**Installation, Operation and Maintenance Instructions**


# Oil-Sealed Rotary Screw Vacuum Pumps Manual

*Part number 2212 0208 76.00*

MSV030, MSV040, MSV050

*March 28, 2018*

BeaconMedæs®

*Part of the Atlas Copco Group*

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# Installation, Operation and Maintenance Manual

“Oil-sealed” Rotary Screw Vacuum Pumps
MSV030, MSV040, MSV050

**This unit is purchased from:** _____

**Date purchased:** _____

**Model number:** _____

**Serial number:** _____

**Option(s) included:** _____

**Any information, service or spare parts requests should include the machine serial number and be directed to:**

**NFPA Standard:**
**BeaconMedæs**
**1059 Paragon Way**
**Rock Hill, SC 29730**

**Telephone: +1(803) 817-5600**

**HTM/ISO Standard:**
**BeaconMedaes**
**Telford Crescent, Staveley**
**Derbyshire S43 3PF**

**Telephone: +44(0)1246 474242**

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Explanation

| | |
|---|---|
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|  | Warning |
|  | Important Note |

## 1.2 Safety Precautions, General

General Precautions

1. The operator must employ safe working practices and observe all related work safety requirements and regulations.
2. If any of the following statements does not comply with the applicable legislation, the stricter of the two shall apply.
3. Installation, operation, maintenance and repair work must only be performed by authorized, trained, specialized personnel.
4. This vacuum pump is designed for handling atmospheric air only. No other gases, vapors or fumes should be exposed to the vacuum pump intake or processed through the vacuum pump.
5. Before any maintenance, repair work, adjustment or any other non-routine checks:
   - Stop the Vacuum pump
   - Press the emergency stop button
   - Switch off the voltage
   - Make sure that the vacuum pump system is at atmospheric pressure level
   - Lock Out - Tag Out (LOTO):
     - Open the power isolating switch and lock it with a personal lock
     - Tag the power isolating switch with the name of the service technician
   - On units powered by a frequency converter, wait 10 minutes before starting any electrical repair.
   - Never rely on indicator lamps or electrical door locks before maintenance work, always disconnect and check with measuring device.

| | |
|---|---|
|  | If the machine is equipped with an automatic restart after voltage failure function is active, be aware that the machines will restart automatically when the power is restored if it was running when the power was interrupted! |
|  | In a domestic environment, this product may cause radio interference in which case supplementary mitigation measures are required. |

6. Avoid contact with pump intake during operation.
7. The owner is responsible for maintaining the unit in safe operating condition. Parts and accessories shall be replaced if unsuitable for safe operation.
8. It is not allowed to walk or stand on the unit or on its components.

## 1.3 Safety Precautions During Installation

All responsibility for any damage or injury, resulting from neglecting these precaution, 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.

**Precautions during installation**

1. The machine must be lifted using suitable equipment 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.

# 1 Safety Precautions

2. The unit is designed for indoor use. If the unit is installed outdoors, special precautions must be taken; consult BeaconMedaes.
3. Place the machine where the ambient air is as cool and clean as possible. Never obstruct the cooling air inlet. Water handling capacity is detailed in the specification.
4. Any blanking flanges, plugs, caps and desiccant bags must be removed before connecting the pipes.
5. Vacuum connection and discharge pipes must be of correct size and suitable for the working pressure and temperature. Never use frayed, damaged or worn hoses. Distribution pipes and connections must be of the correct size and suitable for the working pressure.
6. The aspirated air must be free of flammable fumes, vapors and particles, e.g. paint solvents, that can lead to internal fire or explosion. Follow the material safety.
7. The external force extended on the in- and outlet connection is limited to 10 kg; the connection pipes must be free of strain. No supports may be fixed to the canopy of the machine.
8. If remote control is installed, the machine must bear a clear sign stating: **DANGER: This machine is remotely controlled and may start without warning.** The operator has to make sure that the machine is stopped and that isolating switch is open and locked before any maintenance or repair. As a further safeguard, persons switching on remotely controlled machines shall take adequate precautions to ensure that there is no one checking or working on the machine. To this end, a suitable notice shall be affixed to the starting equipment.
9. Air-cooled machines must be installed in such a way that an adequate flow of cooling air is available and that the exhausted air does not recirculate to the vacuum pump air inlet or cooling air inlet.
10. The electrical connections must correspond to 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 vacuum pump.
11. On machines with automatic start/stop system or if the automatic restart function after voltage failure is activated, a sign stating “This machine may start without warning” must be affixed near the instrument panel.
12. Never remove or tamper with the safety devices, guards or insulation fitted on the machine.
13. Piping or other parts with a temperature that exceeds 70°C (158°F) and which may be accidentally touched by personnel in normal operation must be guarded or insulated. Other high temperature piping must be clearly marked.
14. If the ground is not leveled or can be subject to variable inclination, consult the manufacturer.
15. Pump outlet air contains traces of oil mist. Ensure compatibility with the working environment.
16. Any vacuum pump placed in an application with inlet gas stream temperatures above the published maximum temperature should be approved by BeaconMedaes prior to start-up.
17. For water-cooled machines, the cooling water system installed outside the machine has to be protected by a safety device with set pressure according to the maximum cooling water inlet pressure.

# 1 Safety Precautions

Also consult following safety precautions: Safety precaution during operation and Safety precaution during maintenance.

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 machines types and equipment; hence some statements may not apply to your machine.

## 1.4 Safety Precautions During Operation

All responsibility for any damage or injury resulting from neglecting these precaution, 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.

