shut off valve of ±20% of normal distribution pressure

Views screen:

In the views screen the most important inputs of the sensors are visible on the screen. How this is displayed can be chosen by the user.

In the screen the status of the compressors is visible. You can see each compressor and whether it is stand-by, in load or in unload. A compressor in load has a full bar, in unload a partially filled bar and when in stand-by an empty bar. It is also visible which compressor/dryer is the next to be called or stopped by the controller (see below picture, the white dotted box show which compressor/dryer is the next to be called or stopped by the controller).

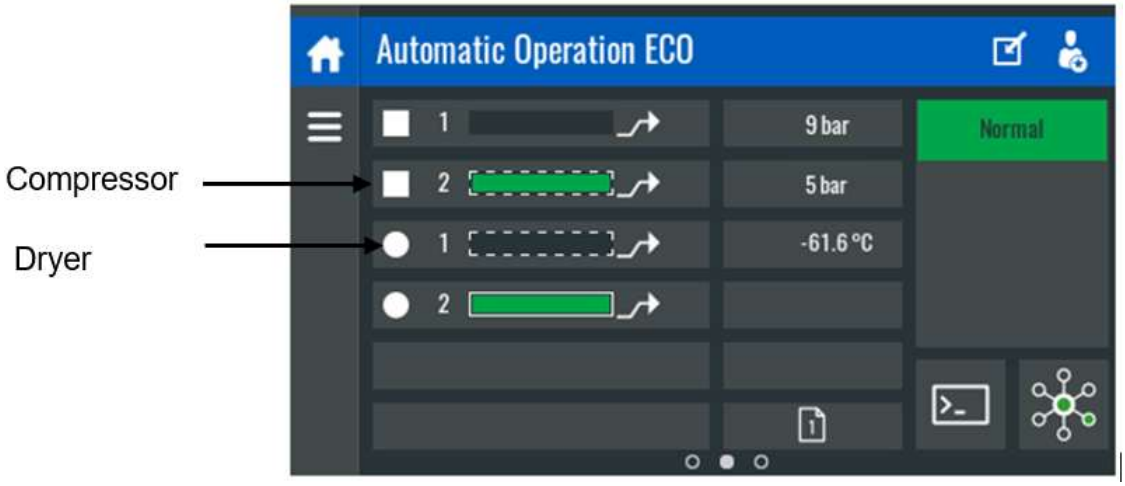


Figure 24

In the screen the status of the 2 dryers is visible. You can see which dryer is active and if there is a fault on the dryer(s).

Figure 25

The Elektronikon™ Touch controller

3.1.1 Introduction

The Elektronikon™ controller has following functions:

- Controlling the compressor
- Monitoring components subject to service
- Automatic restart after voltage failure (ARAVF)

3.1.2 Automatic control of the compressor

The controller maintains the net pressure between programmable limits by automatically loading and unloading the compressors. A number of programmable settings, e.g. the pressures, the minimum stop time and the maximum number of motor starts and several other parameters are taken into account.

The controller stops the compressors whenever possible to reduce the power consumption and restarts it automatically when the net pressure decreases. If the expected unloading period is too short, the

compressor is kept running to prevent too short standstill periods.

3.1.3 Service warning

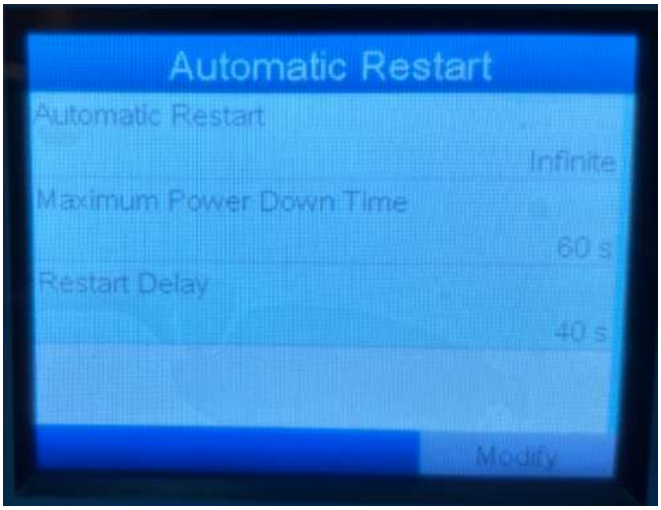
A number of service operations are grouped (called Service Plans). Each Service Plan has a programmed time interval. If the service timer exceeds a programmed value, this will be indicated on the display to warn the operator to carry out the service actions belonging to that Service Plan.

3.1.4 Automatic restart after voltage failure (ARAVF)

The controller has a built-in function to automatically restart the compressor when the voltage is restored after voltage failure.

	The function is activated and provided the regulator was in the automatic operation mode, the compressor will automatically restart if the supply voltage to the module is restored. The ARAVF label (see section Pictographs) shall be glued near to the controller.

There is maximum 6 compressors connect to PMA, set the compressor “Automatic Restart” to be “Infinite”, from 1 to 6 compressors, set the “Restart Delay” time in turn to be 20s, 40s,60s,80s100,120s.



Setting menu of controller

3.2 Control panel

Figure 26
Control panel

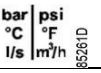
3.2.1 Parts and functions

Reference	Designation	Function
1	Touch screen	Shows the unit operating condition and a number of icons to navigate through the menu. The screen can be operated by touch.
2	Warning sign	Flashes in case of a shut-down, is lit in case of a warning condition.
3	Service sign	Is lit when service is needed.
4	Operation sign	Is lit when the unit is running in automatic operation.
5	Voltage sign	Indicates that the voltage is switched on.

3.3 Icons used

Menu icons

Menu	Icon	Menu	Icon	Menu	Icon
Data	85233D	Status	85239D		
		Inputs	85240D		
		Outputs	85241D		
		Counters	85242D		

		Aux. Equipment Parameters		Converters	
Service		Service		Overview	
				Service Plan	
				Service History	
		Service functions			
		Clean Screen			
Week Timer				Week	
				Remaining Running Time	
Event History		Saved Data			
Machine Settings		Alarms			
		Regulation			
		Control Parameters			
		Aux. Equipment Parameters		Converter(s)	
				Fan	
				Internal SmartBox	
		Auto Restart			
Controller Settings		Network Settings		Ethernet Settings	
				CAN Settings	
		Localization		Language	
				Date/Time	
				Units	
		User Password			

		Help		
		Information		

Status icons

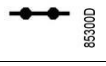
Icon	Description
	Motor Stopped
	Motor Stopped Wait
	Running Unloaded
	Manual Unload
	Runing Unloaded Wait
	Running Loaded
	Failed to Load
	Running Loaded Wait
	Manual Stop
	Machine Control Mode, Local
	Machine Control Mode, Remote
	Machine Control Mode, LAN
	Automatic Restart After Voltage Failure
	Week Timer Active

System icons

Icon	Description
	Basic User

 85277D	Advanced User
 85278D	Atlas Copco Service
 85279D	Antenna 25%
 85280D	Antenna 50%
 85281D	Antenna 75%
 85282D	Antenna 100%
 85283D	Change between screens (indication)
 85284D	Energy recovery
 85285D	Dryer
 85286D	Compressor Element
 85287D	Drain(s)
 85288D	Analgue Output
 85289D	Menu
 85290D	Reset
 85291D	Auto Restart
 85292D	Filter(s)
 85293D	Cooler
 85294D	Valve(s)
 85295D	Power Meter

Input icons

Icon	Description
	Pressure
	Temperature
	Special Protection
	Open
	Closed

	This chapter gives a general survey of available icons. Not all icons mentioned in this chapter are applicable to every machine.

3.4 Main screen

Function

The Main screen is the screen that is shown automatically when the voltage is switched on. It is switched off automatically after a few minutes when there is no touch input.

Description

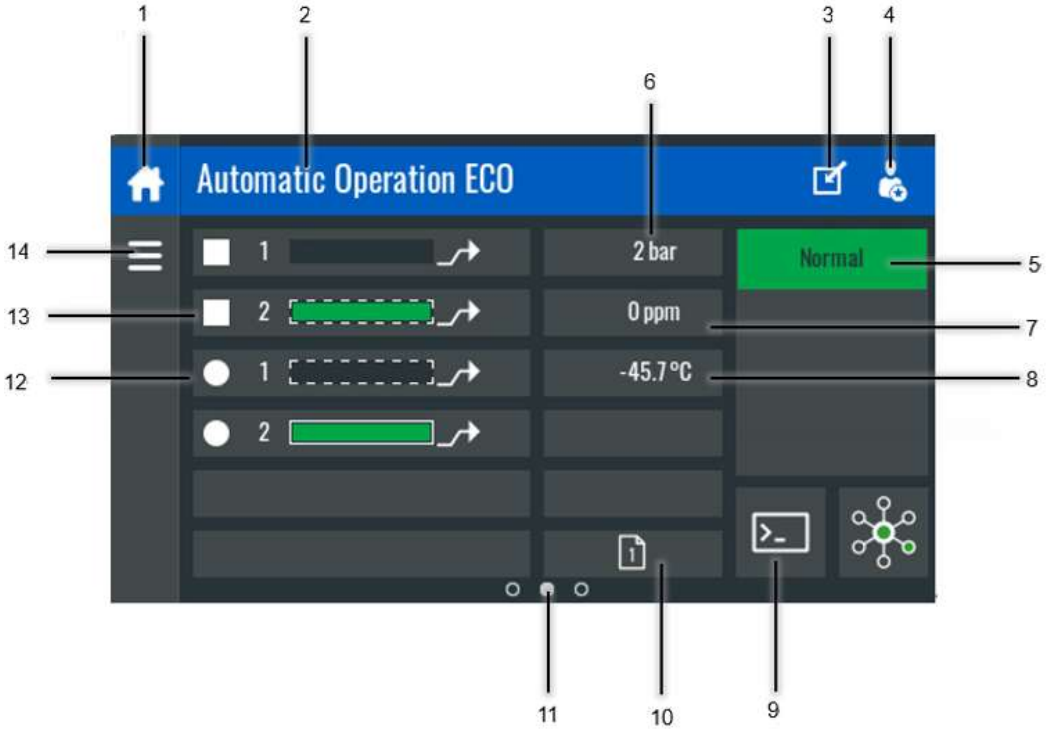


Figure 27

Reference	Designation	Function
1	Home button	The home button is always shown and can be tapped to return to the main screen.
2	Screen information	On the main screen, the screen information bar shows the serial number of the machine. When scrolling through menus, the name of the current menu is shown.
3	Machine Control Mode, Local	This icon changes the current Machine Control status.
4	Access level button	The access level button is always shown and can be tapped to change the current user access level.

Reference	Designation	Function
5	Alarms	The alarm button can be tapped to show the current alarms. If an alarm occurs, the icon on the button will be red.
6,7,8	These fields can contain a history chart, an input or a counter value, depending on the type of the machine.	Tap the field to view the type of measurement. This will be shown in the screen information bar. Examples of inputs: • Unit outlet pressure • Dryer dewpoint Examples of counters: • Running hours
9	ECO start/stop and Dryer switch	This icon can choose ECO start/stop and Dryer switch
10	Machine Settings	Alarms settings, Regulation settings and Control parameters can be changed through this menu. Auxiliary equipment parameters can also be changed.
11	Page indicator	Indicates which page you currently see. The middle indication is the main screen, left is the menu screen and at the right the quick access screen. Swipe left or right to go to another screen.
12	Dryer information	It is also visible which dryer is the next to be called or stopped by the controller
13	Compressor information	It is also visible which compressor is the next to be called or stopped by the controller
14	Main menu	Main menu

3.5 Quick access screen

Function

The screen is used to directly access some frequently used functions.

3.5.1 Procedure

The Quick access screen can be viewed by swiping left, starting from the main screen.

3.5.2 Description

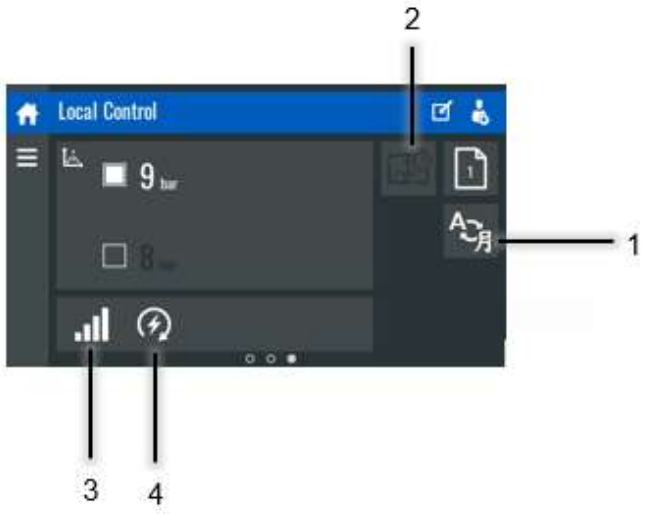


Figure 28

Through this screen, several important settings can be viewed and modified

	Function	Description
1	Display language	The display language of the controller can be changed by tapping this icon.
2	Week timer	Week timers can be set by tapping this icon.
3	Internal SmartBox	The reception quality of the internal antenna can be monitored.  Each bar represents 25% reception strength. If the four bars are filled, the reception strength is 100%. If only one bar is filled, the reception strength is just 25%.
4	Auto restart	Auto restart icon to set the ARAVF time interval.

3.6 Menu screen

3.6.1 Function

This screen is used to display the different menus where settings can be viewed or changed.

3.6.2 Procedure

The Menu screen can be viewed by tapping the Menu button or by swiping right, starting from the main screen.

3.6.3 Description

Figure 29

Reference	Designation	Function
(1)	Data menu	The data menu contains the Compressor status, information about the Inputs, Outputs and Counters. The Auxiliary equipment can also be viewed through this menu.
(2)	Service menu	The service menu contains the Service information. The ‘Clean screen’ function can be used to clean the touchscreen.
(3)	Week timer menu	Multiple Week timers and a Remaining running time can be set through this menu.
(4)	Event history menu	In case of an alarm, the compressor Status information is saved and can be viewed through this menu.
(5)	Machine settings menu	Alarms settings, Regulation settings and Control parameters can be changed through this menu. Auxiliary equipment parameters can also be changed. The Auto restart function can be set through this menu. This function is password protected.
(6)	Controller settings menu	Network settings, Localisation settings and a User password can be set through this menu. There is also a Help page available and the Controller information can be shown.

3.7 Data menu

Figure 30

3.7.1 Function

This screen is used to display the following submenus:

- Status
- Inputs
- Outputs
- Counters

These submenus can be entered by tapping the icons.

3.7.2 Procedure

To enter the Data menu screen:

1. Tap the Menu button
2. Tap the Data icon

3.7.3 Description

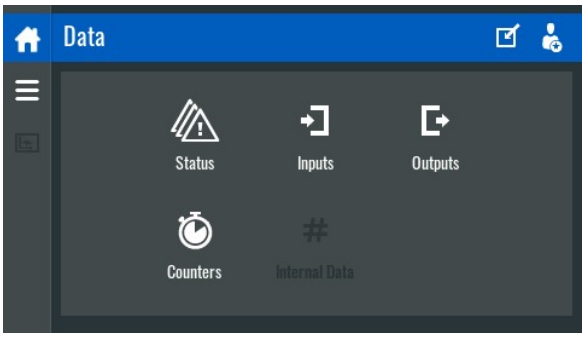


Figure 31

Reference	Designation
(1)	Status menu
(2)	Inputs menu
(3)	Outputs menu
(4)	Counters menu

Status menu

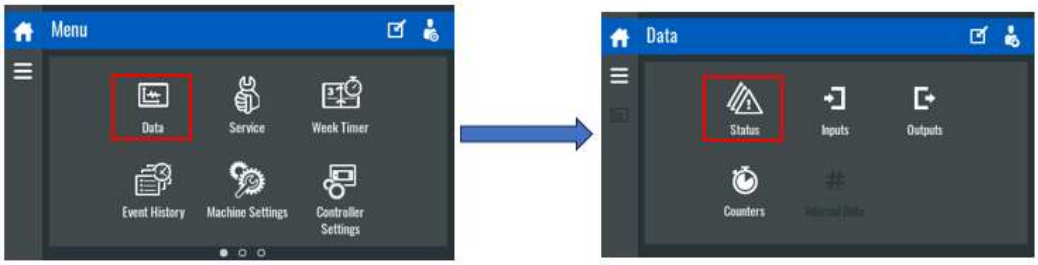


Figure 32

Tap the Status icon to enter the status menu.

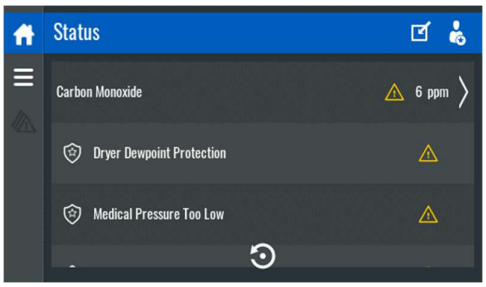


Figure 33

This menu shows dryer status and gas sensor data.

If an alarm is active, it can be viewed by tapping the alarm message. To reset an alarm, tap the reset button (1).

Status	Description
Pressure fault	pipeline pressure alarm
Plant fault	alarm
Normal	operating status
Plant emergency	alarm
Dryer Dewpoint Protection	dew point value alarm
Medical Pressure Too LOW	pipeline pressure alarm
Medical Pressure Too HIGHT	pipeline pressure alarm
Dryer inlet	inlet pressure alarm
Carbon Monoxide	CO value alarm

⚠	Before remedying, consult the Safety precautions. Before resetting a warning or shutdown message, always solve the problem. Frequently resetting these messages without remedying may damage the compressor.

3.7.4 Inputs menu

Tap the Inputs icon to enter the inputs menu.

Figure 34

This menu shows information about all the inputs.

Inputs	**Description**
Medical Pressure	pipeline pressure value
Dryer inlet	Dryer inlet pressure value
Atmosphere dewpoint	ADP value
Carbon Monoxide	Carbon Monoxide value
Compressor1: start/running	Compressor status
Compressor2: start/running	Compressor status
Dryer1 Running	Dryer Running status
Dryer2 Running	Dryer Running status
Service Switch 1	Pressure Switch function status
Service Switch 2	Pressure Switch function status
Dryer1 Lan	Dryer Lan status
Dryer2 Lan	Dryer Lan status
LAN/Local switch1	LAN/Local switch function status
LAN/Local switch2	LAN/Local switch function status
Dryer1 alarm	Dryer alarm function status
Dryer2 alarm	Dryer alarm function status

3.7.5 Outputs menu

Tap the Outputs icon to enter the outputs menu.

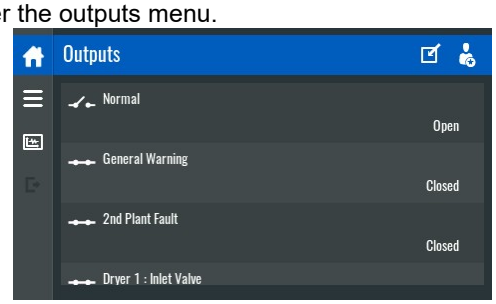


Figure 35

This menu shows information about all the outputs.

Outputs	**Description**
Normal	operating status
General Warning	compressor status
2nd Pressure Fault	Pressure Fault alarm status
Dryer1: Inlet valve	solenoid valve1 status
Dryer2: Inlet valve	solenoid valve2 status

Carbon Monoxide alarm	Carbon Monoxide alarm status
2nd Plant Fault	Plant Fault alarm status
Dewpoint Fault	Dewpoint Fault alarm status
Dryer1 Start	Dryer Start status
Dryer2 Start	Dryer Start status
Dryer1 Stop	Dryer Stop status
Dryer2 Stop	Dryer Stop status

3.7.6 Counters menu

Tap the Counters icon to enter the counters menu.

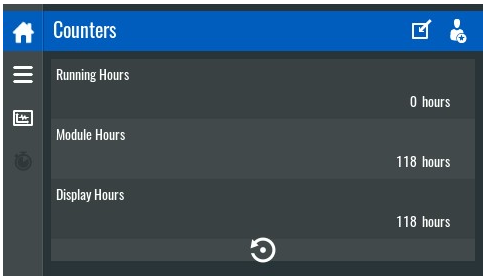


Figure 36

This menu shows an overview of all actual hours and counters of the controller.

Running Hours- Mean the unit running hours.

Module Hours- Mean the controller power on hours.

Display Hours- Mean the controller display hours.

3.8 Service menu

Figure 37

3.8.1 Function

This screen is used to display the following submenus:

- Service
- Service functions (Only visible as advanced user)
- Clean screen

These submenus can be entered by tapping the icons.

3.8.2 Procedure

To enter the Service menu screen:

1. Tap the Menu button.
2. Tap the Service icon.

3.8.3 Description

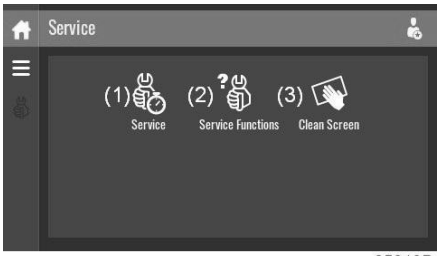


Figure 38

Reference	Designation
(1)	Service menu
(2)	Service functions (Only visible as advanced user)
(3)	Clean screen

3.8.4 Service menu

Tap the Service icon to enter the status menu.

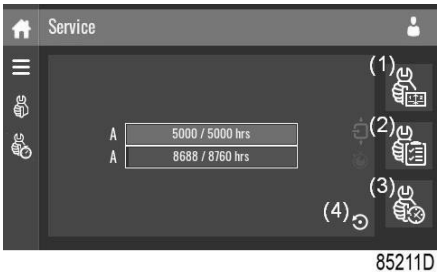


Figure 39

This menu shows the remaining Running Hours and the remaining Real Time Hours until the next service. The first row (A) shows the Running Hours when the first service is needed (green), the second row shows the Real Time Hours (blue)

A service overview can be viewed by tapping icon (1). There are Level A, Level B, Level C, Level D service plans, it could refer section **7.2.5 Preventive maintenance schedule** to find the detail service plan.