### Precautions During Operation

1. Never touch any piping or components of the vacuum pump during operation.
2. Use only the correct type and size of hose end fittings and connections. Make sure that a hose is fully depressurized before disconnecting it.
3. Persons switching on remotely controlled machines shall take adequate precautions to ensure that there is no one checking or working on the machine. To this end, a suitable notice shall be affixed to the remote start equipment.
4. Never operate the machine when there is a possibility of taking inflammable or toxic fumes, vapors or particles.
5. Never operate the machine below or in excess of its limit ratings.
6. Keep all bodywork doors shut during operation. The doors may be opened for short periods only, e.g. to carry out routine checks. Wear ear protectors when opening a door.
7. People staying in environments or rooms where the sound pressure level reaches or exceeds 80 dB(A) shall wear ear protectors.
8. Periodically check that:
   - All guards are in place and securely fastened
   - All hoses and/or pipes inside the machine are in good condition, secure and not rubbing
   - There are no leaks
   - All fasteners are tight
   - All electrical leads are secure and in good order
   - Inlet valve and air not, i.e. pipes, couplings, manifolds, valves, hoses, etc. are in good repair, free of wear or abuse
9. If warm cooling air from vacuum pumps is used in air heating systems, e.g. to warm up a workroom, take precautions against air pollution and possible contamination of the breathing air.
10. Do not remove any of, or tamper with, the sound-damping material.
11. Never remove or tamper with the safety devices, guards or insulation fitted on the machine.
12. The oil separator tank can be slightly pressurised. Do not open and do not leave oil filler or drain plugs open during operation.
13. Do not use the pump as a compressor.
14. Never run the pump without the air intake filter mounted.
15. On water-cooled vacuum pumps using open circuit cooling towers, protective measures must be taken to avoid the growth of harmful

# 1 Safety Precautions

bacteria such as Legionella pneumophila bacteria.

Also consult following safety precautions: Safety precaution during operation and Safety precaution during maintenance.

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 machines types and equipment; hence some statements may not apply to your machine.

## 1.5 Safety Precautions During Maintenance or Repair

### Precautions During Maintenance or Repair

1. Always use the correct safety equipment (such as safety glasses, gloves, safety shoes, etc.).
2. Use only the correct tools for maintenance and repair work.
3. Use only genuine spare parts.
4. All maintenance work shall only be undertaken when the machine has cooled down.
5. A warning sign bearing a legend such as “Work in progress; do not start” shall be attached to the starting equipment.
6. Persons switching on remotely controlled machines shall take adequate precautions to ensure that there is no one checking or working on the machine. To this end, a suitable notice shall be affixed to the remote start equipment.
7. Before removing any component, effectively isolate the machine from all sources of under- and/or overpressure and make sure that the pump system is at atmospheric pressure level.
8. Never use flammable solvents or carbon tetrachloride for cleaning parts. Take safety precautions against toxic vapors of cleaning liquids.
9. Scrupulously observe cleanliness during maintenance and repair. Keep dirt away by covering the parts and exposed openings with a clean cloth, paper or tape.
10. Never weld or perform any operation involving heat near the oil system. Oil tanks must be completely purged, e.g. by steam cleaning, before carrying out such operations. Never weld on, or in any way modify, pressure vessels.
11. Whenever there is an indication or any suspicion that an internal part of a machine is overheated, 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 vapor when air is admitted.
12. Never use a light source with open flame for inspecting the interior of a machine, pressure vessel, etc.
13. Make sure that no tools, loose parts or rags are left in or on the machine.
14. 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.
15. 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. If removed, check that the coupling guard of the vacuum pump drive shaft has been reinstalled
16. Every time the separator element is renewed, examine the discharge pipe and the inside of the oil separator vessel for carbon deposits; if excessive, the deposits should be removed.

# 1 Safety Precautions

17. Protect the motor, air filter, electrical and regulating components, etc. to prevent moisture from entering them, e.g. when steam cleaning.
18. Make sure that all sound-damping material and vibration dampers, e.g. damping material on the bodywork and in the air inlet and outlet systems of the vacuum pump, is in good condition. If damaged, replace it by genuine material from the manufacturer to prevent the sound pressure level from increasing.
19. Never use caustic solvents which can damage materials of the air net, e.g. polycarbonate bowls.
20. Faults or wearing of seals may cause oil lubricant leaks. Avoid dispersion in soil and pollution of other materials.

Also consult following safety precautions: Safety precaution during operation and Safety precaution during maintenance.

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 machines types and equipment; hence some statements may not apply to your machine.

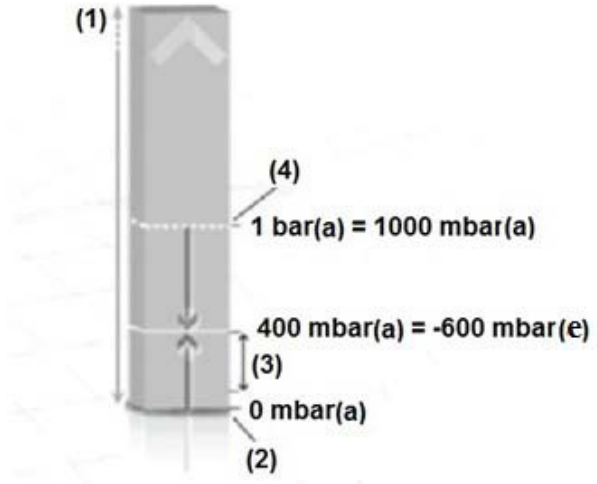
# 2 General Description

## 2.1 What is vacuum and how is flow rate understood?

### What is vacuum and how to denote

A vacuum is any pressure in a system that is below the ambient atmospheric pressure. It can be denoted in absolute terms or in effective (gauge) terms:

- mbar(a) - absolute pressure - denotes how much the pressure is above absolute zero vacuum.
- (minus) mbar(e) - the effective or gauge pressure - denotes how much the pressure is below local atmospheric pressure.




| | |
|---|---|
| (1) | Pressure |
| (2) | Absolute vacuum |
| (3) | Typical MSV pump working range (400 mbar(a) - 10 mbar(a)) |
| (4) | Atmospheric pressure |

Atmospheric pressure at sea level is roughly 1 bar or 1000 mbar. A typical working range for the MSV pumps is 400 mbar(a) to 10 mbar(a). From the illustration it can be seen clearly that this range is also equivalent to -600 mbar(e) and -990 mbar(e).

It is important to understand which type of reference is required before selecting a pressure instrument for measuring the vacuum. It must be noted that the distinction doesn’t matter for a pressure difference (delta P; e.g. pressure loss), since it is always the result of subtracting 2 pressures (whether stated as absolute or effective pressures).

### Flow Rate Definitions

There are 2 common but different ways to denote flow rate in vacuum. The first one is based on the displacement or volumetric flow rate and the second one is based on the throughput or mass flow rate. BeaconMedaes vacuum pumps use volumetric flow rate to denote performance, the unit being $Am^3/hr$.

### Displacement/volumetric flow rate

For the relevant pressure range, when a MSV pump operates at quasi constant motor speed (rotations per minute) and since the compression chambers have fixed dimensions, the same volume of air is pumped from inlet to outlet with falling pressure level. Over the relevant pressure range, this makes the volumetric flow rate quasi independent of the vacuum level. It is the expression of the flow rate inside the piping at the governing vacuum level ($Am^3/hr$), and always higher than the throughput in mass flow rate.

### Throughput in mass flow rate

Even if the volumetric flow rate is quasi unchanged with falling pressure level, the number of molecules in that pumped volume is not. By definition: the deeper the vacuum, the lower the amount of molecules in the same volume of air. This means that the mass flow will decrease with decreasing (absolute) pressure. It is clear that a flow rate must be stated at a certain vacuum level when using this denotation.

# 2 General Description

## 2.2 Introduction

The MSV030 to MSV050 are single-stage, oil-sealed screw vacuum pumps driven by an electric motor.

The vacuum pumps are controlled by the Elektronikon® Graphic regulator (ER).

The regulator is fitted to the front door. An electric cabinet (1) comprising fuses, transformers, relays, etc. is located behind this door.

The vacuum pumps use VSD (Variable Speed Drive) technology. This means: automatic adjustment of the motor speed, depending on the process demand.

The vacuum pumps are air-cooled and are enclosed in a sound-insulated bodywork.


*Figure 1 Front view*

*Figure 2 Open view front*

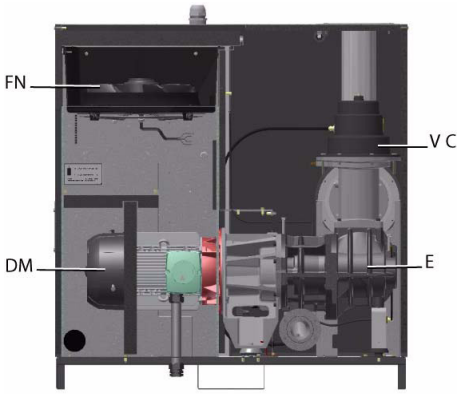
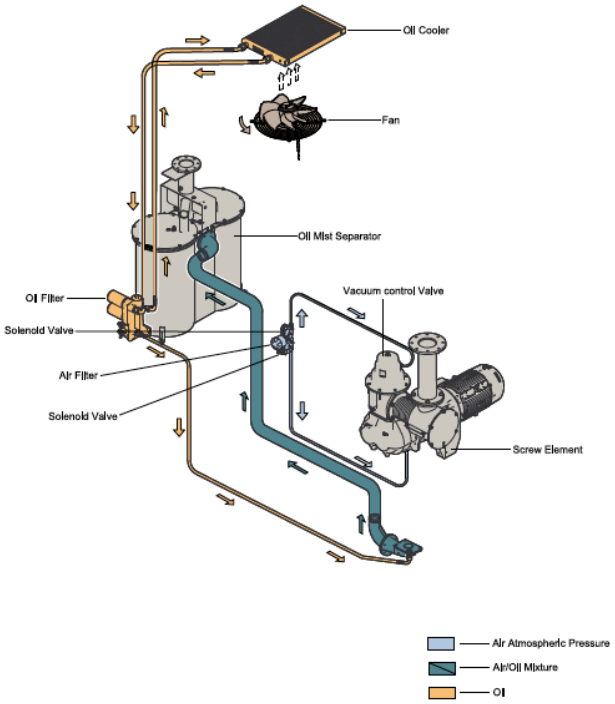



*Figure 2 Open view front*

| Ref | Name |
|---|---|
| Co | Oil cooler |
| E | Element |
| ER | Elektronikon® Graphic controller |
| FN | Cooling fan |
| DM | Drive motor |
| OT | Oil separator tank |
| S3 | Emergency stop button |
| 1 | Electric cabinet |
| VC | Vacuum control valve |
| IC | Inlet connection |
| DC | Discharge connection |
| CE | Cable entry |
| AF | Air intake filter |
| OF | Oil filter |
| BV | Thermostatic bypass valve |

# 2 General Description

## 2.3 Flow diagram




### Air Flow

Air comes in through air intake filter (AF) and Vacuum Control Valve (VC) and is displaced by the vacuum pump element (E).

A mixture of air and oil flows into the oil separator tank (OT).

After passing the air/oil separator filter, clean air, conditioned to a few parts per million, is discharged through the outlet.

### Oil system

The oil separator tank (OT) removes most of the oil from the air/oil mixture by centrifugal action. The oil separator (OS) removes the remaining oil. The oil collects in the lower part of the oil separator tank (OT) which serves as oil tank.