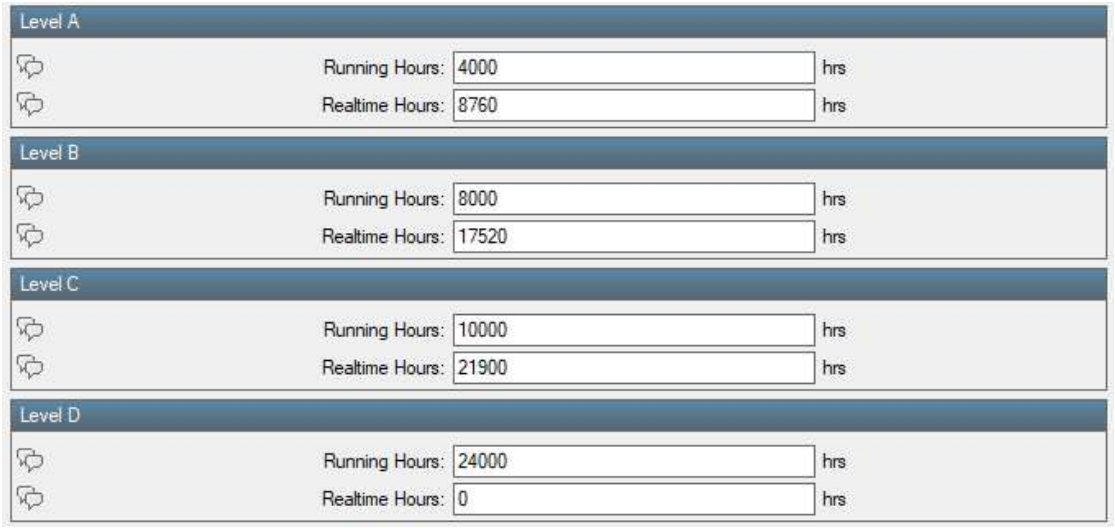


Figure 40

The service plan can be viewed by tapping icon (2).

The service history can be viewed by tapping icon (3).

When a service plan interval is reached, a message will appear on the screen. When service has been performed, the service timer can be reset by tapping the reset button (4).

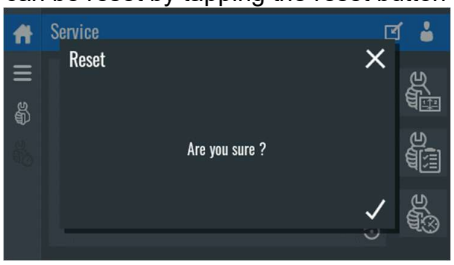


Figure 41

3.8.5 Clean screen

Tap the Clean Screen icon to start the 15 seconds countdown to perform cleaning of the touch screen.

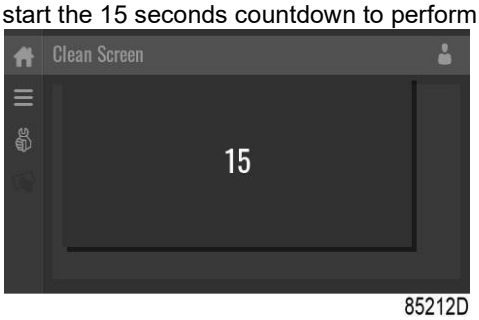


Figure 42

The touchscreen and the start and stop button become inactive and could not operate the screen for 15 seconds, then you could use cleaning cloth to clean the controller's screen.

3.9 Event history menu

3.9.1 Function

This screen is used to display the saved data in case of an alarm. These

submenus can be entered by tapping the icons.

3.9.2 Procedure

To enter the Event history menu screen:

1. Tap the Menu button
2. Tap the Event history icon

3.9.3 Description

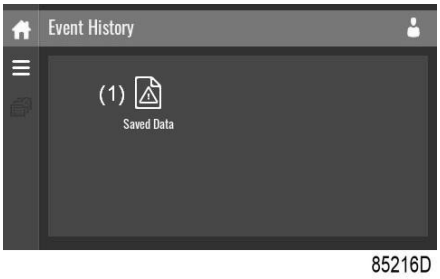


Figure 43

Reference	Designation
(1)	Saved data

3.9.4 Saved data

Tap the Saved data icon to enter the saved data menu.

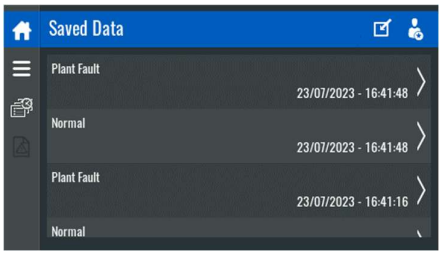


Figure 44

Scroll through the items swiping up and down in this list. The event date and time is shown at the right side of the screen.

Press on one of the items in the list for more information reflecting the status of the compressor when the shutdown occurred.

For HTM

Status	Color	Trigger condition			
NORMAL	Green constant				
PLANT FAULT	Yellow with auditory	Control circuit failed	Failing transducer (dew point or pressure)	Failed compressor (General warning) • motor tripped • after-cooler temperature high • compressor temperature high • compressor failed to go on load • compressor emergency force to local	
		Compressor communication error	Dryer failure（resettable warning）	All compressors in load (LAG alarm)	
PLANT EMERGENCY	Yellow with auditory	Receiver pressure 0.5 bar below the standby cut-in pressure;	Receiver pressure 0.5 bar above cut-out pressure;	Dryness above –51°C at atmospheric pressure;	
RESERVE LOW	Yellow with auditory	Reserve manifold low pressure			
PRESSURE FAULT	Red with auditory	Low pipeline pressure;	High pipeline pressure		

For ISO

Status	Color	Trigger condition

NORMAL	Green constant				
		All compressors in load (LAG alarm)	Malfunctioning of compressor (General warning) • motor tripped • compressor temperature high • compressor emergency force to local	Dew point fault	
OPERATING ALARM	Yellow with auditory	CO high(10PPM)	Control circuit failed	Dryer failure	
Emergency operating alarm	red flashing Auditory	LINE PRESSURE HIGH	LINE PRESSURE LOW	CO too high(25PPM)	High output temperature

Figure 45 Alarm triggers

3.10 Machine settings menu

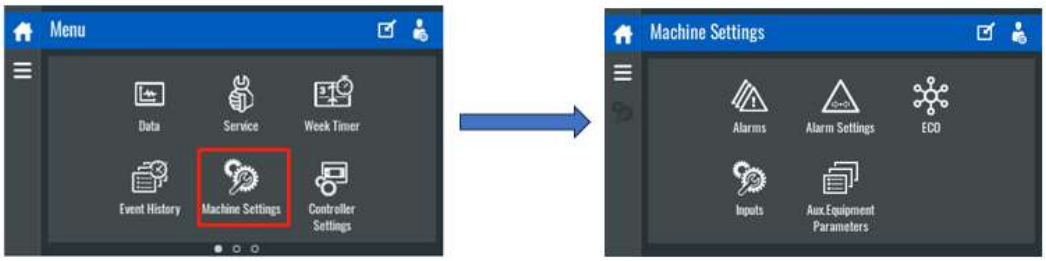


Figure 46

3.10.1 Function

This screen is used to display the following submenus:

- Alarms
- Alarms setting
- ECO
- Inputs
- Aux. Equipment parameters

These submenus can be entered by tapping the icons.

3.10.2 Procedure

To enter the Machine settings menu screen:

1. Tap the Menu button
2. Tap the Machine Settings icon

3.10.3 Description

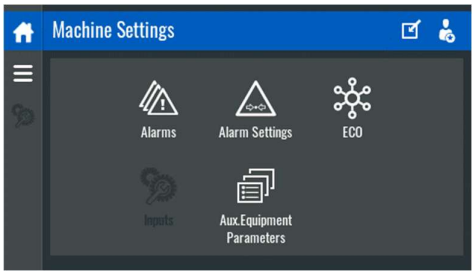


Figure 47

Reference	Designation
(1)	Alarms menu
(2)	Alarms setting
(3)	ECO menu
(4)	Auxiliary Equipment Parameters menu

3.10.4 Alarms menu

Tap the Alarms icon to enter the alarms menu.

A list of all alarms is shown.

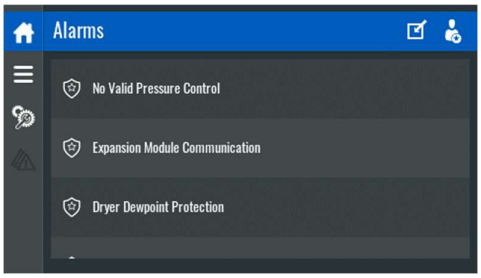


Figure 48

When pressing on one of the items in this list, the warning and/or shutdown levels are shown for this alarm.

Alarms	Description
Dryer inlet	Dry inlet pressure alarm
Carbon Monoxide	Carbon Monoxide value alarm
No valid pressure control	No valid pressure control alarm
Expansion Module Communication	I/O Expansion Module Communication error alarm
Dryer Dew point Protection	ADP value alarm
Medical Pressure Too LOW	pipeline pressure alarm
Medical Pressure Too HIGHT	pipeline pressure alarm
Backup unit in operation	Backup unit in operation alarm
Pressure Fault	pipeline pressure fault alarm
Plant Emergency	Plant Emergency alarm
Reserve Fault	Reserve Fault alarm
Normal	

3.10.5 ECO Menu-ECO regulation

Tap the ECO icon then tap the Master icon and next tap the ECO Regulation icon to enter the regulation menu, setting this parameter need to use top access level.

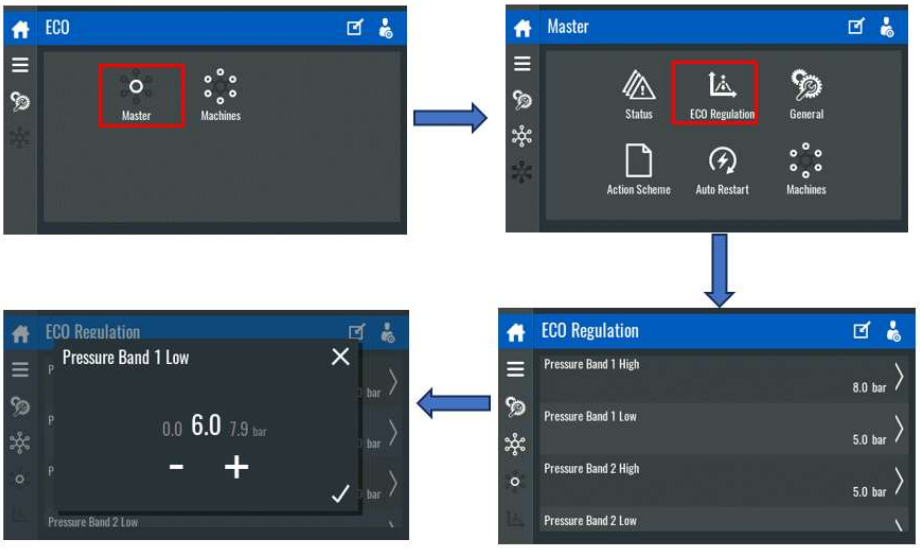


Figure 49

Setpoints or pressure bands can be modified through this menu.

Modify a setting

When tapping a list item, a selection screen pops up. The user can modify the setting by tapping '–' or '+' and can confirm by tapping '√' or decline by tapping 'X'

Pressure band high: maximum air receiver pressure

Pressure band low: minimum air receiver pressure

You can set up two pressure bands and select pressure band according to different requirements, the pressure band will control the compressors to start or stop to let the air receiver pressure be between the pressure band.

Please adjust the pressure band according to the actual operating conditions.

Change a selection

When tapping a list item, a selection screen pops up. The user can change the selection by swiping up or down and confirm by tapping '√' or decline by tapping 'X'.

ECO Menu-Machines

Tap the Machines icon to enter the Machines menu.

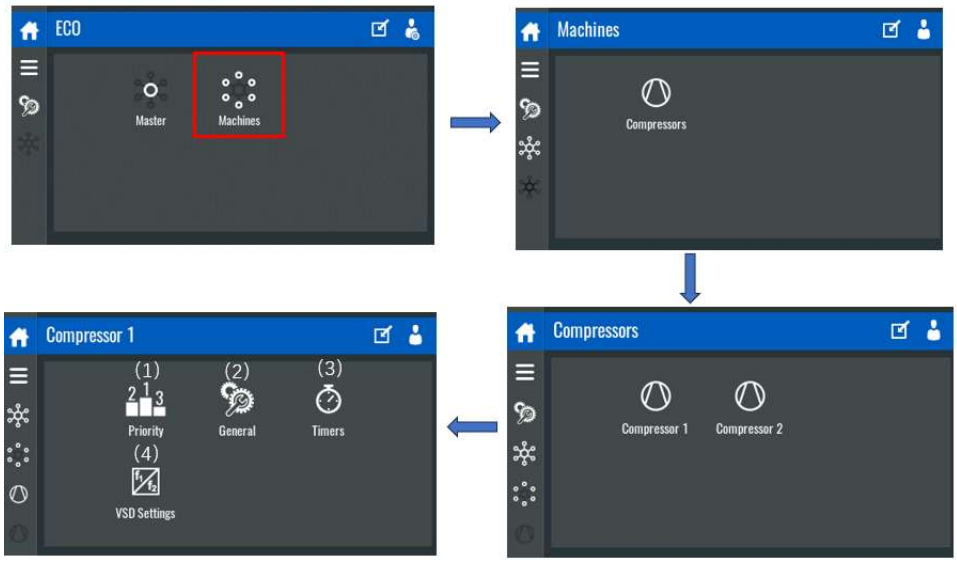


Figure 50

This menu shows information about the control parameters.

Reference	Designation
(1)	Set the compressor priority
(2)	Compressor settings
(3)	Time related parameter settings
(4)	VSD compressor setting

NOTE： All parameters are set up by the ex-factory test.

Modify a setting

When tapping a list item, a selection screen pops up. The user can modify the setting by tapping '–' or '+' and can confirm by tapping '√' or decline by tapping 'X'.

3.10.6 Auxiliary equipment parameters menu

Tap the Aux. Equipment Parameters icon to enter the auxiliary equipment parameters menu.

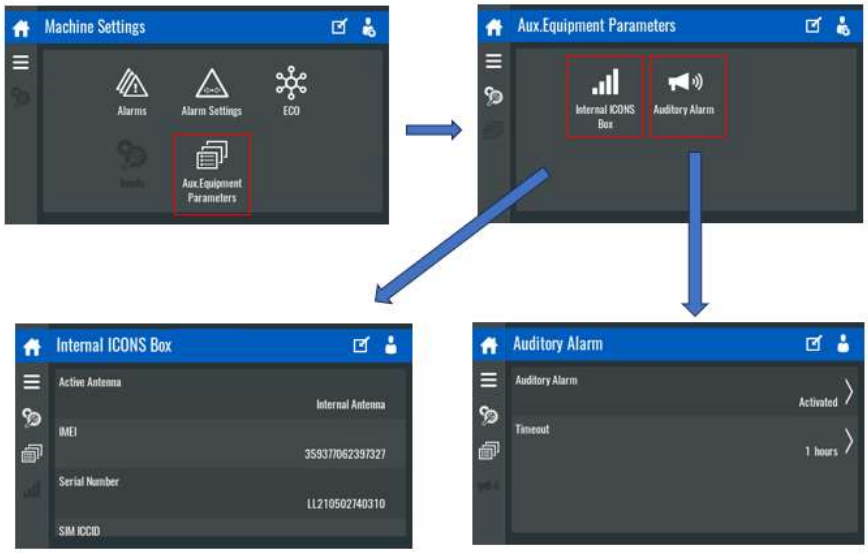


Figure 51

This menu shows an overview of all the auxiliary equipment fitted.

Through this menu, the parameters of the auxiliary equipment can be changed.

Internal ICONS Box:3G internal information.

Auditory Alarm: Audible alarm setting (Not Applicable)

Modify a setting

When tapping a list item, a selection screen pops up. The user can modify the setting by tapping '–' or '+' and can confirm by tapping '√' or decline by tapping 'X'.

3.11 Controller settings menu

3.11.1 Function

This screen is used to display the following submenus:

- Network Settings
- Localisation

- User Password
- Help
- Information

These submenus can be entered by tapping the icons.

3.11.2 Procedure

To enter the Controller settings menu screen:

1. Tap the Menu button
2. Tap the Controller Settings icon

3.11.3 Description

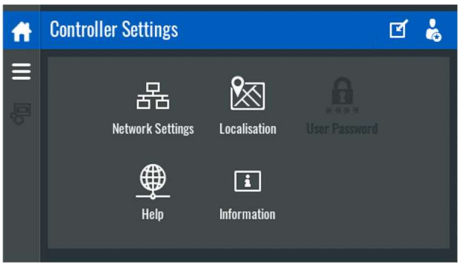


Figure 52

Reference	Designation
(1)	Network Settings menu
(2)	Localisation menu
(3)	User Password menu
(4)	Help menu
(5)	Information menu

3.11.4 Network settings menu

Tap the Network settings icon to enter the network settings menu.

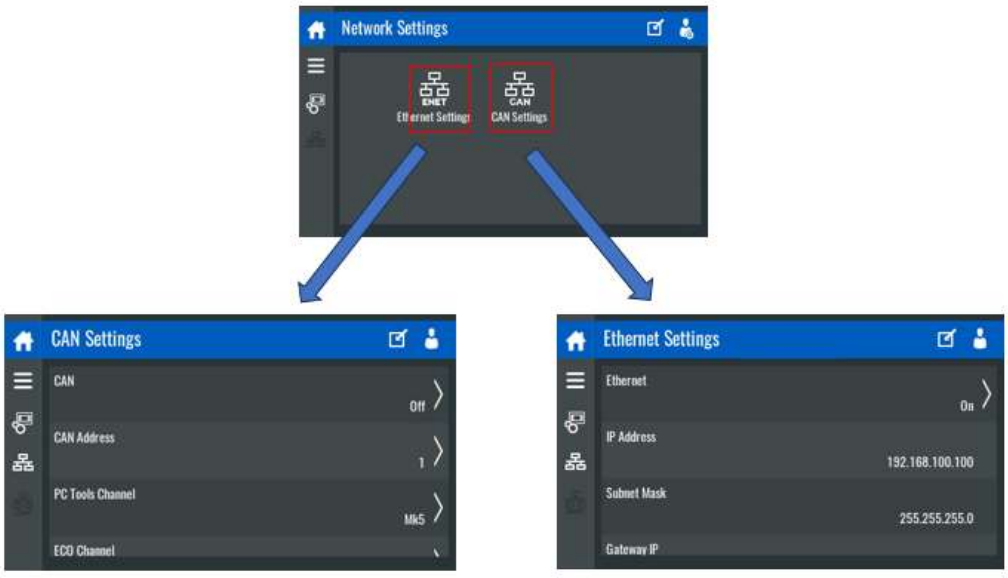


Figure 53

Ethernet Settings

The list of Ethernet settings is shown. When ethernet is turned off, the settings can be modified.

You can set ethernet information in this interface to build ethernet network.

CAN Settings

The list of CAN settings is shown. When CAN is turned off, the settings can be modified.

You can activate CAN setting and set CAN address to build CAN communication network.

Modify a setting

When tapping a list item, a selection screen pops up. The user can modify the setting by tapping '–' or '+' and can confirm by tapping '√' or decline by tapping 'X'.

Change a selection

When tapping a list item, a selection screen pops up. The user can change the selection by swiping up or down and confirm by tapping '√' or decline by tapping 'X'.

3.11.5 Localisation menu

Tap the Localisation icon to enter the localisation menu.

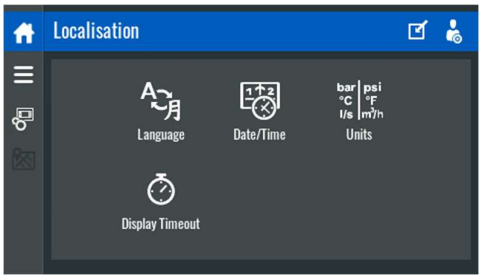
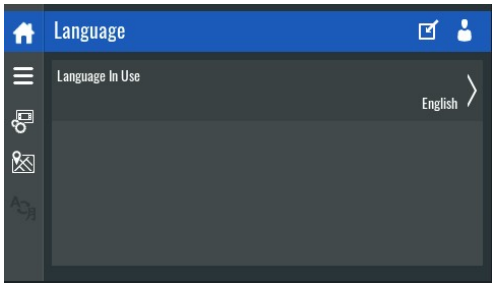


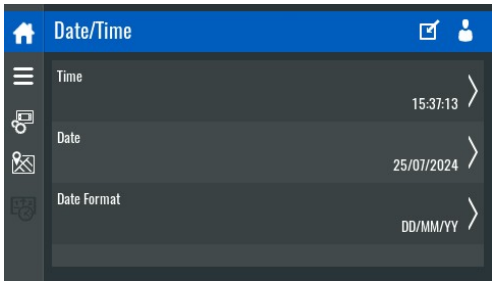
Figure 54

Language



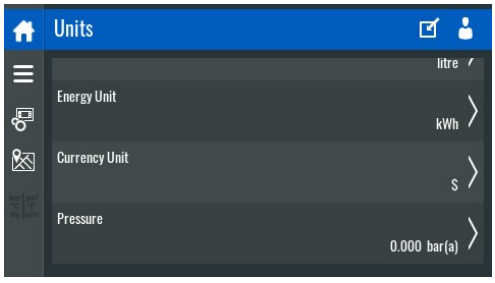
The language setting of the controller can be modified through this menu.

Date/Time



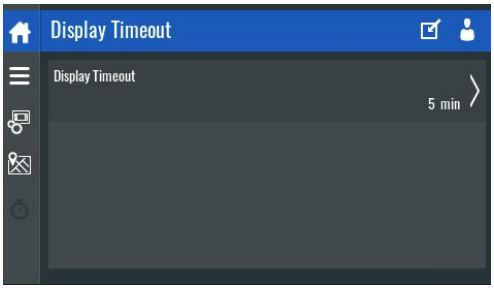
The date and time settings of the controller can be modified through this menu.

Units



The units of Energy, Currency and pressure displayed can be modified through this menu.

Display Timeout



The data can be modified through this menu.

Modify a setting

When tapping a list item, a selection screen pops up. The user can modify the setting by tapping '–' or '+' and can confirm by tapping '√' or decline by tapping 'X'.

Change a selection

When tapping a list item, a selection screen pops up. The user can change the selection by swiping up or down and confirm by tapping '√' or decline by tapping 'X'.

3.11.6 User password menu

Tap the User password"2801" icon to enter the user password menu.

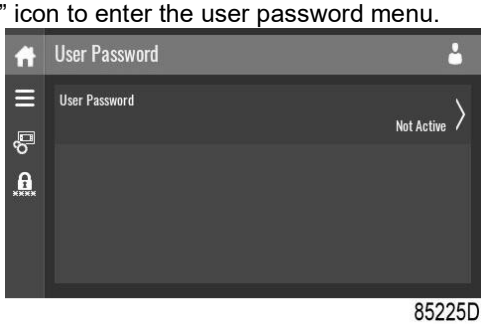


Figure 55

The user password can be activated or deactivated through this menu. Enter and confirm a user password to activate, repeat to deactivate.

3.11.7 Enter a password

When tapping a password protected item, a selection screen pops up. The user can enter the password by swiping up or down to select the desired number. Once the 4 digits "**2801**"are entered, the user can confirm by tapping '√' or decline by tapping 'X'.

3.11.8 Help menu

Tap the Help icon to enter the help menu.

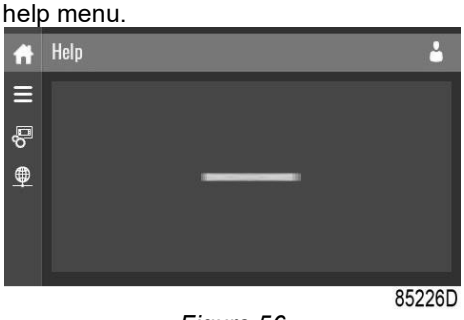


Figure 56

This menu can show a link to the web page of your supplier, a helpdesk phone number or other helpful information.

3.11.9 Information menu

Tap the Information icon to enter the information menu.

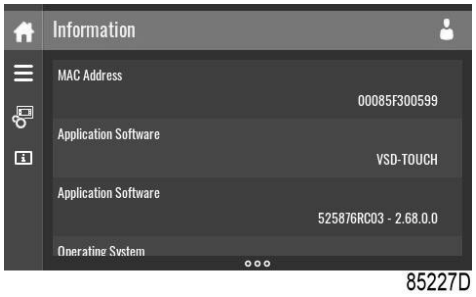


Figure 57

This menu shows information about the controller.

MAC Address: mean the MAC address of the controller.

Application Software: mean the software used for the controller.

3.12 Access level

3.12.1 Function

Through this pop-up screen the access level settings can be viewed or changed.

3.12.2 Procedure

The Access level screen can be viewed or changed by tapping the Access level button at the upper right corner of the screen.

3.12.3 Description

Figure 58

Reference	Designation	Function
(1)	Basic user	A basic set of parameters is visualized, no password required.
(2)	Advanced user	A basic set of parameters can be modified, no password required.
(3)	Service	This access level is not accessible to end users.
(4)	Decline	Tap to decline the selected user level.
(5)	Confirm	Tap to confirm the selected user level.

Advanced user

Figure 59

Tap the advanced user icon (1) and confirm (2) to operate the controller as an advanced user.

4 Desiccant Dryer controller

4.1 Control Interface

Figure 60
Indicator Light

First Indicator (LOC/REM): Remote Local Indicator with Two-Color Light (Blue/Green)

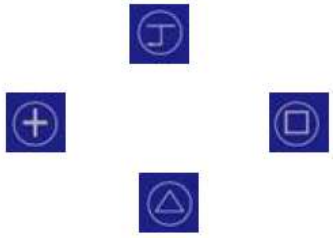
Local mode shows blue, remote mode shows green.

Second Indicator (Alarm): Fault Information Indicator (Red)

Fault exists will cause Red Flashing.

During maintenance the indicator is always red.

Third Indicator (Power): Display green when device is powered.



Operation Button

Function:  Start,  Check,  Query time,  Menu.

4.2 First Level Menu

4.2.1 Initial Interface

After the equipment is powered on, the display screen shows the initial interface and at the same time alarm detection is running. If maintenance time runs out, fault information indicator will be always red.

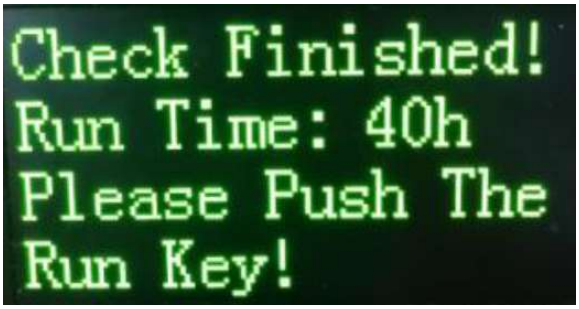


Figure 61

The initial interface displays system initialization, detection completion and the cumulative running time of the machine.

4.2.2 Normal Working Interface

Press  key to start the dryer after system initialization, the following interface will appear.

(Note: After press the startup key, within the first 5 seconds numeric parameter displays, after 5 seconds display will be normal.)

Figure 62 Working interface

"Out ADP" is atmospheric dew point, the specific numbers are displayed according to the actual.

"A: P 15S B: W 60S"

A is chamber A, B is chamber B, W is working, R is regeneration, P is pressure charging, each state is followed by the cumulative timing of that state.

All the working states are as below:

Tower A	Tower B	
A: W	B: R	A Working, B Regeneration
A: W	B: P	A Working, B Pressure charging
A: R	B: W	A Regeneration, B Working
A: P	B: W	A Pressure charging, B Working

The dryer working cycle see below:

	Dryer type	Working Cycle
PMA S1~S3	GFMD	The working cycle of GFMD dryer is 120s, the single chamber works 60s: the regeneration time is 45s, the pressure charging time is 15s.
PMA S4~L3	GFSD	The working cycle of GFSD dryer is 180s, the single chamber works 90s: the regeneration time is 70s and the pressure charging time is 20s.
PMA XL1~XL2	GFLD	The working cycle of GFSD dryer is 360s, the single chamber works 180s: the regeneration time is 150s and the pressure charging time is 30s.

If you want to change the “DICS” (dewpoint setting value of enter energy saving mode) when do Start up after long-term storage or offline, the password is 222333, pls follow the procedure on **6.1.2.1 Pre-preparation.**

4.2.3 Dew point energy saving system DICS

When the outlet dew point value is lower than the set value (-56 ℃), the dryer will start the dew point energy saving procedure. The working chamber will go on working, while the regeneration chamber starts to save energy. The working status on display screen will show “E + saving energy time”. When the outlet dew point value is higher than the set value or the energy saving time reaches the max of the set value, the dryer will quit the energy saving procedure and start working normally, force it to run 3 half working cycles.

Next the sensor will measure the atmospheric dew point, once the dew point rises above the set point, the purge cycling function will become active. If not, the purging of the regenerating tower will be de-active and get into Energy saving mode again.

4.2.4 Stop working

When the dryer is running normally, press  key, dryer stops working, return to initial interface, then press  key, dryer resume working.

4.2.5 Maintenance & Fault query selection interface

Figure 63

In the initial interface after system initialization or normal working interface, press key to enter into maintenance and fault query selection interface. Select the menu through and , press to enter into the appropriate menu. Press key to return to upper menu.

TROUBLE is fault query.

MAINTENANCE is maintenance time query.

4.2.6 Fault query interface

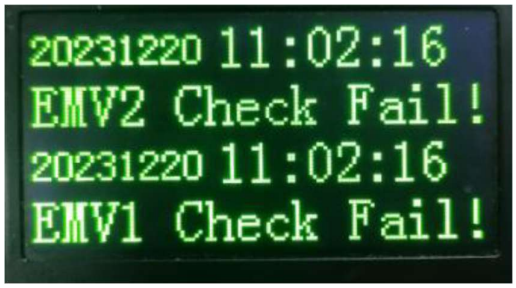


Figure 64

Check the fault resume through and (up and down). Press to return to upper menu. The fault list is presented by the time of failure occurrence and the cause of the failure. It can display 2 faults at the same time, and query more faults through the up and down page key. The latest fault is displayed at the front. When the fault information exists, the second indicator (ALARM) is red flashing.

All faults of the general class:

TMP Check Fail!	Fault on Dryer inlet temperature sensor (only for dryer GFLD and GFSD)
PRE Check Fail!	Fault on Dryer inlet pressure sensor (only for dryer GFLD and GFSD)
ADP Check Fail!	Fault on Dew point sensor
TMP HIGH!	Inlet temperature exceeds the high limit (50 °C) (only for dryer GFLD and GFSD)
TMP LOW!	Inlet temperature exceeds the low limit (2 °C) (only for dryer GFLD and GFSD)
PRE HIGH!	Inlet pressure exceeds the high limit(13bar) (only for dryer GFLD and GFSD)
PRE LOW!	Inlet pressure lower than the low limit(4.5bar) (only for dryer GFLD and GFSD)
ADP HIGH!	Dewpoint exceeds the upper limit (-51 °C)

Only for dryers GFSD

EMV1 Check Fail!	Fault on inlet solenoid valve
EMV2 Check Fail!	Fault on exhaust solenoid valve
EMV3 Check Fail!	Fault on fast pressurize solenoid valve

Only for dryers GFMD

EMV1 Check Fail!	Fault on left exhaust solenoid valve
EMV2 Check Fail!	Fault on right exhaust solenoid valve

Only for dryers GFLD

EMV1 Check Fail!	Fault on tower A inlet solenoid valve
EMV1 Check Fail!	Fault on tower B inlet solenoid valve
EMV2 Check Fail!	Fault on tower A exhaust solenoid valve
EMV3 Check Fail!	Fault on tower B exhaust solenoid valve
EMV5 Check Fail!	Fault on fast pressurize solenoid valve
EMV6 Check Fail!	Fault on outlet solenoid valve

4.2.7 Maintenance Time Query Interface and reset Maintenance Time

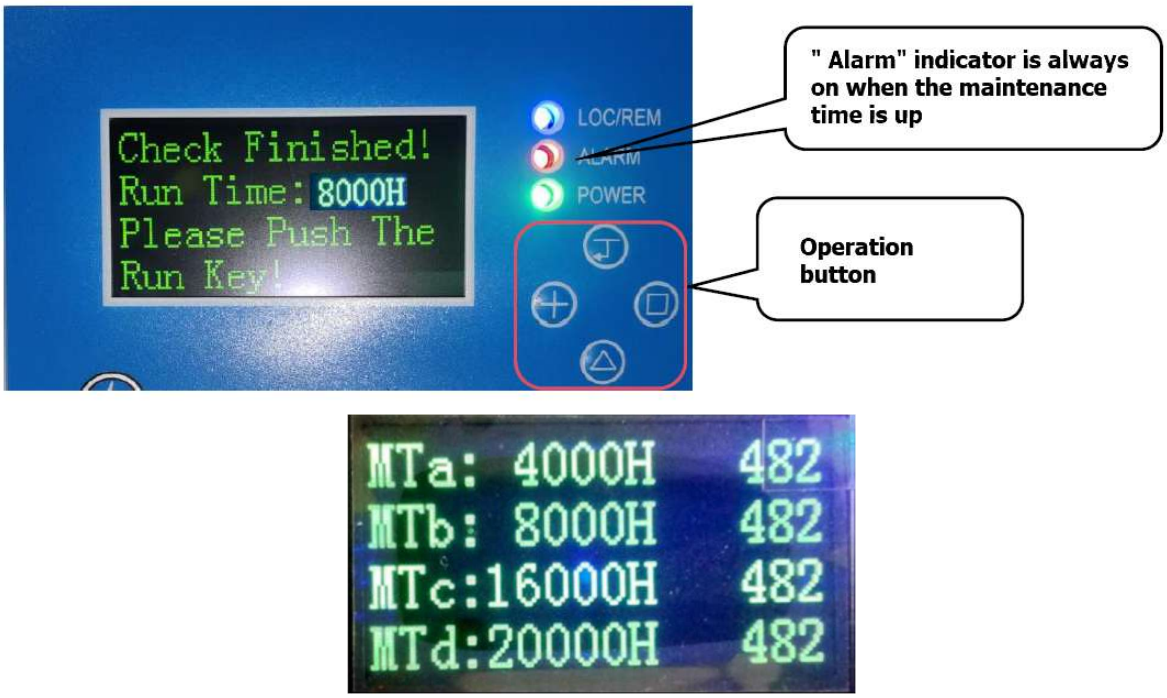
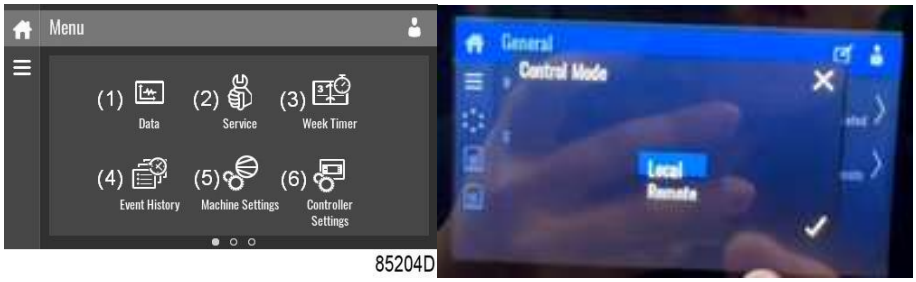


Figure 65

Maintenance time consists of maintenance class, maintenance reference time and current running time, when the alarm is maintained, the second indicator (ALARM) is always red.

To reset the dryer maintenance time and perform maintenance, follow the following procedure:

1. Set the dryer to “Local” in the MK5 controller, follow bellow steps: machine settings > ECOi > Machines > Dryers > Dryer 1 or Dryer 2 > General >Local



2. Press  to enter the menu, enter the password “222333”.

3. Press  to the next menu, then press  to “ “MAINT SET” .

4. Press  to enter the menu, then press  or  to go up or down to move to the row

5. Press  to reset to be 0, and then press  to back to the previous menu, and then finally to the main menu

6. Cut off the dryer power, then do the maintenance.
7. After finishing the maintenance, then restart the dryer, the maintenance “Alarm” indicator will be off.
8. Set the dryer back to “Remote” in the MK5 controller.

5 Installation

5.1 Dimension drawings

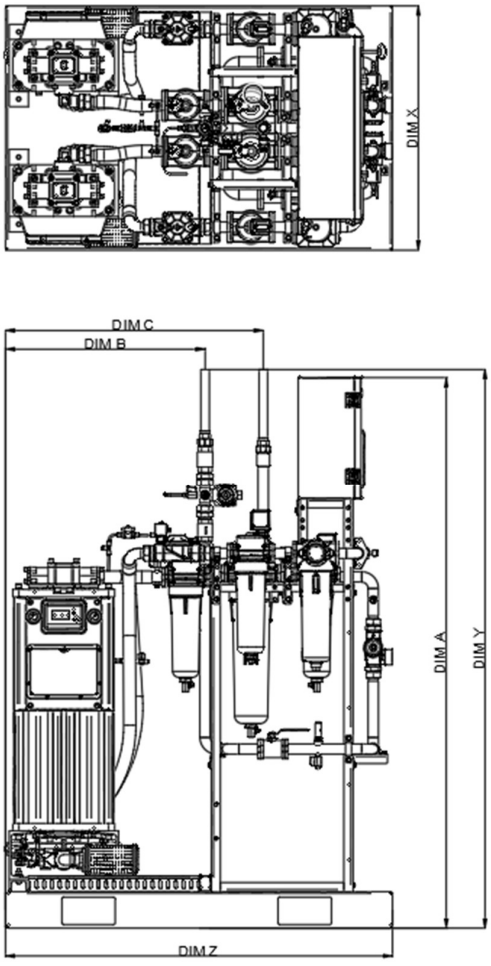
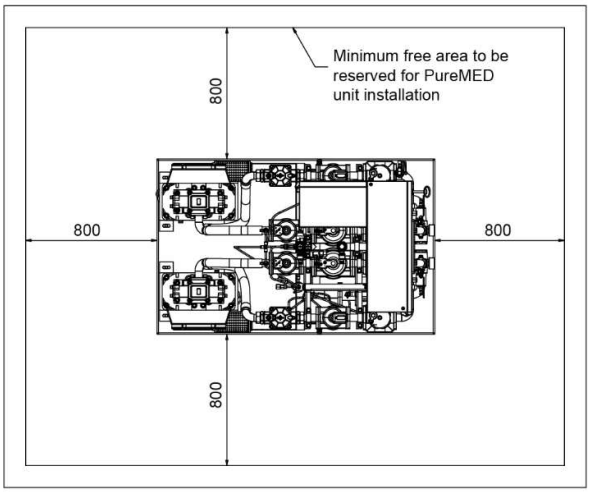


Figure 66

MODEL	DIM X	DIM Y	DIM Z	DIM A	DIM B	DIM C
PMA-S1	800	1735	840	1660	340	485
PMA-S2	800	1735	840	1660	340	485
PMA-S3	800	1735	840	1660	340	485
PMA-S4	800	1735	1070	1660	570	715
PMA-M1	800	1840	1270	1810	655	845
PMA-M2	800	1840	1270	1810	655	845
PMA-M3	800	1840	1270	1810	655	845
PMA-L1	850	1910	1880	1810	1106	1345
PMA-L2	850	1910	1880	1810	1106	1345
PMA-L3	850	1910	1880	1810	1106	1345
PMA-XL1	850	1910	1880	1810	1126	1426
PMA-XL2	900	1910	2165	1810	1411	1711

5.2 Installation proposal



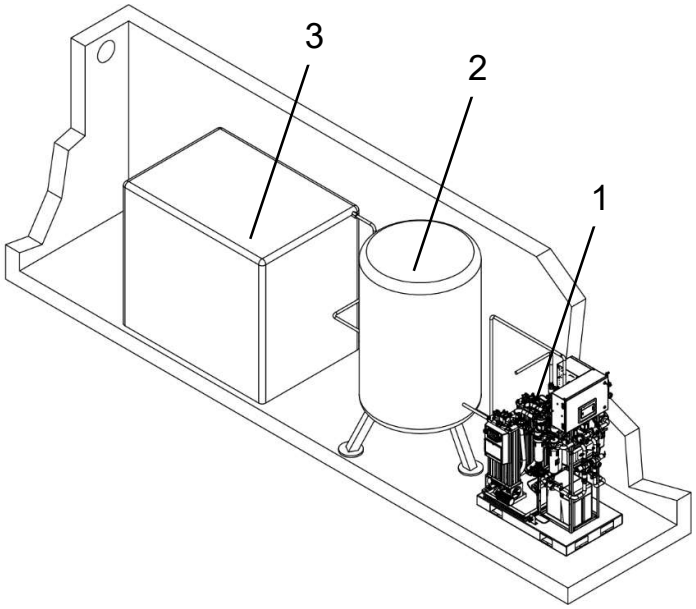


Figure 67

Notes:

- Install the accessories by referring to the documents provided, install isolation valve before PMA inlet.
- Isolate to the pipeline during brazing of the connection line.
- All pipes should be installed stress-free to the compressor unit.
- For more information concerning air nets, cooling systems, etc refer to the compressor installation manual.
- For dimensions and air flow directions refer to the dimension drawings.
- Vessel should equip with safety valve, pressure gauge, and automatic drain.

Installation procedure:

1. Bolting the units to the ground
2. Install isolation valve before PMA inlet pipe
3. Brazing the inlet and outlet
4. Connect the plastic tube to the drain
5. Assemble the CAN cable to PMA

The PMA unit (1) must be installed on a level floor suitable for taking the weight of the dryer. The weight of PMA unit sees Section **10.5 Technical data.** There must be a free space of 800mm around the unit.

The installation sequence must be compressor(s) (3) - vessel(s) (2) - PMA unit (1).

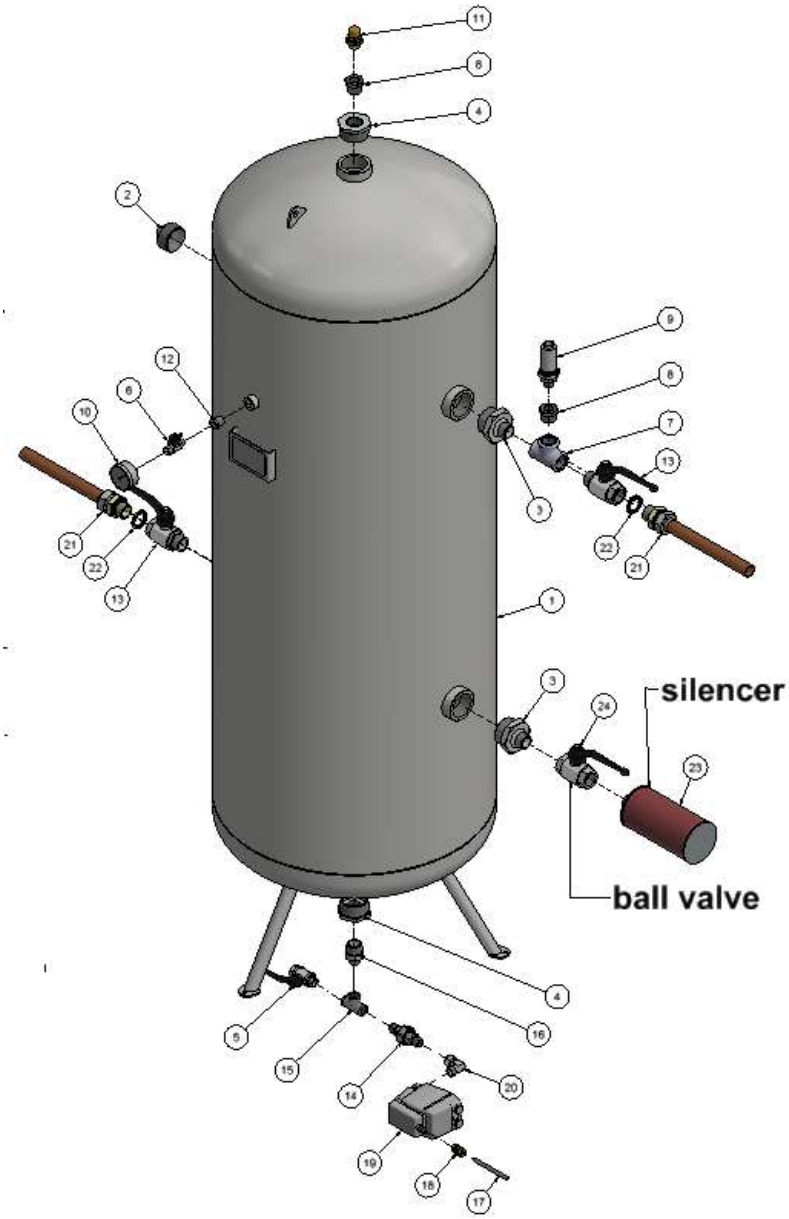
Check that the correct startup procedure is followed. This procedure is described in detail in the instruction book.