The oil system has a thermostatic bypass valve (BV).When the oil temperature is below 80 °C (176 °F)(87°C (189° F) for optional high water handling capacity versions), the bypass valve shuts off the oil supply from the oil cooler (Co).

Air pressure forces the oil from oil separator tank through the oil filter (OF). The oil cooler (Co) is bypassed.

When the oil temperature has increased up to 80°C (176 °F) (87°C (189° F) for optional high water handling capacity versions), bypass valve (BV) starts opening the supply from the oil cooler (Co). At approx. 95°C (203 °F)(104°C (219° F) for optional high water handling capacity versions), all the oil flows through the oil cooler. The filtered oil flows into the vacuum pump element (E).

### Cooling

The cooling system has an oil cooler (Co).

The fan (FN) blows air over the coolers. This fan is set to run on or off, depending on the operating conditions, according to a specific algorithm.

## 2.4 Condensate system


When discharge piping is used, water in the discharge air can condense in the piping and is accumulated in the collector of the outlet pipe, where a drain point (Dr) is available.

When the pump leaves the factory, this drain point is connected with the external valve(EV).

# 2 General Description

Preventing condensate collection in the oil separator will extend oil life.

Consult local regulations, which are applicable for water drainage.

## 2.5 Regulating system

### Description

If the vacuum process demand is less than the throughput of the vacuum pump, the vacuum pressure decreases.

When the pressure is lower than the set-point (desired vacuum pressure), the regulator decreases the motor speed.

If the vacuum pressure decreases and the motor operates at minimum speed, the regulator stops the motor.

When the motor is stopped automatically and the vacuum pressure comes to the set-point, the regulator starts the motor again.

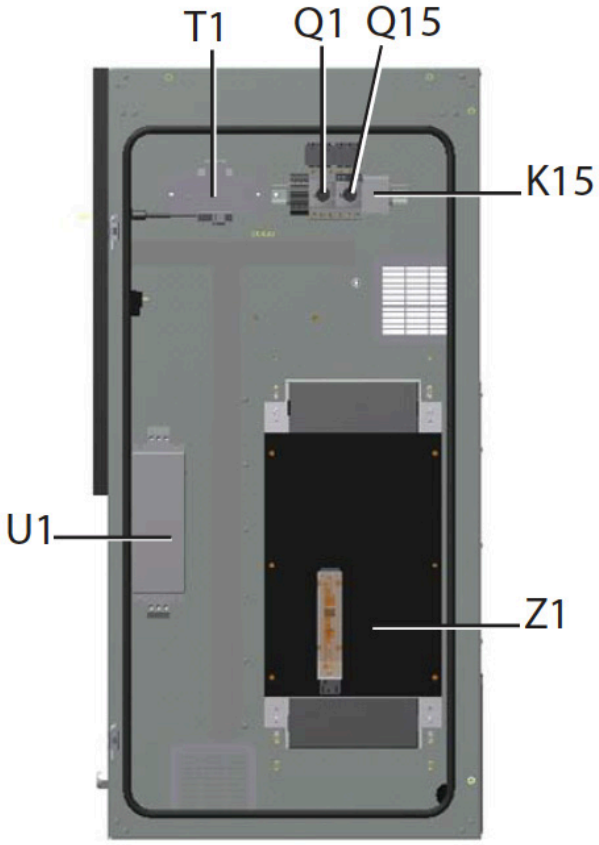
### Turbo version

The regulation system of the Turbo version is designed to handle fast cycling duties. When the vacuum pressure reaches the set-point, the regulator will keep the motor running at increased speed for an adjustable time before the regulator decreases the motor speed.

## 2.6 Electrical system

### Electric components

The electrical system has following components:




| Ref | Description |
|---|---|
| T1 | Transformer |
| Q15 | Circuit breaker |
| Q1 | Circuit breaker |
| K15 | Contactor |
| Z1 | Frequency converter |
| U1 | EMC filter |

### Electrical diagrams

You can find the complete electrical diagram inside the electric cabinet.

# 3 Elektronikon® Graphic Controller

## 3.1 Elektronikon® Graphic controller

### Control panel


*Figure 5 Display of the Elektronikon® Graphic controller*

### Introduction

The Elektronikon® controller has following functions:

- Controlling the vacuum pump
- Protecting the vacuum pump
- Monitoring components subject to service
- Automatic restart after voltage failure (made inactive)

### Automatic control of the vacuum pump operation

The controller maintains the pressure within programmable limits by automatically adapting the motor speed. A number of programmable settings, e.g. the setpoint, the minimum stop time and the maximum number of motor starts and several other parameters are hereby taken into account.

The controller stops or reduces the speed of the vacuum pump whenever possible to reduce the power consumption and restarts it automatically when the pressure decreases. For High Water Handling Capability pumps, the pump is equipped with a purge cycle which prevents and removes condensed water in the sealing oil.

A number of time based automatic start/stop command may be programmed. Take into account that a start command will be executed (if programmed and activated), even after manually stopping the vacuum pump.

### Protecting the Vacuum pump

### Shut-down

Several sensors are provided on the vacuum pump. If one of the measurements succeeds the programmed shut down level, the vacuum pump will be stopped. This will be indicated on display(1) and general alarm LED(2) will blink.

Remedy the trouble and reset the message. See also the Inputs menu.

Before remedying, consult the Safety precautions.

### Shut-down warning

A shut-down warning level is a programmable level below the shut-down level.

If one of the measurements succeeds the programmed shut-down warning level, a message will appear on display(1) and general alarm LED(2) will light up, to warn the operator that the shut-down warning level is exceeded.

The message disappears as soon as the warning condition disappears.

### Warning

A warning message will appear if:

- Element outlet temperature is too high
- Pump discharge pressure is too high
- Purge cycle was not successful (temperature not reached within requested time)

# 3 Elektronikon® Graphic Controller

### Service warning

A number of service operations are grouped (called Service Plans). Each Service Plan has a programmed time interval. If a time interval is exceeded, a message will appear on display (1) to warn the operator to carry out the service actions belonging to that Service Plan.