A detailed log has to be kept of when and by whom service was performed.

⚠	Make sure that the air delivered to the PMA unit does not exceed the limitations mentioned in this instruction book. Please See Section **10.5 Technical data.**

	Make sure that only clean parts come in contact with the outlet of the PMA unit. If not, this may have an effect on the delivered air quality of the PMA unit. This is also applicable for piping and other parts that are installed after the PMA unit.
	The compressor intake has to be located in an area where there is minimal contamination from internal combustion engine exhaust, vacuum systems, anaesthetic gas scavenging systems, ventilation systems discharge and other contaminants (see EN ISO 7396-1 and HTM 02-01 for details).

	If the compressors are at low load condition, pls open the blow off valve which at tank to increase the load.



Example of compressor room

Reference	Description
(1)	Minimum free area to be reserved for the medical air unit installation

- Install the equipment on a level floor, suitable for taking its weight. Provide enough space (approximately 800 mm (31.5 in)) around the PMA unit for installation and maintenance operations.
- Details about the special requirements concerning the degree of cleanliness can be found in EN 7396-1(not have a level of hydrocarbon contamination greater than 550 mg/m2.) and the herein mentioned standards and regulations.
- Make sure that the air delivered to the PMA unit is within the allowed performance data and inlet limitations.See section Perforamcne data and limitations.
- A high efficiency PDp+ filter is placed at the outlet for the removal of particles down to 0.01µm

General recommendations

	The installation of the PMA unit can only be done by trained and certified BeaconMedaes service personnel.
	Make sure that only clean parts come in contact with the outlet of the PMA unit. If this is not the case, this may have an effect on the quality of the air delivered by the unit. This is also applicable for piping and other parts installed after the unit.
	The installation sequence must be compressor(s) (3), vessel (2)and PMA unit. It may be required to install an additional dew point sensor downstream the unit. Consult BeaconMedaes before operating the unit. The PMA does not require extra ventilation.
	The power cable must be connected by a qualified electrician. Check that the electrical installation corresponds to the applicable codes. Before switching on the main power supply, check the voltage requirements in the technical specifications or on the data plate of the unit. The PMA unit must be earthed and protected against short circuits using fuses of the inert type. An isolating switch must be installed near the unit.
	Follow the correct start-up procedure. See section Operating instructions.
	Positioning: Place the unit at a location where the temperature of the ambient air, never exceed the 40 ˚C.If not the quality of the outlet air is not guaranteed as stated in the part Technical Data.
	**Piping:** • All valves, couplings and pipes used/installed after the unit must be free from oil and grease (hydrocarbon contamination below 550 mg/m^2) and dust (particles size below 50 micrometer). • All connections to the unit must be mounted stress-free. Pay extra attention when connecting the compressed air lines to the unit's inlet and outlet.
	Verification: Before the installation is going to be used, a validation of the air quality according pharmacopoeia must be done. These records must be kept by the user at all times.

5.3 Storage after installation

Procedure

When the desiccant is in good shape (the dew point reaches -51 ˚C), if want to storage after installation, stop the unit and keep all valves closed to avoid moisturefrom entering the unit.

1. When pressure in dryer ＞ 1atm: pressure inside the dryer is maintained, start the machine once every three months, and run the machine no less than 2 hours, and the ambient dew point reaches -61 ˚C.

2. When pressure in dryer ≤1atm: start the machine once every month, run the machine for no less than 2 hours, and the ambient dew point reaches -61˚C.

	Keep the PMA and its spare parts away from materials which easily oxidize(e.g. peroxides, chlorates, acids, …). Spare parts must be stored in dry, cool and closed containers.
	Although the unit does not contain hazardous substances, it must be handled with care under any condition.

5.4 Electrical connections

General

	The electrical wiring must comply with the local regulations. The PMA unit must be earthed and protected by fuses against short-circuiting. Consult the electric diagram deliveredwith the unit. Before switching on the main power supply, check the voltage requirements in the technicalspecifications or on the unit's data plate.

Installation

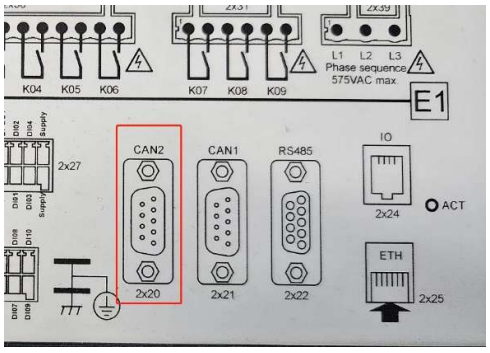
The PMA can be connected to a 115V/230V AC power supply. For the way of connecting, please see the "Service diagram". The PMA has 2 power supply connections.

	Set 0.2bar differential for the load pressure of compressors on the compressor own controller.

CAN network

Take the CAN network cable from the box supplied with every compressor. Verify that the lengths (10 m) are sufficient to connect each unit. Route the cables properly and attach each cable as follows:

1. Connect the CAN cable from the PMA controller to the top connection of the last compressor (ensure that the CAN connector is plugged into slot CAN2 on PMA and each compressor).



2. Connect the CAN cable from the 1st compressor's bottom socket to the next compressor's top socket. Fit the label number '1' to compressor 1 (VSD CAN ID must be 1). Repeat until the last compressor, fitting the associated compressor label number.
3. Open the controls cabinet on the compressor unit of the first Compressor and PMA. Change the first compressor and PMA CAN switches to [ON], other compressors CAN switches to [OFF].

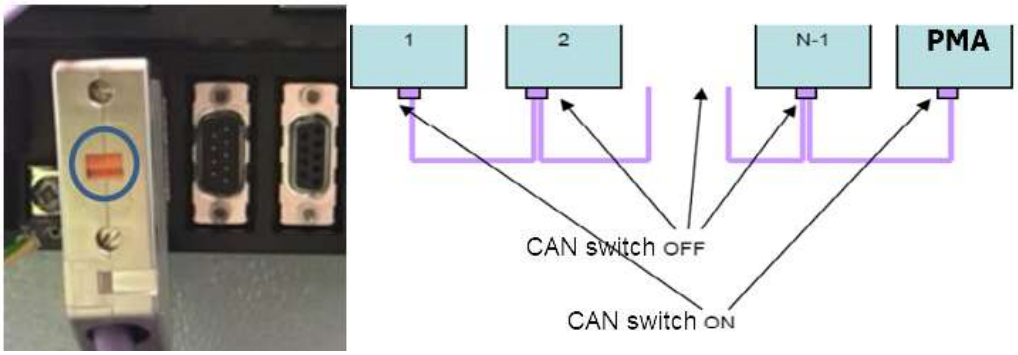
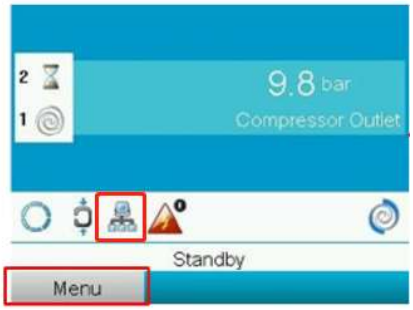


Figure 68

4. Make sure all the compressors in “LAN” mode, put the compressors’ “LAN/LOCAL” switch (HTM version) in “LAN” position or choose “LAN” mode in compressor’s controller screen, check the “LAN” icon in compressors’ controller(see below picture). And set the compressors’ “CAN” be “ON”.



852730	Machine Control Mode, LAN

Below are the general setting steps for compressors with MK5 graphic controller, the detailed CAN setting steps can be seen in compressor’s own instruction book.

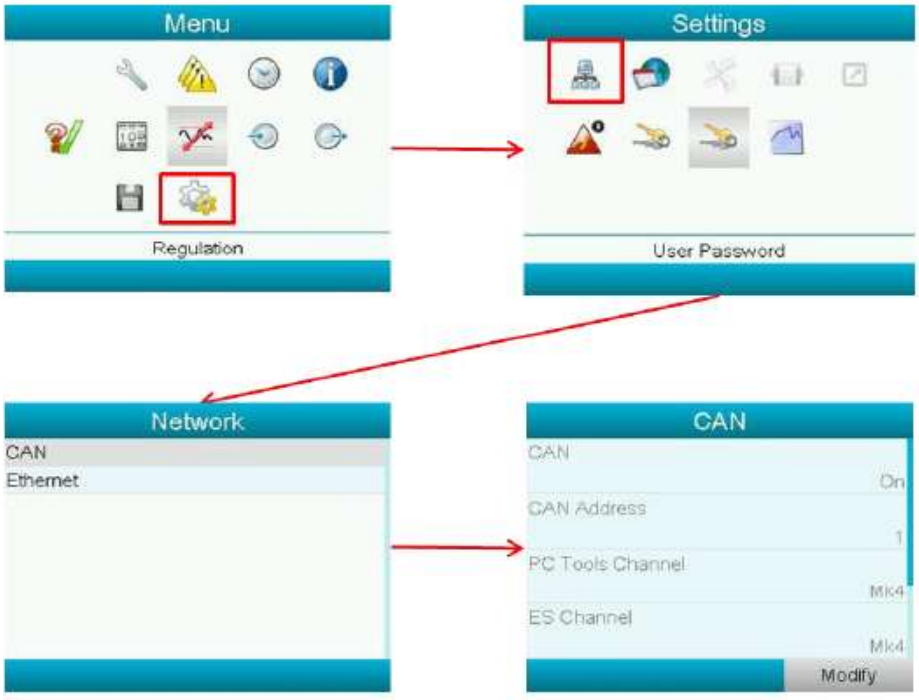


Figure 69

Compressors with MK5s Touch Controller CAN address setup

Power up the compressors and complete the following step on each compressor to set the CAN addresses numbers.

Set the CAN addresses number of compressors from 1 to N-1 which connected to the PMA, for up to a maximum of 6 compressors. Set PMA CAN address number be compressor quantity plus 1.

To change compressor CAN address, on the compressor controller go to:

Menu>Settings>CAN Address

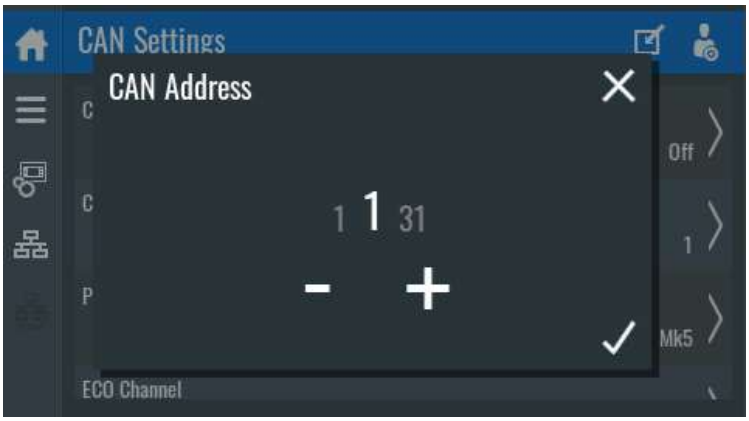


Figure 70

Menu>Settings>CAN (Change to [ON])

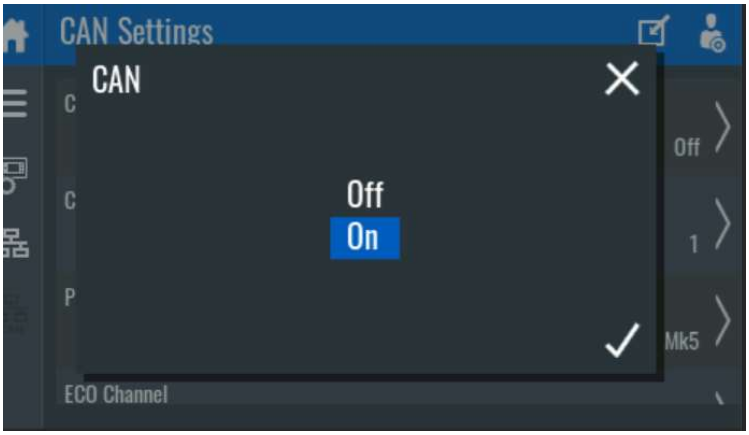


Figure 71

For PMA **controller's CAN setting see 3.11.4** Network settings menu

PMA Controller setting

The controller screen is on and displays normally. The main interface shows that the analog signals is normal.

Figure 72

- Click the icon as below;

Figure 73

- Click “ECO”, and enter password-“2801”

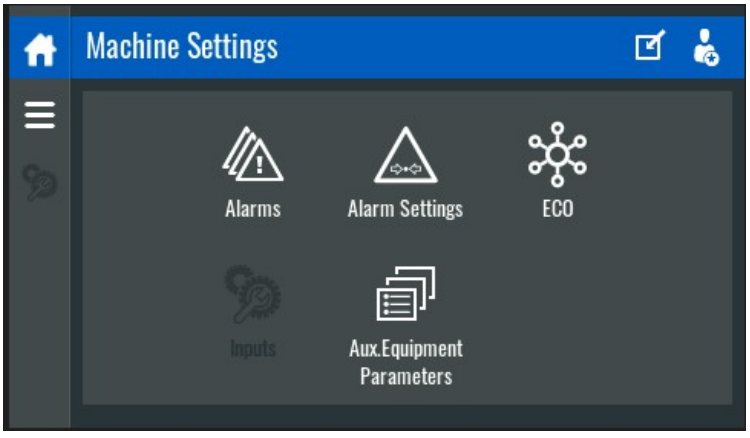


Figure 74

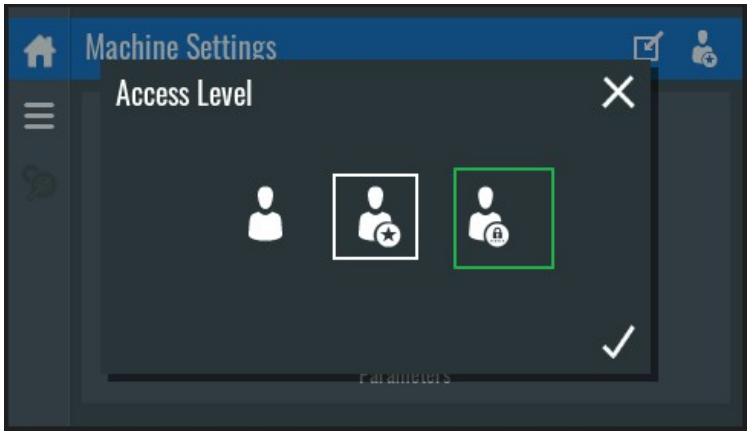


Figure 75

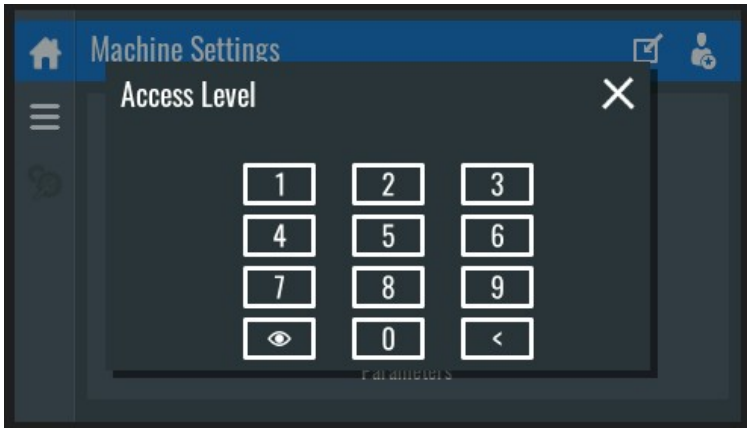


Figure 76

- Click “Status”, and open ”ECO”

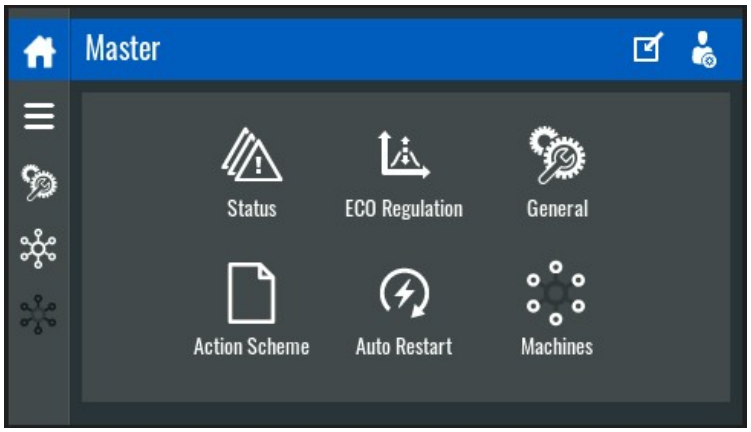


Figure 77

Figure 78

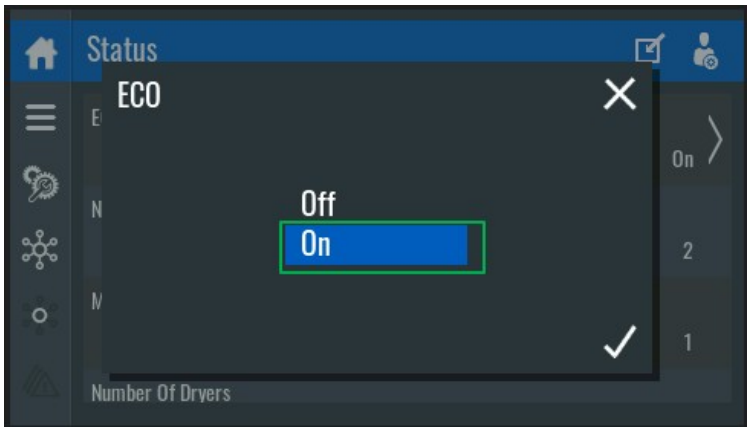


Figure 79

- Set the quantities for “Number of Compressors”, which is the total number of compressors on the system. Set the quantity for ‘Max Nr Of Loaded Compressors”, which is the number of duty compressor on the system.

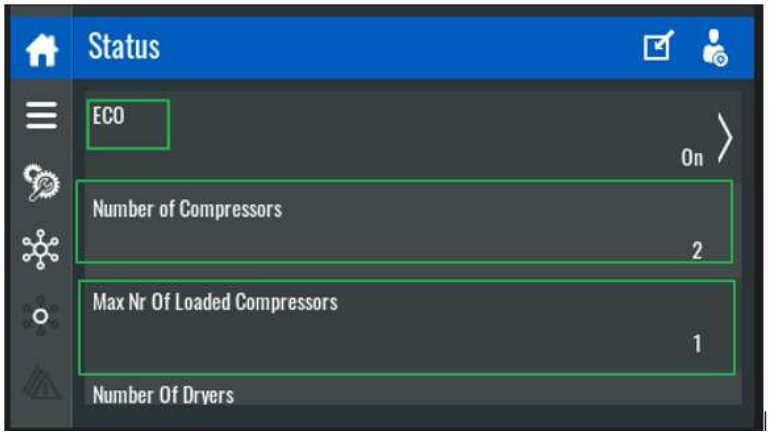


Figure 80

⚠	Check if Compressors are in auto running

Click on the bottom right corner of the screen of central controller, select "ECO Stop" in the pop-up window and click ‘√’ to stop the compressors, select” ECO Start” and click ‘√’ could start the compressors. The

user select confirm by tapping '√' or decline by tapping 'X'.

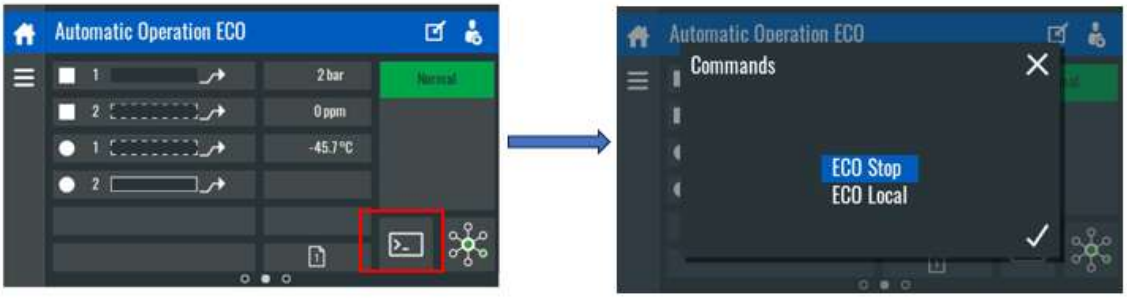


Figure 81

BMS and alarm out connection
For BMS and alarm out connection, connect as shown in service diagram.

6 Operating instructions

Safety

⚠	Always observe all relevant safety instructions.