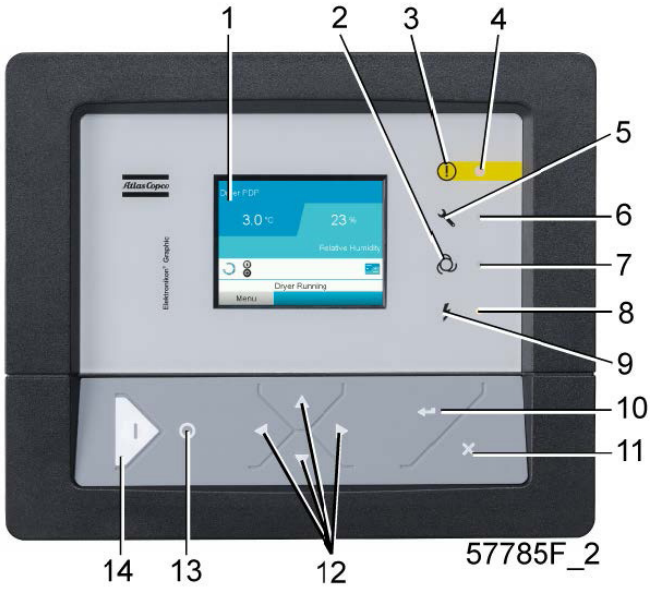
Automatic restart after voltage failure

The regulator has a built-in function to automatically restart the vacuum pump if the voltage is restored after voltage failure. For vacuum pumps leaving the factory, this function is made inactive. If desired, the function can be activated. Consult the BeaconMedaes Customer Center.

If activated and provided the regulator was in the automatic operation mode, the vacuum pump will automatically restart if the supply voltage to the module is restored.

## 3.2 Control panel

### Elektronikon regulator



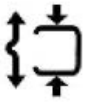

*Elektronikon regulator*

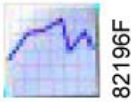
| Ref | Designation | Function |
|---|---|---|
| 1 | Display | Shows the vacuum pump operating condition and a number of icons to navigate through the menu. |
| 2 | Pictograph | Automatic operation |
| 3 | Pictograph | General alarm |
| 4 | General alarm LED | Flashes if a shut-down warning condition exists. |
| 5 | Pictograph | Service |
| 6 | Service LED | Lights up if service is needed |
| 7 | Automatic operation LED | Indicates that the regulator is automatically controlling the vacuum pump. |
| 8 | Voltage on LED | Indicates that the voltage is switched on. |
| 9 | Pictograph | Voltage on |
| 10 | Enter key | Key to select the parameter indicated by the horizontal arrow. Only the parameters followed by an arrow pointing to the right can be modified. |
| 11 | Escape key | To go to previous screen or to end the current action |
| 12 | Scroll keys | Keys to scroll through the menu. |
| 13 | Stop button | Button to stop the vacuum pump LED (7) goes out. |
| 14 | Start button | Button to start the vacuum pump. LED (7) lights up indicating that the Elektronik on regulator is operative. |

# 3 Elektronikon® Graphic Controller

## 3.3 Icons used

### Status icons

| Name | Icon | Description |
|---|---|---|
| Stopped/ Running |  57786F | When the vacuum pump is stopped, the icon stands still. When the vacuum pump is running, the icon is rotating. |
| Vacuum pump status |  57787F | Motor stopped |
| |  57788F | Running Purge and Intermediate states. |
| |  57789F | Running Vacuum Control |
| Machine control mode |  57790F | Local start/stop |
| |  57791F | Remote start/ stop |
| |  57792F | Network control |
| Automatic restart after voltage failure |  57793F | Automatic restart after voltage failure is active. |
| Week timer |  57794F | Week timer is active |

| Name | Icon | Description |
|---|---|---|
| Active protection functions |  57795F | Emergency stop |
| |  57796F | Shutdown |
| |  57797F | Warning |
| Service |  | Service required |
| Main screen display |  59162F | Value lines display icon |
| |  82196F | Chart display icon |
| General icons |  81105D | No communication / network problem |
| |  82418D | Not valid |

### Input icons

| Icon | Description |
|---|---|
|  | Pressure |
|  57800F | Temperature |
|  57801F | Digital input |
|  57802F | Special protection |

# 3 Elektronikon® Graphic Controller

### Menu icons

| Icon | Description |
|---|---|
|  57813F | Inputs |
|  57814F | Outputs |
|  57812F | Alarms (Warnings, shutdowns) |
|  57815F | Counters |
|  57816F | Test |
|  57817F | Settings |
|  57798F | Service |
|  57818F | Saved data |
|  57819F | Access key/User password |
|  57792F | Network |
|  57820F | Regulation |
|  57867F | Info |
|  58470D | General |

### System icons

| Icon | Description |
|---|---|
|  57803F | Vacuum pump element |
|  57805F | Fan |
|  57806F | Frequency converter |
|  57809F | Motor |
|  57792F | Network problem |
|  57812F | General alarm |