6.1 Initial startup

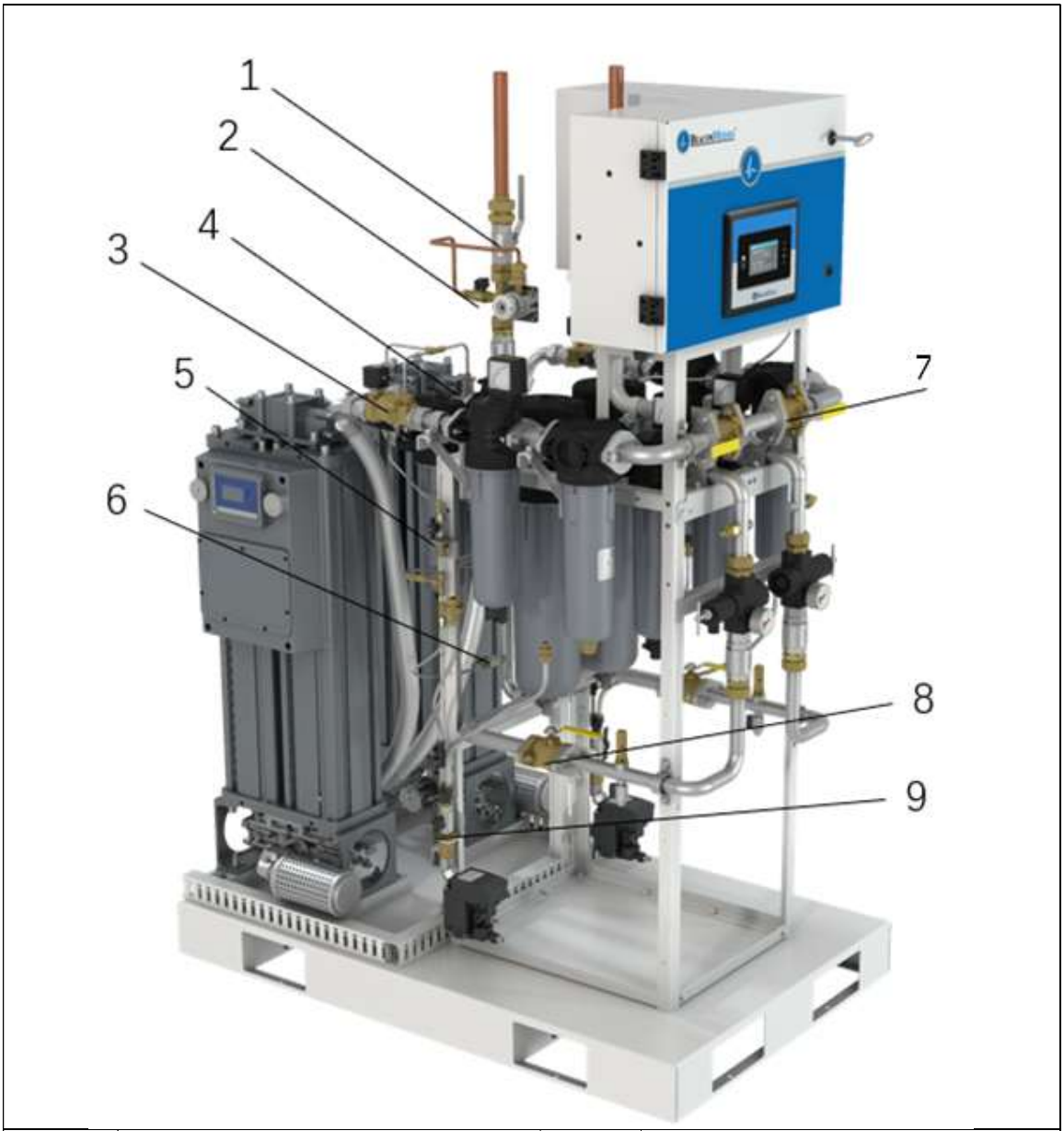
Electrical connection and CAN address please refer to **5.4 Electrical Connections**,
To start up the PMA unit for the first time,proceed as follows:

1. If the dryer has been stored <3 months, refer to section "Normal Initial Start".
2. If the dryer has been stored >3 months, refer to section "Start-up after long-term storage.

6.1.1 Normal initial start

Proceed as follows:

1. Make sure unit status is ECO stop.
2. Check Valve status refer to below except the outlet valve (no. 1) should be closed (The ball valve handle position should be at horizontal to be closed).



1	Outlet Valve (Open)	2	Test terminal Valve (Closed)
3	Solenoid valve (Set as control)	4	Back feeding Valve (two valves) (Open)
5	Ball valve (Closed)	6	Test point valve (Open)
7	Flange Valve 01(two valves) (Open)	8	Flange Valve 02(two valves) (Open)
9	Drain Valve (Open)		

3. Ensure the dryer is powered on.
4. Cut off the air supply from the compressor towards the dryer by closing the inlet valves between tank and PMA unit.
5. Check that outlet valve of PMA unit is closed (refer to Figure 82, the ball valve handle position should be at horizontal to be closed).

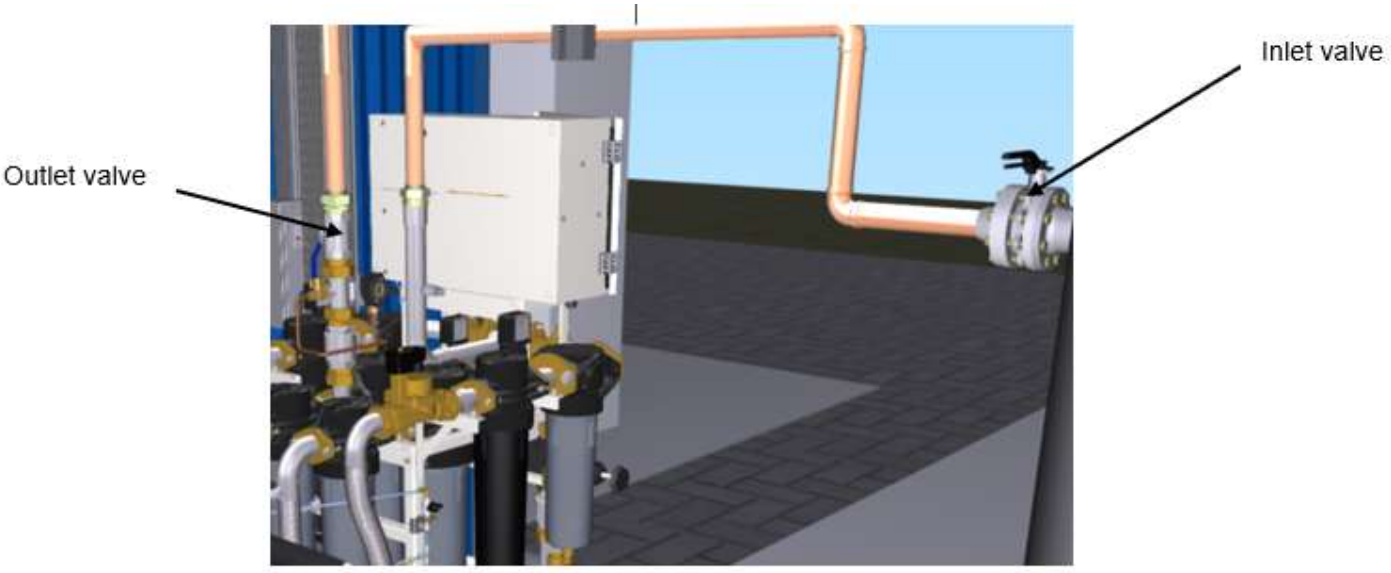


Figure 82 Outlet valve

6. Select" ECO Start" to start the compressors and slowly open the inlet valve between pressure vessel and PMA unit to full open.

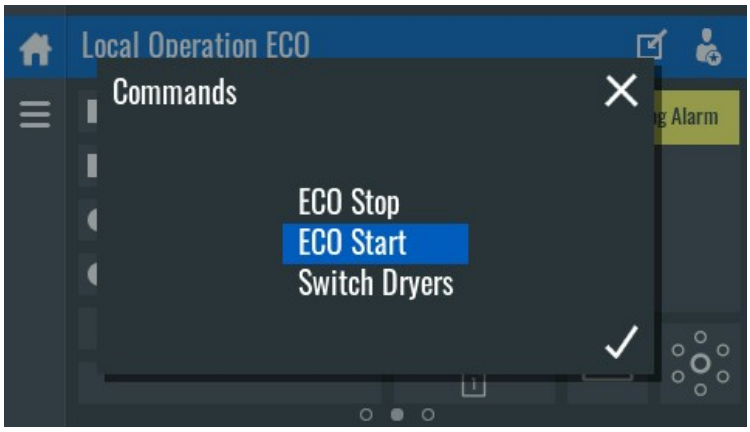


Figure 83 Select ECO Start

7. Because at beginning of start, the compressors' outlet pressure goes high gradually, when it's lower than 80% of load pressure set point, the "emergency force to local" function will be triggered. Then the compressors will run on local mode, and an alarm" Emergency force to local" will show on compressor's controller. This alarm can only be manually reset after the compressors' outlet pressure is higher than 80% of load pressure set point (see below pictures), reset the "emergency force to local" alarm.

Figure 84 Emergency force to local

8. Select" ECO stop", then select the "ECO start" to restart the unit.
9. Check all connections for air leaks and remedy if necessary.
10. Check if the system is running correctly, there is only one dryer is running(see below picture), if both dryers are running, it's not correct.

Figure 85 Only one dryer is running

11. Let the unit operate for several hours with the outlet valve closed.
12. Check pressure in vessel to reach design value, refer to nameplate for inlet pressure value.
13. Check the dew point downstream the purifier unit. Make sure the atmospheric dew point has reached below -51˚C. Since the air quality needs to meet Pharmacopoeia regulations, it is necessary to run the dryer for several hours with the outlet air blown off to make sure that the pipes are not contaminated and air quality meet Pharmacopoeia regulations. **This flow must not be directed into the air net but needs to be blown off via another way.** Use the vent valve (see below picture) which under the pressure relief valve to bleed across each dryer separately to blow off.

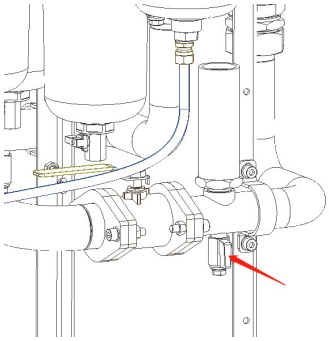


Figure 86 Vent valve

14. After the air quality meet Pharmacopoeia regulations and installation compromising approved and handed over, then could gradually fully open the air outlet valve.

⚠	• All valves, couplings and pipes used/installed after the unit must be free from oil and grease (hydrocarbon contamination below 550 mg/m^2) and dust (particles size below 50 micrometer). • For the location of the external inlet valve and external outlet valve (customer's installation), see section Installation proposal.

If dryer has been stocked or unit is offline for more than **3 months**, refer to section **Start up after long-term storage or offline.**

6.1.2 Start up after long-term storage or offline

6.1.2.1 Pre-preparation

1. Power on the dryer, if the dryer is not in "Remote" status, set the dryer to "Local" in the MK5 controller, follow bellow steps: machine settings > ECOi > Machines > Dryers > Dryer 1 or Dryer 2 > General >Local

Figure 87 set dryer to “Local” in MK5 controller

Figure 88 Dryer’s own controller

First Indicator (LOC/REM) in dryer controller: “Local mode” shows blue, “remote mode” shows green.

2. Change the dew point setpoint in dryer’s own controller to -80 ˚C in order to avoid dryer getting into **Dew point Energy Saving Mode**.

3. Dew-point setting procedure

- When dryer is in standby mode, press  ,password screen appears. Then press  ,enter password 222333.
- Next press  ,go to the next screen. Then press  ,choose “ADP” row,
- Press  into next screen.
- Press  , to set DICS value until -80℃.

- Next press  to enter the top screen, press  to run the dryer.

Figure 89

- Set the dryer back to “Remote” status, follow bellow steps: machine settings > ECOi > Machines > Dryers > Dryer 1 or Dryer 2 > General >Remote

	**Just can change the “DICS” data when do procedure of Start up after long-term storage or offline, other data like “HIGH” or “MAX” or others don’t allow to be changed at any time.**

6.1.2.2 Startup procedure

If unit offline for more than 3 months complete **6.1.2 Start up after long-term storage or offline** first.

1. Keep ECO in Local mode.

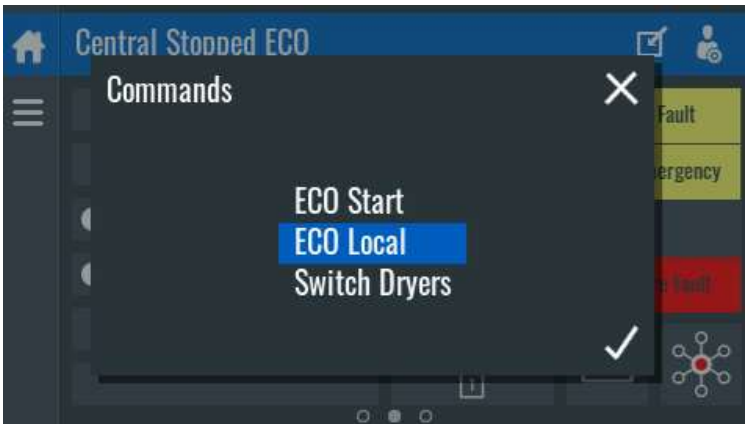


Figure 90

2. Close the air supply from the compressor towards the dryer by closing the inlet valve.
3. When activating **dryer 1**, keep valve 2 and valve 1, valve 3 and valve 6 closed, then open valve 4,5. As *Figure 91* shown.
4. Power on Dryer 1 and then press  to run dryer.
5. Then start the compressors until pressure in vessel reaches design pressure, please refer to **10.5 Technical data** by model type.
6. Slowly fully open the inlet valve between pressure vessel and PMA unit.

7. Check all connections for air leaks and remedy if necessary.
8. Let the dryer operate for 4 hours or longer with the outlet valve 1 opening 1/4, bypass substandard gas if necessary ,operating time depends on when the dew point reaches the required value ADP -61 ˚C.
9. When the atmospheric dew point has reached -61 ˚C, It means Activation complete, then change the dew point set point in dryer 1's own controller DICS value back to -56 ˚C.
10. When activating **dryer 2**, keep valve 1 and valve 4, valve 5 and valve 6 closed, then open valve 2,3, Refer to Figure *91*.
11. Power on dryer 2 then press  to run dryer.
12. Repeat step 5-9.
13. Close the inlet valve between tank and PMA unit.
14. Then recover valve position，pls refer to section 6.2.
15. Select ECO start.
16. Slowly fully open the inlet valve between tank and PMA unit.

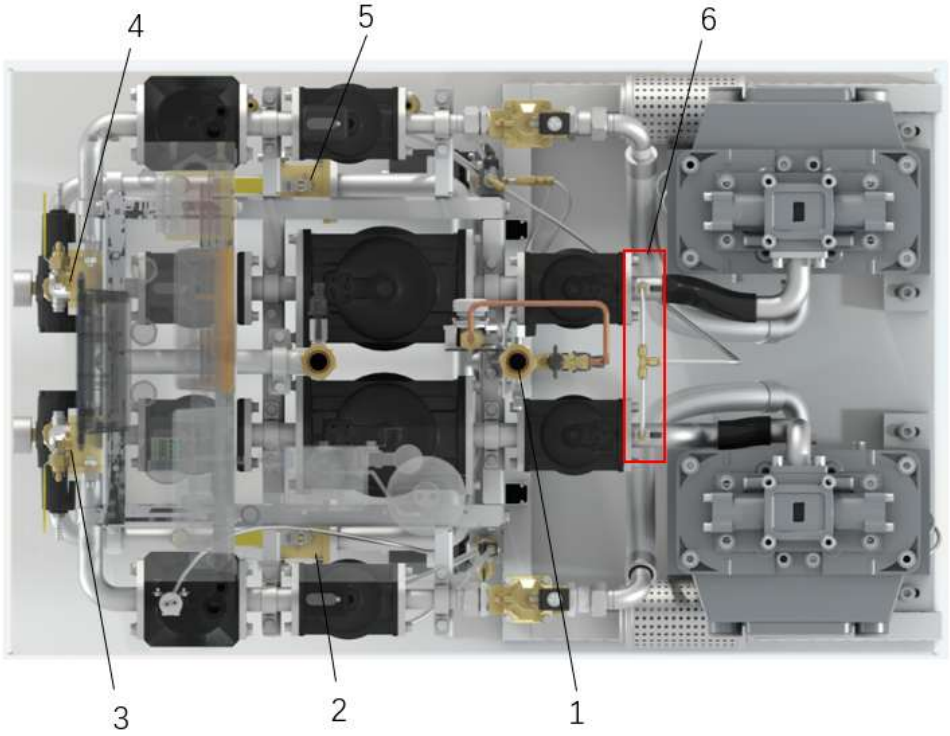


Figure 91

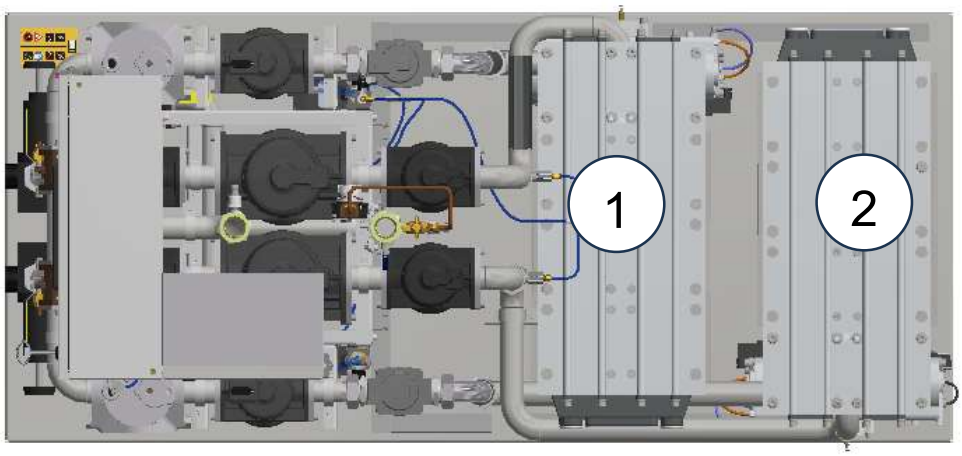
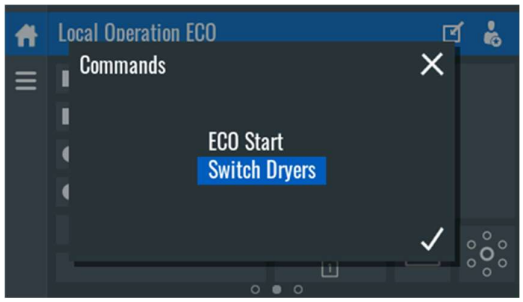


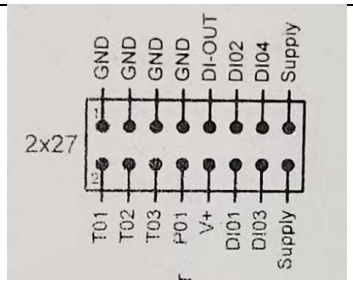
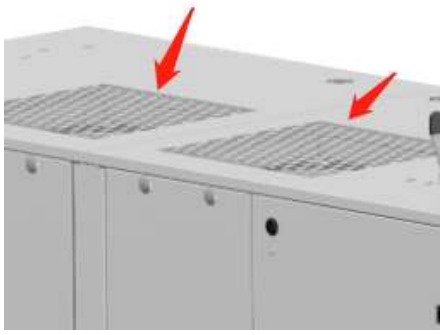
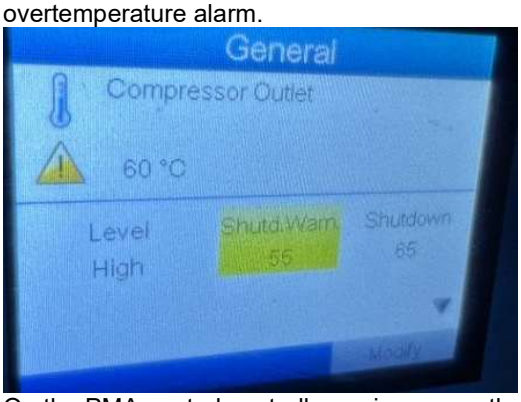
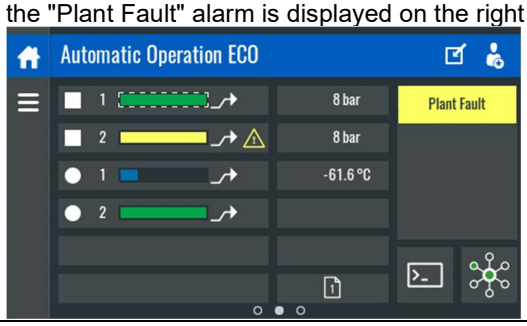
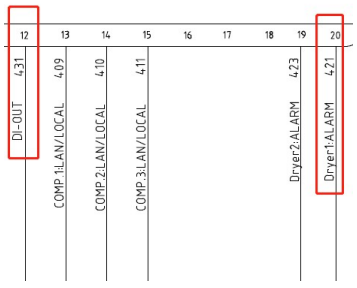
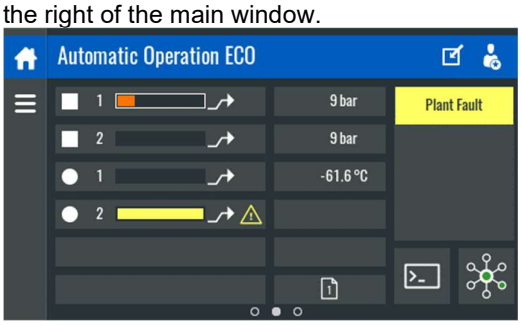
Figure 92 Serial dryer of L platform

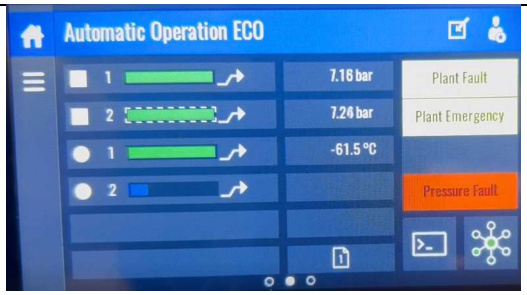
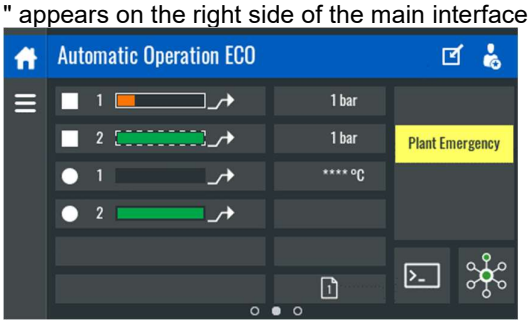
	• All valves, couplings and pipes used/installed after the unit must be free from oil and grease (hydrocarbon contamination below 550 mg/m²). • For the location of the external inlet valve and external outlet valve (customer's installation), see section Installation proposal. • Before starting the unit make sure that all pipes are connected and that items in drains or pipes for protection during transport are removed.