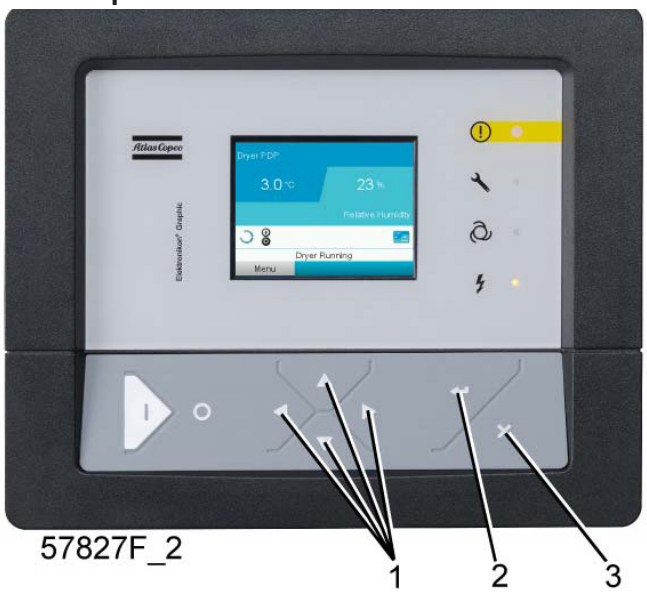
### Navigation arrows

| Icon | Description |
|---|---|
|  57821F | Up |
|  57822F | Down |

# 3 Elektronikon® Graphic Controller

## 3.4 Main screen

### Control panel




| | |
|---|---|
| 1 | Scroll keys |
| 2 | Enter keys |
| 3 | Escape key |

### Function

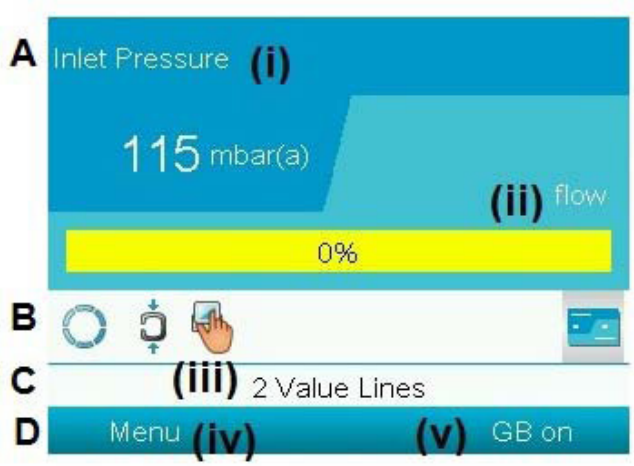
The Main screen is the screen that is shown automatically when the voltage is switched on and one of the keys is pushed. It is switched off automatically after a few minutes when no keys are pushed.

Typically, 5 different main screen views can be chosen:

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

### Two and four value lines screens

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

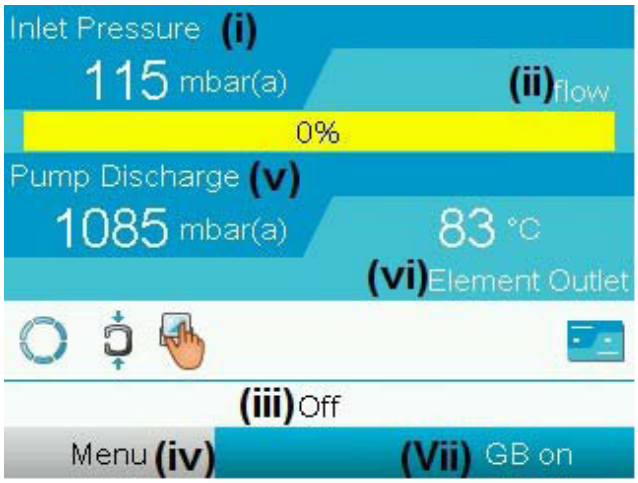



*Typical Main screen (2 value lines)*

Text on figures

| | |
|---|---|
| (i) | Inlet pressures |
| (ii) | Flow |
| (iii) | Vacuum control, shutdown,... (text varies upon the vacuum pumps actual condition) |
| (iv) | Menu |
| (v) | ES,...(text varies upon the vacuum pumps actual condition) |

# 3 Elektronikon® Graphic Controller




*Typical Main screen (4 value lines)*

Text on figures

| | |
|---|---|
| (i) | Inlet pressures |
| (ii) | Flow |
| (iii) | Off, Shutdown,... (text varies upon the vacuum pumps actual condition) |
| (iv) | Menu |
| (v) | Pump discharge |
| (vi) | Element outlet |
| (vii) | Vacuum control, purge, preparing to go online,...(text varies upon the vacuum pumps actual condition) |

- Section A shows information regarding the vacuum pump operation (e.g. the Inlet pressure or the temperature at the vacuum pump outlet). On Vacuum pumps with a frequency converter, the load degree (flow) is given in % of the maximum flow at the actual inlet pressure.
- Section B shows Status icons. Following icon types are shown in this field:
  - Fixed icons: These icons are always shown in the main screen and cannot be selected by the cursor (e.g. vacuum pump stopped or running, vacuum pump status (running, running unloaded or motor stopped).
  - Optional icon: These icons are only shown if their corresponding function is activated (e.g. week timer, automatic restart after voltage failure , etc.)
  - Pop up icons: These icons pop up if an abnormal condition occurs (warnings, shutdowns, service,...)To call up more information about the icons shown, select the icon concerned using the scroll keys and press the enter key.
- Section C is called the Status bar. This bar shows the text that corresponds to the selected icon.
- Section D shows the Action buttons. These buttons are used:
  - To call up or program settings
  - To reset a motor overload, service message or emergency stop
  - To have access to all data collected by the regulator

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

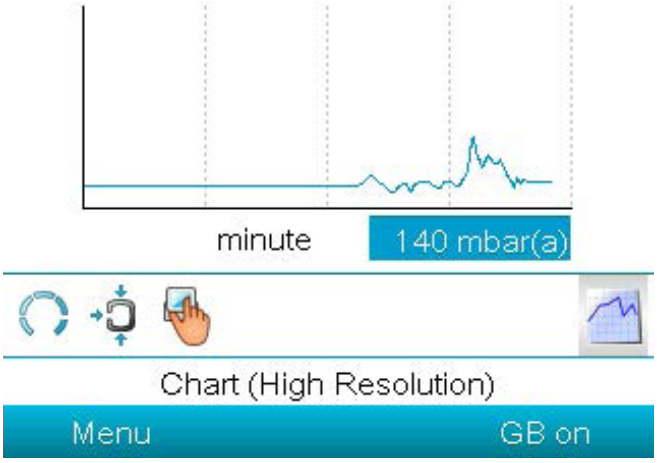
| Designation | Function |
|---|---|
| Menu | To go to the menu |
| Modify | To modify programmable settings |
| Reset | To reset a timer or message |

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

### Chart views

Instead of viewing values, it is also possible to view a graph of one of the input signals (see section Inputs menu) in function of the time.