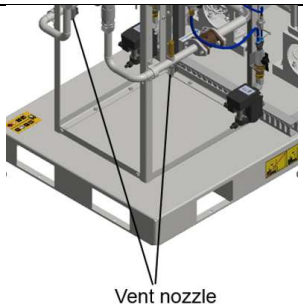
6.1.3 Commissioning test

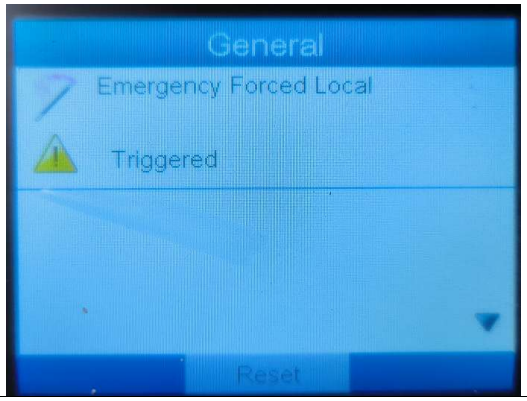
Follow the section **Normal initial start steps** 1~11or **Start up after long-term storage** 1~15 to start the unit then do the following tests:

Description	Test Method	Result
Switch dryers	Click on the bottom right corner of the screen and select " Switch dryers " in the pop-up window. 	Switch to the second dryer operating. 
Plant Fault (HTM02-01)	Control loop failure: Disconnect the power "2x27" cord from the 1# compressor's MK5 Graphic controller.	The 1# compressor status icon changes to "X", and the yellow alarm "Plant Fault" is displayed on the

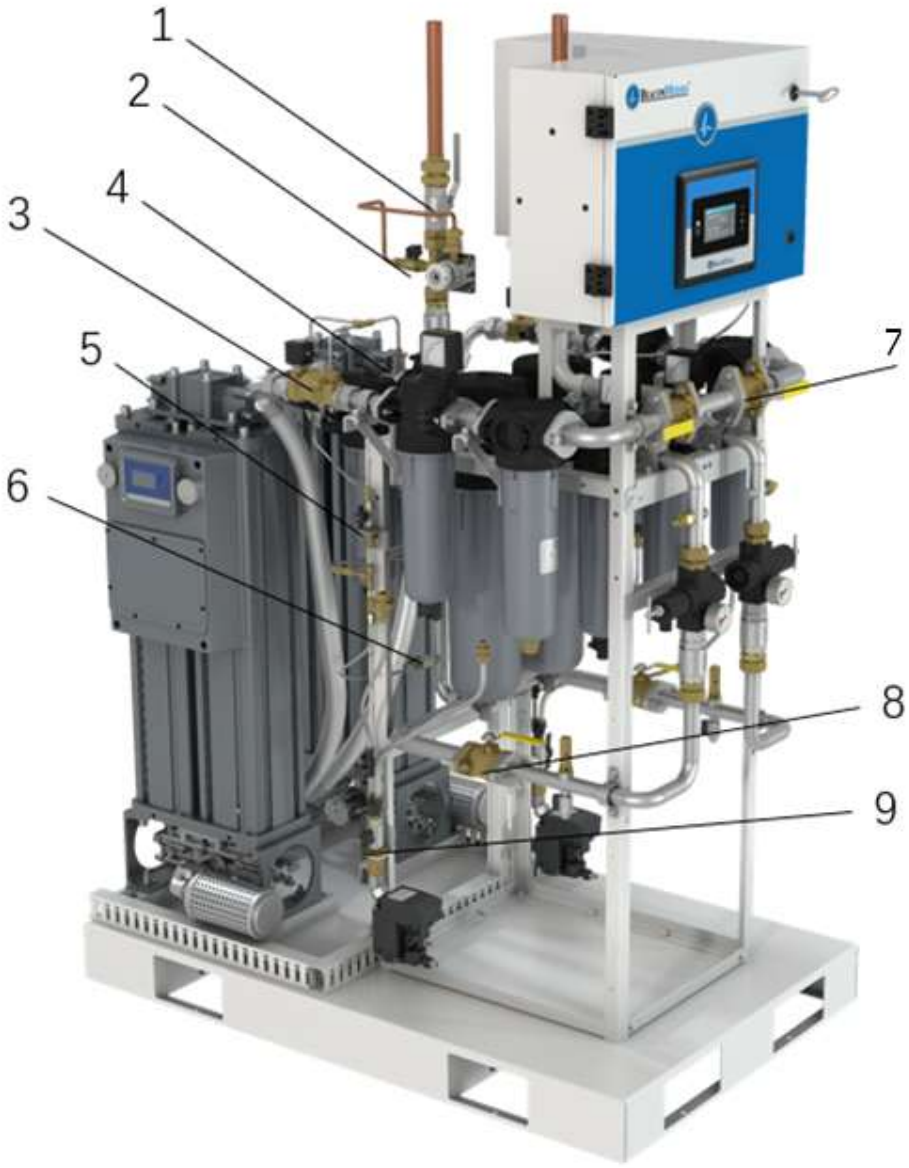
		right side of the main interface. 
	After cooler temperature is too high: Use cardboard to shield the compressor's aftercooler to raise the temperature. 	Compressor's MK5 Graphic controller Displays overtemperature alarm.  On the PMA central controller main screen, the status bar corresponding to the compressor turns yellow with a yellow triangle exclamation mark, and the "Plant Fault" alarm is displayed on the right. 
	Dryer failure: Short-circuit the dryer fault signal on MK5. 	When the dryer is faulty, the status bar corresponding to the dryer on the main interface turns yellow with a yellow triangle exclamation mark. A yellow alarm indicating "Plant Fault" is displayed on the right of the main window. 
Plant Emergency (HTM02-01)	The inlet pressure is too high. ○ Inlet pressure 13bar, alarm trigger when inlet pressure>= 14.5bar	

	○ Inlet pressure 10bar, alarm trigger when inlet pressure>= 11.5bar ○ Inlet pressure 7bar, alarm trigger when inlet pressure>=8.5bar	 Inlet pressure exceeds the set value.
	The inlet pressure is too low. ○ Inlet pressure 13bar, alarm trigger when inlet pressure<= 11.5bar ○ Inlet pressure 10bar, alarm trigger when inlet pressure<= 8.5bar ○ Inlet pressure 7bar, alarm trigger when inlet pressure<= 5.5bar	
	1. Directly unplug the dew point meter connection during normal operation to simulate single fault. 2. Atmospheric dew point above -51 °C: Remove the gas pipe of the dew point meter during normal operation.	1. For point 1, When the dew point signal is faulty, the dew point value is displayed as *, and the yellow alarm " Plant Emergency " appears on the right side of the main interface.  2. For point 2, need to wait for the dew point to raise above the alarm condition. 
Pressure Fault (HTM02-01)	The pipeline pressure is low. ○ For 4bar outlet, alarm trigger when pipeline pressure<= 3.7bar ○ For 7bar outlet, alarm trigger when pipeline pressure<= 6.5bar ○ For 10bar outlet, alarm trigger when pipeline pressure<= 9bar	Outlet pressure exceeds the set value.

	 Vent nozzle By open the vent nozzle to let the pipeline pressure reduce to alarm value to trigger the alarm.	
	The pipeline pressure is high. ○ For 4bar outlet, alarm trigger when pipeline pressure>= 5bar ○ For 7bar outlet, alarm trigger when pipeline pressure>= 10.5bar ○ For 10bar outlet, alarm trigger when pipeline pressure>= 12bar By adjust the regulator to let the pipeline pressure to be higher than alarm value to trigger the alarm.	
ARAVF	Disconnect the power supply when the device is running normally and connect the power supply again within 5 seconds.	After the device is powered off and powered on again, the PMA and compressors will start and keep running in the state before the power failure.
Operating alarm (ISO)	1, Directly unplug the dew point meter connection during normal operation to simulate single fault. 2. Simulate dew point too high. Atmospheric dew point above -51 °C: Remove the gas pipe of the dew point meter during normal operation.	1.For point 1, the "Operating Alarm" yellow alarm is displayed on the right side of the main interface and flashes.  2. For point 2, need to wait for the dew point to raise above the alarm condition. 

Emergency operating alarm (ISO)	Simulate medical/Surgical air pressure too low. Simulate medical/Surgical air pressure too high. Refer to Pressure Fault trigger mode to bring the pressure value to trigger point.	The " Emergency operating alarm " red alarm is displayed on the right side of the main interface and flashes. 
EFL-Emergency Forced Local	In normal operation of the equipment, open outlet valve port completely to reduce the air pressure of the equipment to less than 80% of the set point of compressor's load pressure.	In this case, the compressor goes offline and runs locally, and the "Emergency Forced Local" alarm will show. 
Pressure switch function	Disconnected the cables of pressure switch of 1# dryer or 2 # dryer, wait some time.	It can automatically switch to another side dryer.

6.2 Normal Running valve positions



1	Outlet Valve (Open)	2	Test terminal Valve (Closed)
3	Solenoid valve (Set as control)	4	Back feeding Valve (two valves) (Open)
5	Ball valve (Closed)	6	Test point valve (Open)
7	Flange Valve 01(two valves) (Open)	8	Flange Valve 02(two valves) (Open)
9	Drain Valve (Open)		

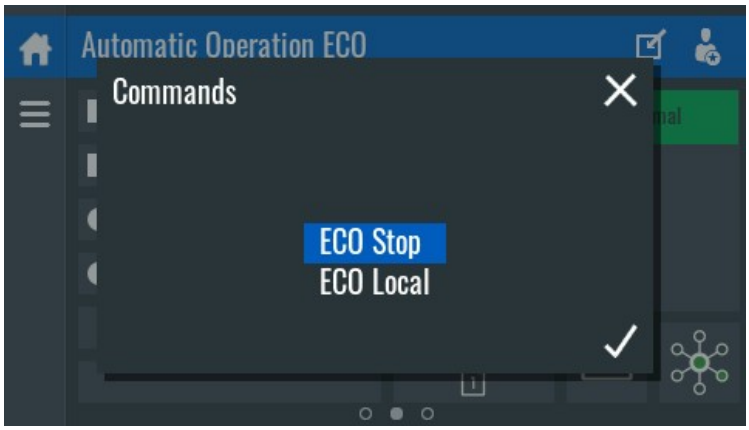
6.3 Service check

Refer to 7.2.5 Preventive maintenance schedule for service check

Procedure for stopping the PMA dryer

To stop the PMA unit, proceed as follows:

1. Switch ECO to “ECO Stop”, so that compressors will stop gradually.



2. When all of the compressors stop, close the inlet valve (between the air receiver and the PMA) and the outlet valve (between the PMA and the medical gas pipeline).
3. Let the unit operate for a period without consumption, then depressurize through the maintenance side vent nozzle.
4. Cut off the power to stop the PMA unit.

Procedure for individual dryer

1. Pls refer to 8.1.1 General preparing process for maintenance procedure to stop the individual dryer.

	If the PMA unit need be offline for a long period, must keep the external inlet and outlet valve closed to avoid moisture from entering the unit. No compressed air be allowed to flow through the unit under any circumstances when the electrical power is switched off. If happen, it will result in failure of the desiccant material, causing regeneration will no longer be possible.

7 Maintenance

7.1 Service agreement

Description

	Since all service and maintenance have to be done by properly certified and trained service personnel, it is strongly advised to consider a service agreement.

BeaconMedaes Customer have a range of service agreements to suit your needs:

Contact your Customer Centre to set up a tailor-made service agreement. It will ensure optimum operational efficiency, minimize downtime and reduce the total life cycle costs.

7.2 Maintenance instructions

7.2.1 General

The dryer need maintenance according to maintenance schedule.

However, the scheduled performance and service life may decrease if liquid water or particles enter the unit. Therefore, correct maintenance of the water separator and the filters is crucial.

7.2.2 Safety precautions

	Maintenance must be done by trained and certified service personnel. Use only authorized genuine parts. Check the correct operation after maintenance.
	Only disconnect the electrical power supply of the maintained side before any installation or maintenance works.

Before carrying out any maintenance or corrective activity, apply the following recommendations and safety precautions:

1. Select “Switch Dryers” to the non-maintenance side purification system in this dual system.

Figure 92

2. Switch off the power of the dryer which needs to be maintained. (see Service diagram in documents pouch).
3. Isolate the components which need to maintain and depressurize the system with vent nozzle before maintaining any components, refer to 8.1.1 general preparing process for maintenance.
4. WARNING! It is essential that only genuine BeaconMedaes spare parts are fitted during maintenance.
   Consult the Spare Parts List for part numbers. For preventivemaintenance, dedicated Service kits are available.
5. Check all connections are tight.
6. Select “Switch Dryers” on controller to start the dryer of the maintenance side. Ensure there is no leaks and the dewpoint reaches -51 ˚C.

7.2.3 Warranty-Product Liability

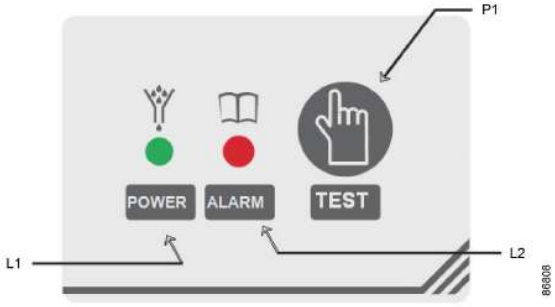
	Use only authorized parts. Any damage or malfunction caused by the use of unauthorized parts isnot covered by Warranty or Product Liability.
	Any damage or malfunction caused by bad maintenance is not covered by Warranty or Product Liability.

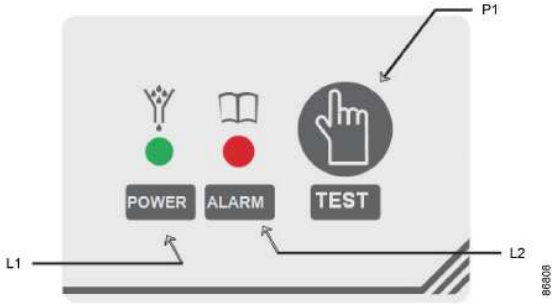
7.2.4 Service kits

For overhauling or carrying out preventive maintenance, service kits are available for the desiccant and the filters (see section Service kits).

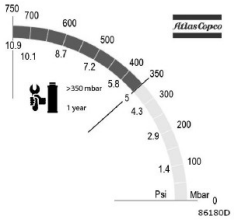
7.2.5 Preventive maintenance schedule

	Carry out following operations at the interval (period or running hours) which comes first. The longer interval checks must also include the shorter interval checks.
	The local Customer Centre may overrule the maintenance schedule depending on the environmental and working conditions of the unit.

	Maintenance Activities	Maintenance Interval	Maintenance Kits Available
Site engineer			
1	**Dryer - Check power LED** • Check if power LED is green, green means dryer is power up	**Daily**	
2	**Dryer - Check control panel indicators** • Check if alarm indicator is red lightened or not, if it's lightened, consult section Problem solving. 	**Daily**	
3	**IWD - Visual check and function verification** • Check that no alarm is displayed on the service panel of the IWD and that oil/water aerosols and/or solid particles are discharged via drain outlet. The amount depends on the operating conditions.  Reference / Description L1 — Green LED, Power status indicator L2 — Red LED, Alarm indicator P1 — Multifunctional test button	**Daily**	
4	**All safety equipment is in good working order.** • Check safety valve is in normal condition, check the relief outlet is not blocked	**Weekly**	
5	**All hoses, cables, wiring, pipes are in good condition, secure and not rubbing.**	**Weekly**	
7	**Check the service indicator of UD+ filter, PDP+ filter, replace the filter if necessary²**	**Weekly**	

<table>
<tr><td>8</td><td>Check the water level of the bottle (Option) which in the small cabinet is above “Min” line, if it’s below “Min” line, need add water into the bottle.
 
</td><td>Weekly</td><td></td></tr>
<tr><td>9</td><td>Record dryer dew point, pressure and alarm</td><td>Weekly</td><td></td></tr>
<tr><td>10</td><td>Dates of filters, and desiccant recorded</td><td>Weekly</td><td></td></tr>
<tr><td>11</td><td>Record dryer dew point</td><td>Weekly</td><td></td></tr>
<tr><td>12</td><td>OSC - check turbidity of outlet water weekly</td><td>Weekly</td><td></td></tr>
<tr><td>13</td><td>Test dryer operation</td><td>Monthly</td><td></td></tr>
<tr><td colspan="2">Pharmacists check</td><td></td><td></td></tr>
<tr><td>14</td><td>Verify air quality delivered by the unit at regular intervals to guarantee correct usage in correspondence to the applicable legislation. Records of these measurements must be kept by the user</td><td>3 months</td><td></td></tr>
<tr><td colspan="2">PPM service visits</td><td>3 months</td><td></td></tr>
<tr><td>15</td><td>All fasteners are tight.</td><td>3 months</td><td></td></tr>
<tr><td>16</td><td>Check IWD condition
• Inspect the condensate drain for external damages and leaks.
• Check the operating state of the condensate drain by means of the LED displays on the control panel.
Push the TEST button in order to verify the operating status of the discharge and the correct operation of the valve.
 

<table>
<tr><th>Reference</th><th>Description</th></tr>
<tr><td>L1</td><td>Green LED
Power status indicator</td></tr>
<tr><td>L2</td><td>Red LED
Alarm indicator</td></tr>
<tr><td>P1</td><td>Multifunctional test button</td></tr>
</table></td><td>3 months</td><td></td></tr>
<tr><td>17</td><td>Check if flexible pipes have signs of wear and leaks or not, if they have, then need to replace pipe.</td><td>3 months</td><td></td></tr>
<tr><td>18</td><td>Check for possible leaks</td><td>3 months</td><td></td></tr>
<tr><td>19</td><td>Dates of filters, and desiccant recorded, if date is up then need to change the filters or desiccant.</td><td>3 months</td><td></td></tr>
<tr><td>20</td><td>Pressure gauges and differential gauges check and found satisfactory
• Check whether pressure drop below 350 mbar, if it’s above 350 mbar need replace the filter element.</td><td>3 months</td><td></td></tr>
</table>

	 		
21	**Drainage traps checked for correct operation. Replaced / repaired as necessary.** • By open the ball valve to check if there is water discharged.	**3 months**	
22	**Visible electrical connections checked for damage and overheating**	**3 months**	
23	**Check if water level indicator of Oil / water separator reached red or not. (Option)[3] · If yes, replace the OSC cartridge.**	**3 months**	
24	**Test dryer operation** water level indicator reached red • Refer to 6.1.3 Commissioning test- Switch dryer to test	**3 months**	
25	**Record dryer run hours**	**3 months**	
26	**Record dryer dew point**	**3 months**	
27	**Test dryer dew point sensor and 'Dew Point Fault' alarm by simulating fault.** • Refer to 6.1.3 Commissioning test-Plant Emergency to test	**3 months**	
28	**Check all electrical connections for security and visually inspect cables**	**3 months**	
29	**Check dryer inlet solenoid operation** • Refer to 6.1.3 Commissioning test- Switch dryer to test	**3 months**	
30	**Check the operation of sensors.** • Check the sensor cable is not loose and damaged. • Check all readings on screen for errors	**1 Year**	
31	**Replace QD+ filter element , refer to 8.6 UD+ and PDp+, QD+, HOC filter change**	**0.5 Year[1][2][5]**	**1yr Service Kit**
32	**Replace whole IWD, refer to 8.10 IWD maintenance**	**1 Year[1][5]**	
33	**Replace UD+ filter element, refer to 8.6 UD+ and PDp+, QD+, HOC filter change**	**1 Year[2][5]**	
34	**Replace PDp+ filter element, refer to 8.6 UD+ and PDp+, QD+, HOC filter change**	**1 Year [2][5]**	
35	**Replace Dryer Kit filter and silencer, refer to 8.7 Dryer's desiccant cartridge and other service parts change**	**1 Year [5]**	
36	**Replace OSC filter element (Option), refer to 8.9 OSC filter maintenance**	**1 Year [3][5]**	
37	**Replace QDT+ filter element (only for PMA XL2), refer to 8.11 QDT+ filter maintenance**	**1 Year [3][5]**	
38	**Replace Dewpoint sensor**	**2 Years [5]**	**PDP Sensor**
39	**Replace CO, CO/O2, CO/O2/CO2 sensor (Option)**	**2 Years [5]**	
40	**Replace Dryer Kit inlet, outlet, exhaust valve, refer to 8.7 Dryer's desiccant cartridge and other service parts change**	**3 Years[5]**	**Dryer Desc-Valve Kit**
41	**Replace Dryer desiccant, refer to 8.7 Dryer's desiccant cartridge and other service parts change**	**3 Years [5]**	
42	**Replace HOC filter (Option), refer to 8.6 UD+ and PDp+, QD+, HOC filter change**	**2 Years[5]**	
43	**Replace check valve of test point terminal**	**5 Years[5]**	
44	**Replace Safety valve[4], refer to 8.2 Safety valve change**	**5 Years[4]**	**PRV Kit**
45	**Replace Regulators, refer to 8.5 Regulator change**	**5 Years[5]**	**Regulator Kit**

(1) The QD+ Filter must be replaced every 2000 running hours or every 6 months, whichever comes first.

(2) All filters must be replaced if the pressure drop reaches 0.35 bar (5psi).

(3) OSC must be replaced when water level indicator reached red.

(4) This is 5 years from certification date, not installation.

(5) This service period starts from the delivery date.

	The lifetime of the desiccant is related to the operating conditions. The scheduled lifetime is only valid when operating in reference working conditions. If the desiccant becomes contaminated due to more severe operating conditions, it will have to be replaced earlier. It is recommended to have the desiccant replaced by a qualified service technician.

7.3 Service kits

Service kits

Service kits are available, offering the benefits of genuine parts while keeping the maintenance budget low. The kits comprise all parts needed for servicing.

A complete survey of available service kits is given in the Spare Parts Book.

Below is a schedule of service kits required based on the Maintenance Activities:

	Quantity of each kit required (Standard Unit)														
Kit Name	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**	**Year 11**	**Year 12**	**Year 13**	**Year 14**	**Year 15**
1yr Sys Kit	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Dew point Sensor		1		1		1		1		1		1		1	
Dryer Desc-Valve Kit [1]			2			2			2			2			2
PRV Kit[1]					2					2					2
Reg. Kit [1]					2					2					2

	Quantity of each kit required for Options (If your system is equipped)														
Kit Name	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**	**Year 11**	**Year 12**	**Year 13**	**Year 14**	**Year 15**
OSC Filter	1	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
CO, CO/O2 or CO/O2/CO2 sensor		**1**		**1**		**1**		**1**		**1**		**1**		**1**	
HOC Filter[1]		**2**		**2**		**2**		**2**		**2**		**2**		**2**	

Please consult your Spare Parts Book for the specific part # and kits based on the model and operating pressure of your unit(s).

Warning

	The service kits must be installed by trained and certified personnel.

7.4 Long-term storage before commissioning

Warning

	It is forbidden for the dryer adsorbent associated channel to be directly connected with the atmosphere! The air inlet and air outlet of the unit need to be closed. And the VCI bag of the machine need keep the original packaging(see below picture). When the storage period exceeds three months, activation operation is required for the first startup to activate the adsorption capacity (see **6.11 Start up after long-term storage**) And when the storage period exceeds two years, the dewpoint sensor needs to be replaced with a new one. More details refer the 4107951695-“LONG-TERM STORAGE OF MEDICAL GAS EQUIPMENT”.

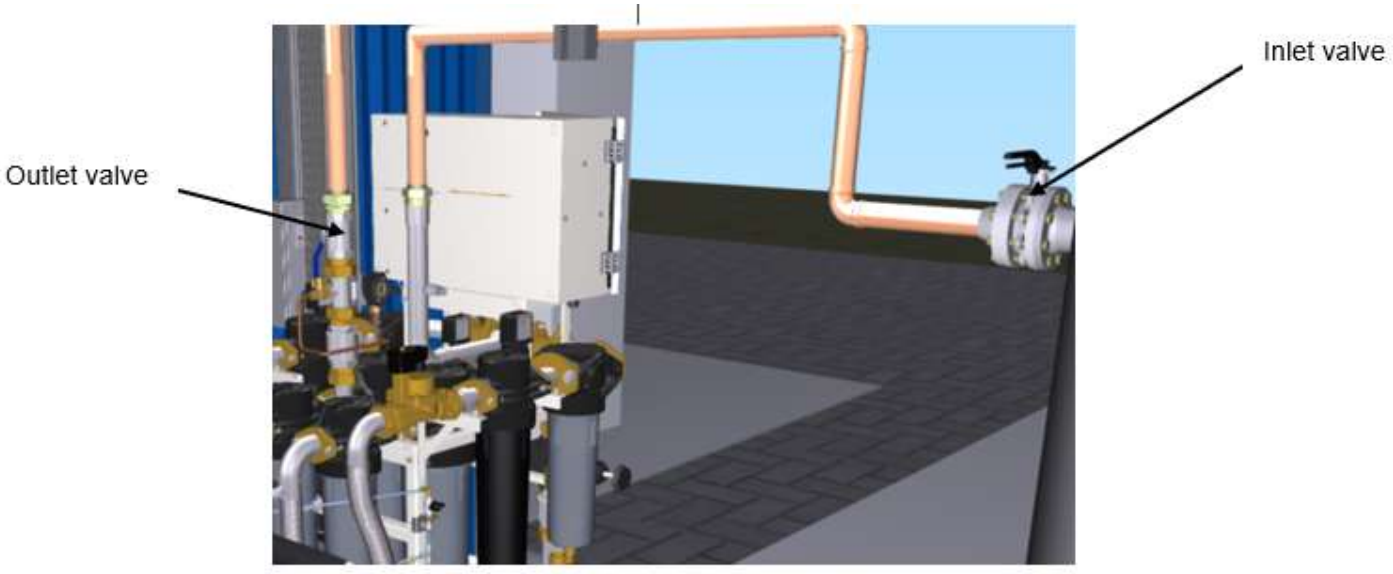


Figure 93 The air inlet and air outlet of the unit

Figure 94 VCI bag of the machine

7.5 Disposal of used material

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

8 Adjustments and servicing procedures

8.1 System Maintenance Operations

8.1.1 General preparing process for maintenance

1. Make sure the dryer of the maintenance side is not running, if it's running you can select "switch dryers" in controller. Refer to Figure 94.
2. Close the flange valves 1&2 and back feeding valves of the maintenance side. Refer to Figure *95*.
3. Depressurize through the maintenance side vent nozzle (the running side vent nozzle should keep closed).
4. Then disconnect the power supply cable of the dryer of the maintenance side refer to electrical diagram in random file.

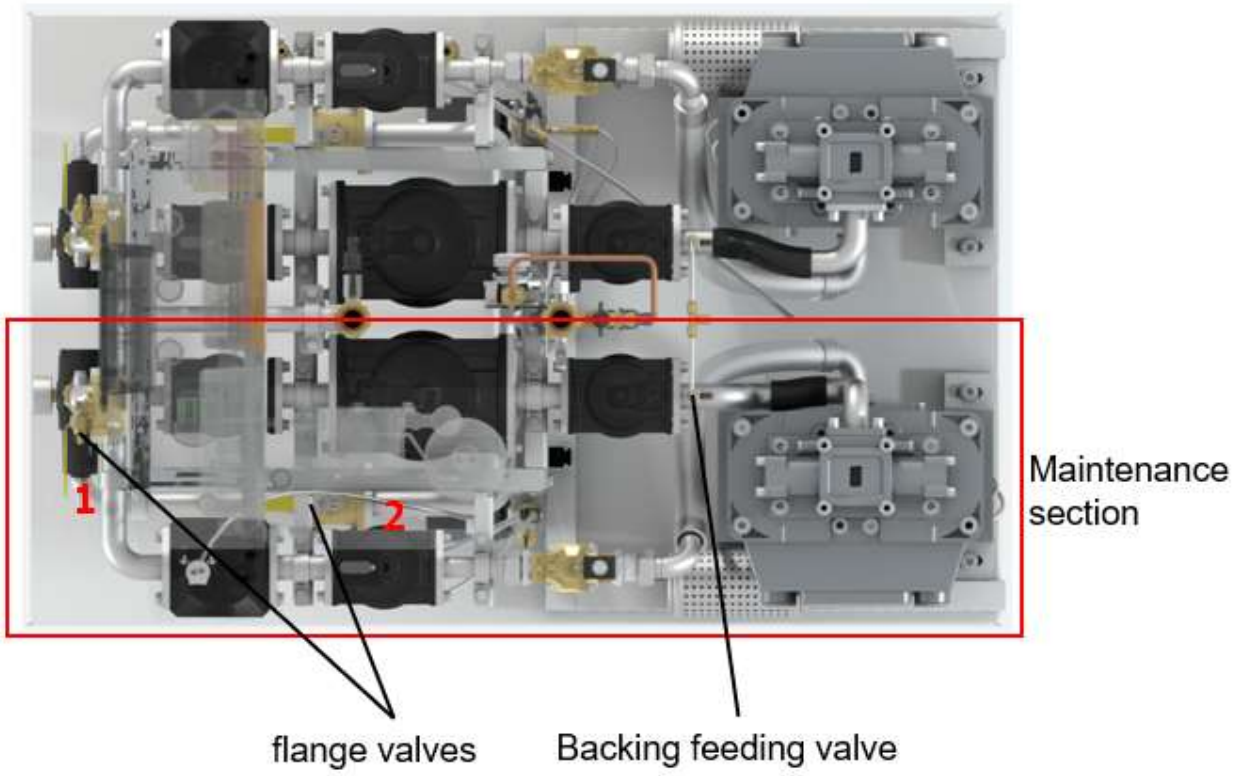


Figure 95 Layout of PMA

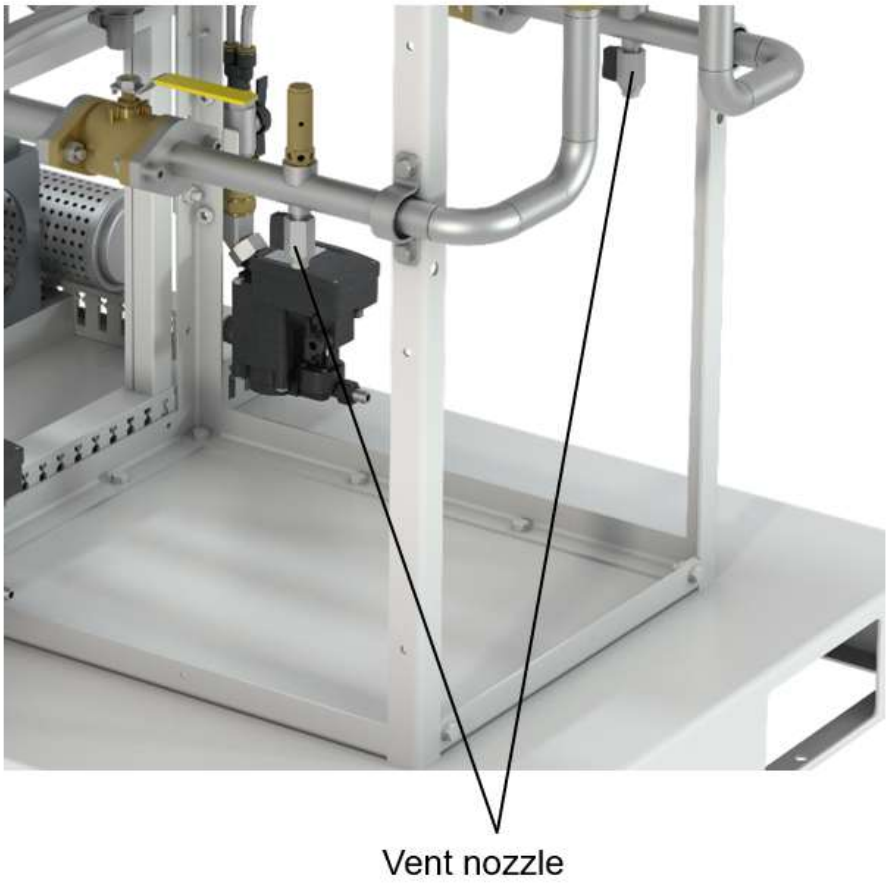


Figure 96 Vent position of two sides

Figure 97 Select switch dryers

8.1.2 Reinstating process

1. Maintain the flange valve 1 of the maintenance side closed. Refer to Figure 95.
2. Open the flange valve 2 of the maintenance side. Refer to Figure 95.
3. Restore power supply of the dryer of the maintenance side.
4. Check all connections are tight.

5. Local start the dryer of the maintenance side by press  button on the dryer's own controller.
6. Ensure there is no leaks and the dewpoint reaches -51 ˚C, bypass air that has not reached the dew point by vent nozzle.
7. If units are offline for over 3 months, pls refer to **6.1.2 Start up after long-term storage** to active desiccant.
8. Open the flange valve 1 and back feeding valves of the maintenance side.
9. Select "Switch Dryers" on controller to switch to the dryer of the maintenance side.

8.2 Pressure sensor change

1. Closed ball valve to isolate sensor.
2. Replace sensor with new one.
3. Open the ball valve.
4. Check pressure value on controller panel. See Figure 99.

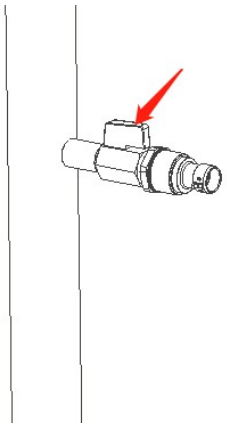


Figure 98

Figure 99

8.3 Pressure gauge change

1. Refer to 8.1.1 General preparing process for maintenance.
2. Replace pressure gauge with new one.
3. Restore installation.
4. Refer to **8.1.2 Reinstating process.**

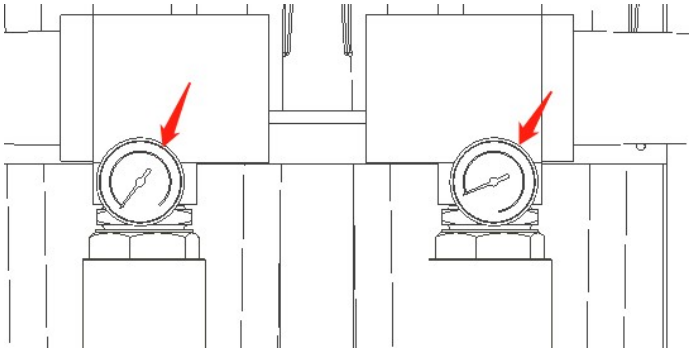


Figure 100

8.4 Safety valve change

Procedure

1. Refer to 8.1.1 General preparing process for maintenance.
2. Replace safety valve with new one.
3. Restore installation.
4. Refer to **8.1.2 Reinstating process.**

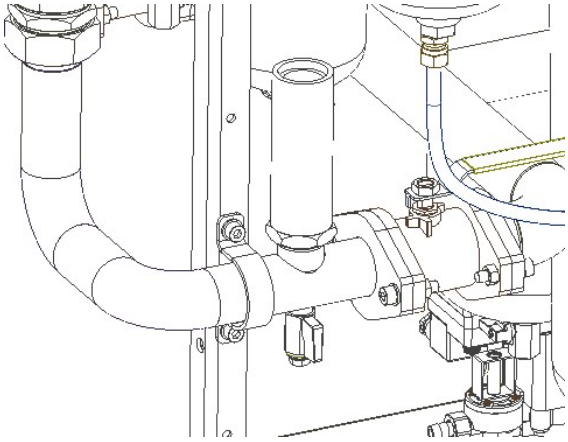


Figure 101

8.5 Regulator change

Procedure

1. Refer to 8.1.1 General preparing process for maintenance.
2. Unscrew union joints, remove pipe clamp and disconnect the flange to fully remove the pipe under the regulator refer to *Figure 102*.
3. Take off regulator assembly.
4. Replace regulator with new one.
5. Restore installation.
6. Vent valve open a little, refer to figure 96;
7. Open the inlet flange valve (refer to *Figure 95* flange valve 1) to apply pressure to the regulator. Slowly turn the handle to adjust to the proper outlet pressure (Anticlockwise turn to reduce the outlet pressure, clockwise turn to increase the outlet pressure), adjust different output pressure 4/7/10 bar according to different product, set the regulator output settings as per the below table depending on the dryer model.

Nominal line pressure	Static set pressure between
4 bar	4.6-4.8
7 bar	8.0-8.5
10 bar	11.0-11.5

5. Close vent valve then refer to **8.1.2 Reinstating process** to bringing the system back online.

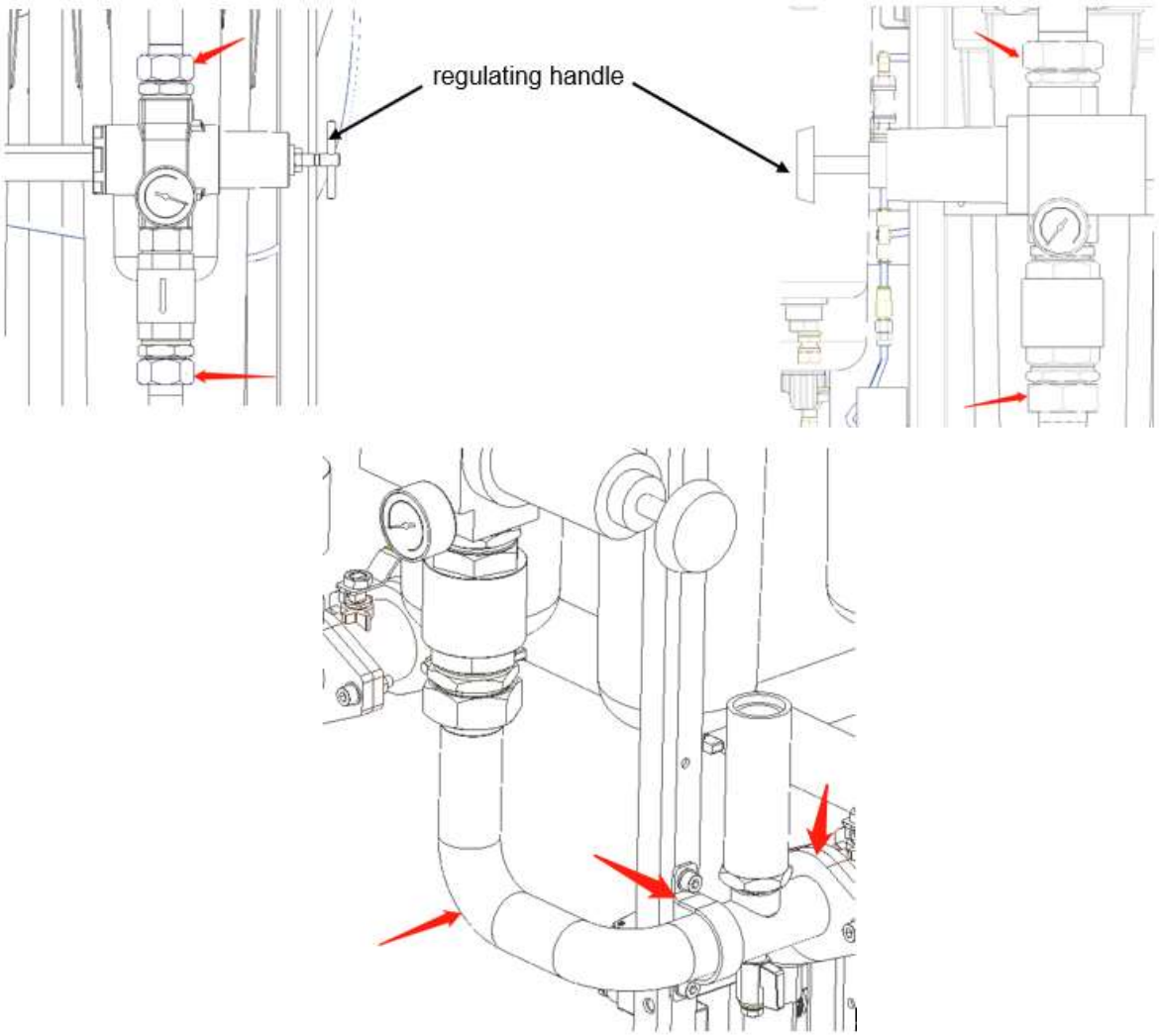


Figure 102

8.6 UD+ and PDp+, QD+, HOC filter change

Filter

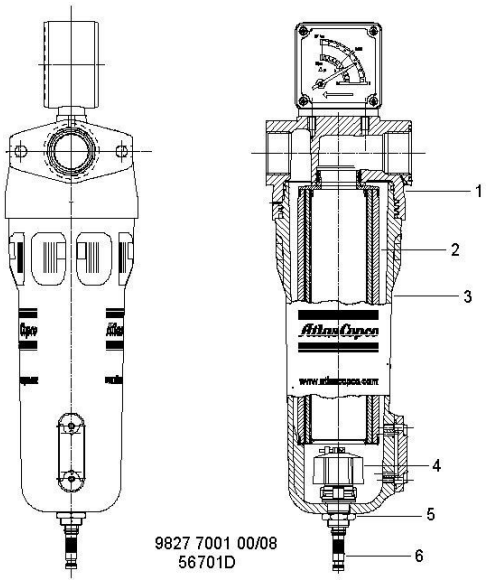


Figure 103

Procedure

Following procedure is valid for the UD+, QD+ and PDp+, HOC filters:

1. Isolate the filter according to the isolation ball valve of PMA unit.
2. Depressurize the filter by turning the connection nipple (6) of the automatic drain valve anti- clockwise.
3. Unscrew the bowl (3). A whistling noise will warn you if the bowl is not fully depressurized. If this occurs, the bowl should be screwed back and the venting should be repeated.
4. Discard the filter element (2).
5. Remove the O-ring from the bowl and clean the bowl. Position a new O-ring on the bowl.
6. Reinstall the drain valve in the bowl using the retaining nut.
7. Reposition the new filter element with the new O-rings. Apply a small amount of water-based lubricant (supplied in the cleaning kit) on the O-ring and on the thread of the bowl.
8. Screw the bowl completely on the filter head (1).

Warning

	To ensure that the unit always produces pharmacopoeia compliant air, only genuine BeaconMedaes spare parts must be used. Consult the spare parts list for part number information.
	The installation and maintenance must be done by trained and certified personnel.

Note

	When replacing the catalyst, make sure that the catalyst is disposed of according to the local regulations.

8.7 Dryer's desiccant cartridge and other service parts change

	Ensure shutdown and start up procedures are followed prior to carrying out any maintenance work on the dryer

Process for maintenance of Desiccant cartridge and other service parts of dryer

Steps:

1. Refer to section 8.11 **General preparing process for maintenance.**
2. Please refer to 4109992719, 4109992720 and 4109992721 dryer service instruction and Maintenance video.
3. Refer to 8.12 **Reinstating process.**

Maintenance information leaflet is provided with each desiccant cartridge replacement kit.

Warning

	To ensure that the unit always produces pharmacopoeia compliant air, only genuine BeaconMedaes spare parts must be used.
	The installation and maintenance must be done by trained and certified personnel.

Pharmacopoeia compliance

	When replacing desiccant, make sure that the desiccant is disposed of according to the local regulations. Consult the parts list for part numbers.

	After carrying out any maintenance or repair work, Pharmacopoeia testing must be done by a local testing company to assure reliable and correct operation of the unit.