# 3 Elektronikon® Graphic Controller




When Chart (High Resolution) is selected, the chart shows the variation of the selected input (in this case the pressure) per minute. Also the instantaneous value is displayed. The screen shows the last 4 minutes.

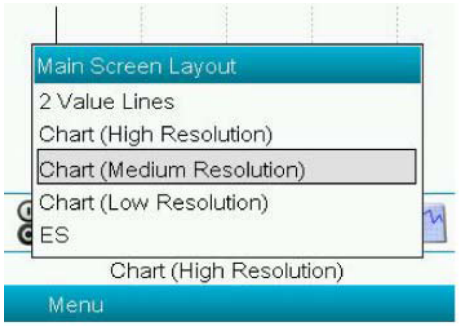
The switch button (icon) for selecting other screens is changed into a small Chart and is highlighted (active).

When the Chart (Medium Resolution) is selected, the chart shows the variation of the selected input per hour. The screen shows the last 4 hours.

When the Chart (Low Resolution) is selected, the chart shows the variation of the selected input per day. The screen shows the evolution over the last 10 days.

### Selection of a main screen view

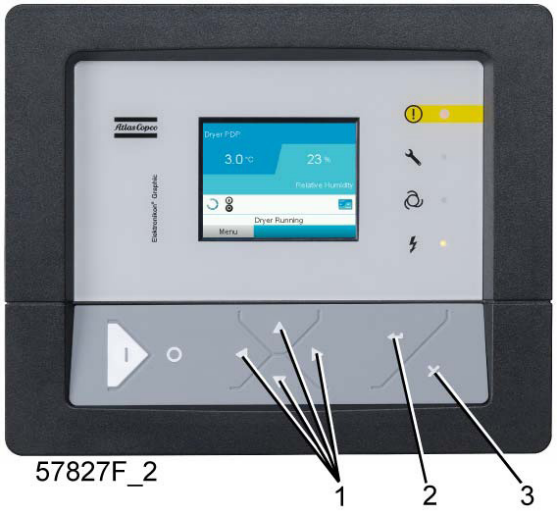
To change between the different screen layouts, select the far right icon in the control icons line (see value lines display icon or chart display icon in section Icons used) and press the Enter key. A screen similar to the one below opens:




Select the layout required and press the Enter key. See also section Inputs menu

## 3.5 Calling up menus

### Control panel

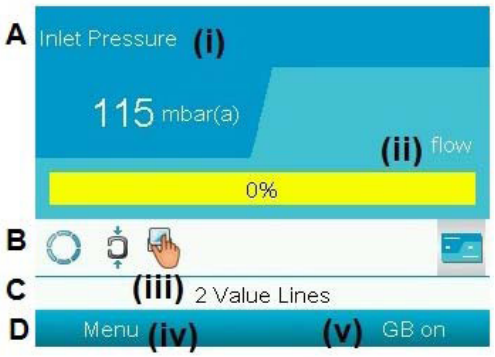



| | |
|---|---|
| 1 | Scroll keys |
| 2 | Enter key |
| 3 | Escape key |

### Description

When the voltage is switched on, the main screen is shown automatically.

# 3 Elektronikon® Graphic Controller

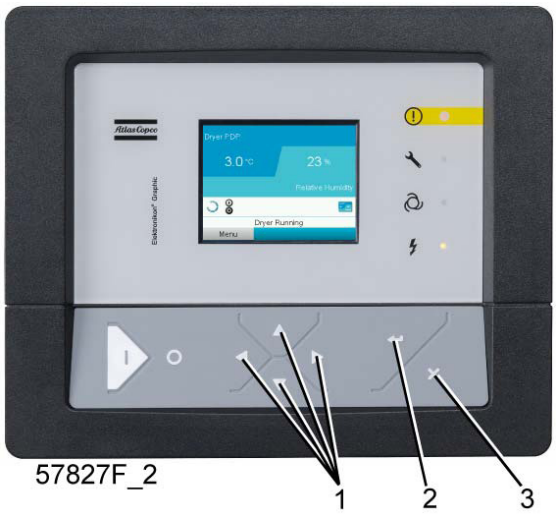



- To go to the Menu screen, select Menu, using the Scroll keys
- Press the Enter key to select the menu. Following screen appears:


- The screen shows a number of icons. Each icon indicates a menu item. By default, the Pressure Settings (Regulation) icon is selected. The status bar shows the name of the menu that corresponds with the selected icon.
- Use the Scroll keys to select an icon.
- Press the Escape key to return to the Main screen.

## 3.6 Inputs menu

### Control panel




| | |
|---|---|
| 1 | Scroll keys |
| 2 | Enter keys |
| 3 | Escape key |

### Menu icon, inputs


### Function

- To display the actual value of the measured data (analog inputs) and the status of the digital inputs (e.g. emergency stop contact, motor overload relay, etc.).
- To select the digital input to be shown on the chart in the main screen.