8.8 Testing the electronic drain valve

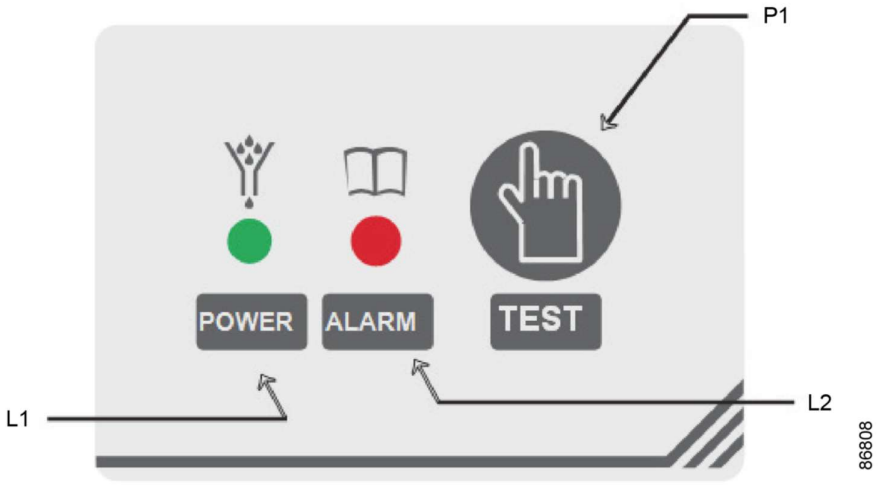


Figure 104
Control buttons of IWD

Reference	Description
L1	Green LED Power status indicator
L2	Red LED

	Alarm indicator
P1	Multifunctional test button

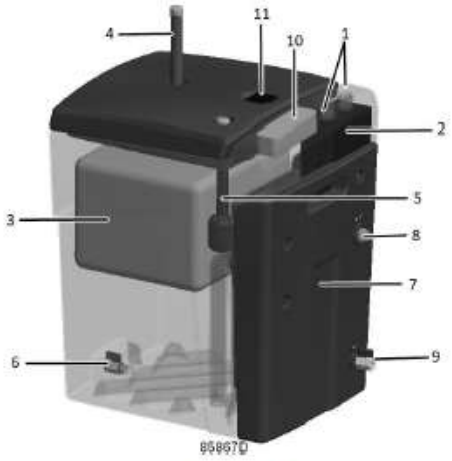
Functional test

Briefly press the TEST button and check that the valve opens for condensate discharge.

Check the alarm signal

- Close the condensate inlet.
- Press the TEST button for at least 1 minute.
- Check that the alarm LED (red) flashes.
- Check that the alarm signal is being relayed (if connected). Release the TEST button and reopen the condensate inlet after the test.

8.9 OSC filter maintenance



OSC 170

1	Condensate inlet
2	Mufflers
3	Oleophilic filters (first stage)
4	Service indicator (oleophilic filter)
5	Service indicator (unit clogged)
6	Drain
7	Activated carbon/organoclay filter (second stage)
8	Condensate outlet
9	Test valve
10	Diffuser
11	Test capsule storage compartment

Service Procedure

- Open the test valve (9) and empty the cartridge into a bucket. Drained condensate can be poured back into the housing later.
- Remove the screws of the cartridge and pull it away from the housing. It is not required to lift the cartridge of OSC 625 – OSC 2500 as they are provided with wheels.

- Remove the ball valve at test outlet and place it to the new cartridge.
- Remove the plugs from the new cartridge and place them to used one. This would make the

used cartridge leak tight.

- Place the cartridge near housing close to housing almost at installation location but enough

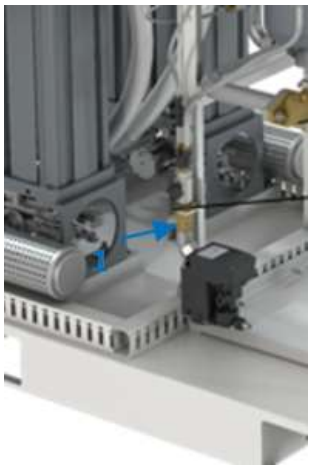
gap to fill the new cartridge with clean water. Start filling the cartridge till the water starts flowing out of the condensate outlet.

- Push the cartridge into the housing and secure it with screws.
- Pour back the drained condensate in the first step into the housing.
- Fill the housing with clean water till water starts flowing out of condensate outlet.
- Inspect for leaks at the connection between housing and cartridge.
- Go back to replacement instructions for oleophilic filters in section Maintenance.

	•If the filters are not installed properly, oil-containing condensate can leave the OSC. • When new activated carbon filters are placed, the outgoing water may initially look black (caused by carbon dust). This is not harmful. • Each new filter is provided with a label. The correct position is marked on the label. • Used filters can be heavy. • See to it that no condensate comes into contact with eyes, mouth, etc.

8.10 IWD maintenance

1. Refer to 8.1.1 General preparing process for maintenance.
2. Unscrew connector (see below picture, no 1), take off IWD assembly.
3. Replace IWD with new one.
4. Restore installation.



8.11 QDT+ filter maintenance (only for PMA XL2)

Service

	Change the QDT+ filter element yearly or every 4000 hours, whichever comes first. Its pressure drop will not increase during its useful life. Nevertheless, the adsorption element must be changed earlier at the first signs of oil vapour and odour.

Procedure

1. Refer to 8.1.1 General preparing process for maintenance.
2. Isolate the filters from the air net.
3. Depressurize the QDT+ filter by means of the U+ filter drain.
4. Uncouple the pipe at the inlet flange.
5. Unscrew the head.
6. Remove the spring and the perforated plate.
7. Remove the filter bag(s).
8. Clean the extrusion and heads with a dry clean cloth.
9. Place a new filter bag inside the extrusion. The label “This side up” must be at the top of the bag.
10. Replace the O-ring in the head (and between the heads).
11. Reposition the perforated plate and spring.
12. Screw the head completely on the extrusion.
13. Torque the bolts with 40 Nm.
14. Connect the head and flange at the inlet of the filter. Replace the O-ring between the flange and the head.
15. Slowly pressurize the filters.
16. Check for leaks.

A small amount of water-based lubricant (supplied in the cleaning kit) may be applied to screw threads and O-rings to facilitate the assembly.

Traceability
The catalyst and activated carbon bags are labeled with production date, batch number and part number.

Warning

	To ensure that the unit always produces pharmacopoeia compliant air, only genuine BeaconMedaes spare parts must be used.
	The installation and maintenance must be done by trained and certified personnel.

Note

	When replacing the activated carbon and catalyst, make sure that the activated carbon and catalyst are disposed of according to the local regulations.

9 Problem solving

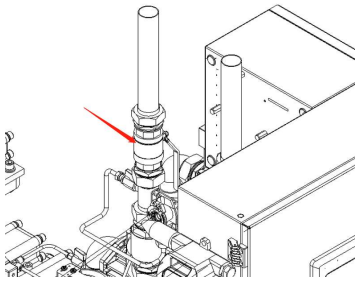


Figure 105

Outlet valve

	Use only authorised genuine parts. Any damage or malfunction caused by the use of unauthorised parts is not covered by Warranty or Product Liability. Apply all relevant.
	All valves, couplings and pipes used/installed after the unit must be free from oil and grease (hydrocarbon contamination < 550 mg/m^2) and dust (particles size < 50 micrometer).
	Before carrying out any maintenance or repair work on the PMA unit: make sure that the tower or unit is not active or under pressure and switch off the voltage of one section at a time and keep the other half running for most activities.

Faults and remedies, dryer unit

Condition	Fault	Remedy
The dryer produces a lot of noise	Check the silencers and their fixation	Replace the silencers if necessary or correct its fixation
The discharge valve continuously exhausts when the machine is restarted after the first startup or power failure or gas failure.	Failure to operate in accordance with the startup operation instructions	Please cut off the working power of the dryer and restart the dryer.
The exhaust solenoid valve continuously exhausts.	• The solenoid valve is faulty. • Controller failure. • Silencer jam causes discharge back pressure to increase	• Replace the solenoid valve. • Replace the controller. • Replace the exhaust muffler.
The drying effect of dryer is poor	• The inlet pressure is low. • The intake air temperature is high. • The intake air flow exceeds the rated value. • Improper treatment of air source, liquid water or excessive oil entering the dryer. • Desiccant failure.	• Check whether the pressure, temperature, flow and quality of the air supply meet the requirements. • Replace the desiccant. • Consult the manufacturer.
Poor Dewpoint	Dryer overload	• Check the difference between actual intake parameters and model selection.

		• Check the difference between environmental conditions and model selection
	Bypass valve open	Check that the bypass valve is fully closed
	The dryer has just started	Wait for the system to work for enough time
	Regeneration side back pressure>350mbar	Replace the exhaust silencer
	Timer failure	Contact service agents.
	Valve failure	Contact service agents.
	Desiccant reaches service life	Contact service agents.
Connection tubing leakage	Tubing ruptured or leaking	Replace worn parts
Instruction book missing or unreadable		Replace (contact your service engineer)
Data label	Not present or unreadable	Clean or replace (contact your supplier)

Faults and remedies, water separator (WSD)

For all references below, consult section Servicing the water separator drain.

Condition	Fault	Remedy
Condensate is not discharged from the separator	Discharge pipe clogged	Check and correct as necessary
	Drain valve of separator malfunctioning	Remove drain valve assembly, clean and check
	For separator with IWD (electronic water drain): IWD malfunctioning	Consult Manufacturer

Faults and remedies, filters

For all references below, consult section UD+ and PDp+ filter change.

Condition	Fault	Remedy
The filter produces a whistling noise	Filter bowl not correctly mounted	Fit the filter bowl correctly
Bad filtration	Filter element damaged Water in sight glass	Replace Check functioning of water separator (WSD)
Insufficient air leaves the filter	Filter clogged	Clean the filter bowl and replace the filter element

HOC filter(option)

Condition	Fault	Remedy
Too high CO concentration at outlet	Wet air from the dryer	Check proper functioning of the dryer Replace the desiccant at indicated intervals
	Too much CO at inlet	Check proper working conditions

Faults and remedies, ancillaries

Condition	Fault	Remedy
Low pressure to the dryer	• Electrical fault • Mechanical fault • Solenoid valve fault	• Check wiring • Replace defective parts
No pressure reading	Pressure sensor malfunction	Replace defective parts
Pressure sensors: error signal (no measurement)	• Electric connection interrupted • Mechanical damage (e.g. too high mounting torque) • Connection plugs not connected • Crack due to incorrect mounting • Internal defect • No supply voltage	• Check connections • Check sensors
Pressure sensors: too high or too low indication	• Condense on connection plugs • Faulty supply signal • Clogging or contamination • Sensor internally defect • Deviation due to ageing • Deviation due to incorrect production	• Check sensors • Replace defective parts
Outlet pressure too high or too low	Regulator wrong setting	• Check gauge of pressure regulator • Adjust regulator to adjust pressure
No dew point reading	Dew point sensor malfunction	Replace defective parts
Dew point sensor: no measurement (error signal)	No direct feedback of dew point	• Check connections • Check sensors
Dew point alarm too early or late	Incorrect measurement	• Check sensors • Replace defective parts

Faults and remedies, controller

Condition	Fault	Remedy
Doesn't read in pressure or dew point	Software fault	• Reprogram the controller • Check wiring
Doesn’t issue alarm(s) when it should	• Software fault • Connection fault between the controller and the control room display	• Reprogram the controller • Check wiring
Doesn't issue service warnings when it should	Software fault	Reprogram the controller
Keeps exhaust valves closed (for purge of dryer)	• Software fault • Communication fault • pilot line circuit fault	• Reprogram the controller • Check wiring • Check solenoid • Check pilot line circuit

10 Technical data

10.1 Fuse values

Attention

	The indicated fuse value is the maximum value. The cable size used may specify fuses of a lower value.

Values

	Frequency	Voltage	Fuse specification	Maximum fuse value
IEC	50/60 Hz	110V/230 V	gL/gG	4 A

10.2 Electric cable size

	Frequency	Voltage	Minimum cable size
IEC	50/60 Hz	110V/230 V	3 x 1.5 mm²

10.3 Device settings

Regulating

The regulator is factory-adjusted to obtain optimum performance of the dryer. The regulator may drift over time, so may need to be checked and adjusted on site.

10.4 Performance data and limitations

Performance data

	Units	
Compressed air inlet pressure	bar(e)	See Technical data
Compressed air inlet pressure	psig	See Technical data
Compressed air to dryer inlet temperature	˚C	37
Compressed air to dryer inlet temperature	˚F	98.6
Reference ambient temperature	˚C	20
Ambient temperature	˚C	1 to 40
Ambient temperature	˚F	33.8 to 104
Inlet relative air humidity	%	95

Limitations

Inlet limitations:	**Units**	
Dryer inlet pressure	bar(e)	13 bar inlet@10bar outlet
Dryer inlet pressure	bar(e)	10 bar inlet@7bar outlet
Dryer inlet pressure	bar(e)	7bar inlet@4bar outlet
Outlet limitations:		
Minimum Atmosphere dew point	°C	-46

Minimum Atmosphere dew point	°F	-50.8
Maximum concentration of contaminants of PMA outlet:		
O_2 concentration	%	20 < x < 22
CO concentration	ppm	5
CO_2 concentration	ppm	500
SO_2 concentration	ppm	1
NO_x concentration	ppm	2
Water vapour amount	mg/L	0.05
Oil vapour amount	mg/m^3	0.1

10.5 Technical data

Data at 7 bar inlet pressure @20 ˚C ambient temperature

	Unit	PMA-S1	PMA-S2	PMA-S3	PMA-S4	PMA-M1
Max. Volume flow at dryer inlet	l/min	300	550	859	1150	1650
Max. Volume flow at dryer inlet	cfm	10.59	19.42	30.33	40.61	58.26
Purge loss	%	16	16	16	16	16
Max. Volume flow at dryer outlet	l/min	252	462	721.5	966	1386
Time of half a cycle	s	60	60	60	90	90
Regeneration time	s	45	45	45	70	70
Pressurization time	s	15	15	15	20	20
Installed power	W	176	176	176	176	176
Net mass	kg	168	180	192	234	276
Net mass	lb	370	396	423	515	608

	Unit	PMA-M2	PMA-M3	PMA-L1	PMA-L2	PMA-L3
Max. Volume flow at dryer inlet	l/min	2000	2300	3300	4000	6200
Max. Volume flow at dryer inlet	cfm	70.62	81.22	116.53	141.25	218.95
Purge loss	%	16	16	16	16	16
Max. Volume flow at dryer outlet	l/min	1680	1932	2772	3360	5208
Time of half a cycle	s	90	90	90	90	90
Regeneration time	s	70	70	70	70	70
Pressurization time	s	20	20	20	20	20
Installed power	W	176	176	176	176	176
Net mass	kg	290	302	451	487	569
Net mass	lb	639	665	994	1073	1254

	Unit	PMA-XL1	PMA-XL2			
Max. Volume flow at dryer inlet	l/min	8520	8520			
Max. Volume flow at dryer inlet	cfm	301	301			
Purge loss	%	16	16			

Max. Volume flow at dryer outlet	l/min	7157	7157			
Time of half a cycle	s	180	180			
Regeneration time	s	150	150			
Pressurization time	s	30	30			
Installed power	W	176	176			
Net mass	kg	850	880			
Net mass	lb	1870	1936			

Data at 10 bar inlet pressure @20 ˚C ambient temperature

	Unit	PMA-S1	PMA-S2	PMA-S3	PMA-S4	PMA-M1
Max. Volume flow at dryer inlet	l/min	414	759	1186	1587	2277
Max. Volume flow at dryer inlet	cfm	14.6	26.8	41.8	56.0	58.2
Purge loss	%	16	16	16	16	16
Max. Volume flow at dryer outlet	l/min	347.8	637.6	996.2	1333.1	1912.7
Time of half a cycle	s	60	60	60	90	90
Regeneration time	s	45	45	45	70	70
Pressurization time	s	15	15	15	20	20
Installed power	W	176	176	176	176	176
Net mass	kg	168	180	192	234	276
Net mass	lb	370	396	423	515	608

	Unit	PMA-M2	PMA-M3	PMA-L1	PMA-L2	PMA-L3
Max. Volume flow at dryer inlet	l/min	2760	3174	4554	5520	8556
Max. Volume flow at dryer inlet	cfm	80.4	112.0	160.8	194.9	302.1
Max. Volume flow at dryer outlet	l/min	2318.4	2666.2	3825.4	4636.8	7187.0
Purge loss	%	16	16	16	16	16
Time of half a cycle	s	90	90	90	90	90
Regeneration time	s	70	70	70	70	70
Pressurization time	s	20	20	20	20	20
Installed power	W	176	176	176	176	176
Net mass	kg	290	302	451	487	569
Net mass	lb	639	665	994	1073	1254

	Unit	PMA-XL1	PMA–XL2			
Max. Volume flow at dryer inlet	l/min	11040	11040			
Max. Volume flow at dryer inlet	cfm	391	391			
Max. Volume flow at dryer outlet	l/min	9274	9274			
Purge loss	%	16	16			
Time of half a cycle	s	180	180			
Regeneration time	s	150	150			
Pressurization time	s	30	30			
Installed power	W	176	176			
Net mass	kg	850	880			
Net mass	lb	1870	1936			

Data at 13 bar inlet pressure @20 ˚C ambient temperature

	Unit	PMA-S1	PMA-S2	PMA-S3	PMA-S4	PMA-M1
Max. Volume flow at dryer inlet	l/min	525	963	1503	2013	2888
Max. Volume flow at dryer inlet	cfm	18.5	34.1	53.1	71.1	102

Purge loss	%	16	16	16	16	16
Max. Volume flow at dryer outlet	l/min	441	809	1263	1691	2426
Time of half a cycle	s	60	60	60	90	90
Regeneration time	s	45	45	45	70	70
Pressurization time	s	15	15	15	20	20
Installed power	W	176	176	176	176	176
Net mass	kg	168	180	192	234	276
Net mass	lb	370	396	423	515	608

	Unit	**PMA-M2**	**PMA-M3**	**PMA-L1**	**PMA-L2**	**PMA-L3**
Max. Volume flow at dryer inlet	l/min	3500	4025	5775	7000	10850
Max. Volume flow at dryer inlet	cfm	123.6	142.1	203.9	247.2	383.2
Purge loss	%	16	16	16	16	16
Max. Volume flow at dryer outlet	l/min	2940	3381	4851	5880	9114
Time of half a cycle	s	90	90	90	90	90
Regeneration time	s	70	70	70	70	70
Pressurization time	s	20	20	20	20	20
Installed power	W	176	176	176	176	176
Net mass	kg	290	302	451	487	569
Net mass	lb	639	665	994	1073	1254

	Unit	**PMA-XL1**	**PMA–XL2**			
Max. Volume flow at dryer inlet	l/min	13980	13980			
Max. Volume flow at dryer inlet	cfm	494	494			
Max. Volume flow at dryer outlet	l/min	11743	11743			
Purge loss	%	16	16			
Time of half a cycle	s	180	180			
Regeneration time	s	150	150			
Pressurization time	s	30	30			
Installed power	W	176	176			
Net mass	kg	850	880			
Net mass	lb	1870	1936			

The dryer inlet pressure and ambient temperature will affect the dryer flow capacity. When the actual inlet pressure or ambient temperature differs from the reference condition, for example, the ambient temperature is higher than **20 ˚C**, the dryer volume flow capacity will decrease, and if the inlet pressure is lower than which shows in nameplate, it will affect the dryer drying capacity, detail data please see the data in TDS. More information, consult BeaconMedæs.

11 European Directives

11.1 Instructions for Use

Instructions

	Description
1	The dryers can contain pressurized air. This can be potentially dangerous if the equipment is misused.
2	The towers of the dryer consist of an extruded profile, which must only be used as a compressed air vessel and must be operated within the limits specified. See section Pressure equipment directives, table A.
3	No alterations must be made to the vessels by welding, drilling or other mechanical methods without the written permission of the manufacturer.
4	The design pressure and temperature of this pressure bearing part must be clearly indicated on the data label.
5	If installed, the safety valve must correspond with pressure surges of 1.1 times the maximum allowable operating pressure. This should guarantee that the pressure will not permanently exceed the maximum allowable operating pressure of the vessel.
6	Original bolts have to be used after opening for inspection. The maximum torque has to be taken into consideration (see table below).

Maximum bolt torque

Thread size	Tightening torque (Nm)	Allowed deviation (Nm)
M3	1	0.3
M4	2.4	0.6
M5	5	1.2
M6	8	2.1
M8	20	5
M10	41	10
M12	73	18
M14	115	29
M16	185	46
M18	238	60
M20	335	84

11.2 Pressure equipment directives

Components are subject to Pressure Equipment Directive 2014/68/EU.

Parts of article 4.3 of 2014/68/EU are subject to Sound Engineering Practice (SEP).

Parts of category I according to 2014/68/EU are integrated into the machine and fall under theexclusion of article I, section 2-(f)-(i).

Recommendation of the manufacturer for the re-inspection time

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

- Every 6 months: visual check of the vessel material on the outside (exposed) for traces ofstrong corrosion. Consult the service department of your supplier if necessary.
- Every 3 years: when replacing the desiccant, following inspections are to be carried out:
  - Inspection of outside and inside of the material for excessive and local corrosion,
  - Inspection of outside and inside of the material for fissures, leaks, damage. Consult theservice department of your supplier if necessary.
- Every 10 years: hydrostatic test according to the Pressure Equipment Directive 2014/68/EU.Consult the service department of your supplier if necessary.

12 Medical Device Regulation

Components subject to (EU) 2017/745 Medical Devices Regulation

All components are designed, manufactured and inspected according to the EuropeanDirective (EU) 2017/745 Annex II.

Overall rating

The PMA unit conform to the Medical Devices Regulation (EU) 2017/745 category IIa

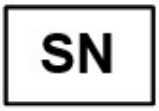
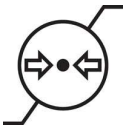
Manufacturer:

Atlas Copco (Wuxi) Compressor Co Ltd
No. 45 Feifeng Road, Xinwu District, Wuxi City,
Jiangsu Province, China

European Authorized Representative

Atlas Copco Airpower N.V.
Boomsesteenweg 957, 2610 Wilrijk

Appendix 1: Symbols

Appendix: Symbols			
	Date of manufacture		Manufacturer
	Authorized representative in the European Community/ European Unio		Serial number
	CE marker		Medical device
	Caution		Consult instructions for use or consult electronic instructions for use
	Temperature limit		Unique device identifier
	Atmospheric		