# 3 Elektronikon® Graphic Controller

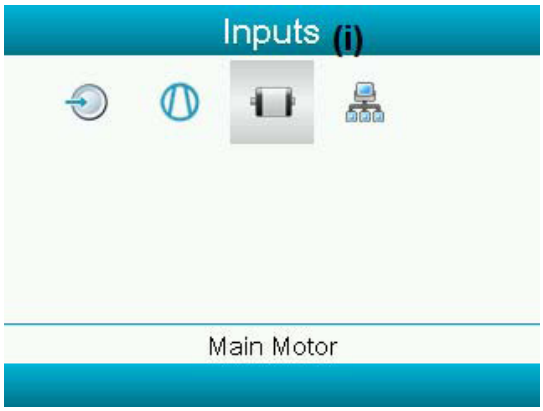
**Procedure**

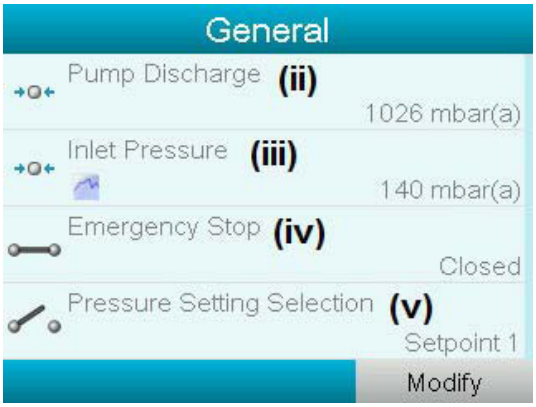
Starting from the Main screen (see Main screen):

- Move the cursor to the action button Menu and press the enter key, following screen appears:


| | |
|---|---|
| (i) | Menu |
| (ii) | Regulation |

- Using the scroll keys, move the cursor to the inputs icon (see above, section Menu icon)
- Press the enter key, a screen similar to the one below appears:




| | |
|---|---|
| (i) | Menu |
| (ii) | Regulation |
| (iii) | Inlet pressure |
| (iv) | Emergency stop |
| (v) | Pressure setting selection |

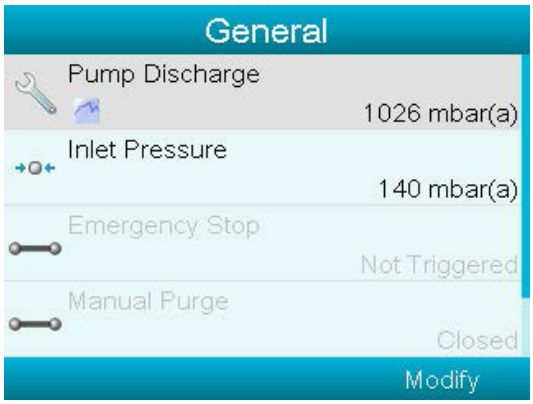
- The screen shows a list of all inputs with their corresponding icons and readings.
- If an input is in warning or shutdown, the original icon is replaced by the warning or shutdown icon respectively (i.c. the Stop icon and the Warning icon in the screen shown above).

A small chart icon, shown below an item in the list means this input signal is shown on the chart at the main screen. Any analog input can be selected.reen (see Main screen):

# 3 Elektronikon® Graphic Controller

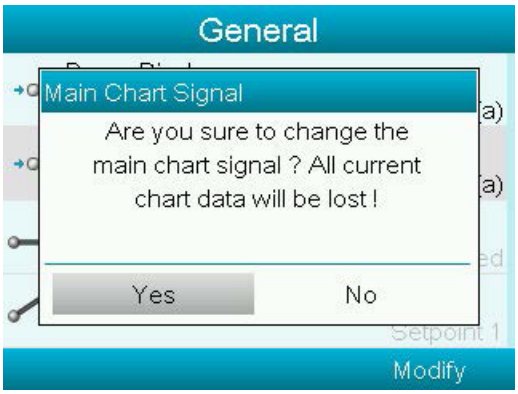
### Selecting another input signal as main chart signal

With the Modify button active (light grey background in above screen), press the Enter button on the controller. A screen similar to the one below appears:



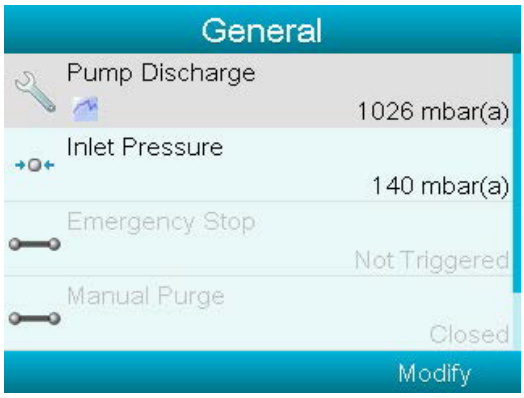

The first item in the list is highlighted. In this example, the inlet Pressure is selected (chart icon). To change, press the Enter button again: a pop-up window opens:

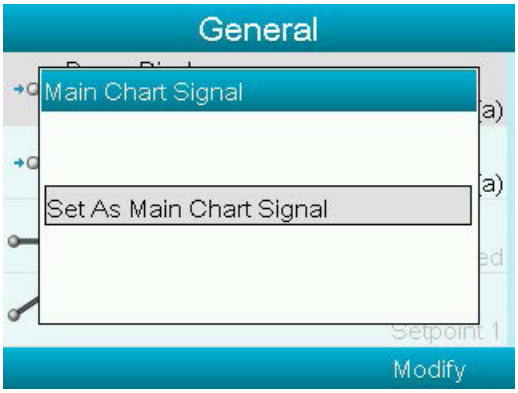

Press Enter again to remove this input from the chart. Another confirmation pop-up opens:




Select Yes to remove or No to quit the current action.

In a similar way, another input signal can be highlighted and selected as Main Chart signal:



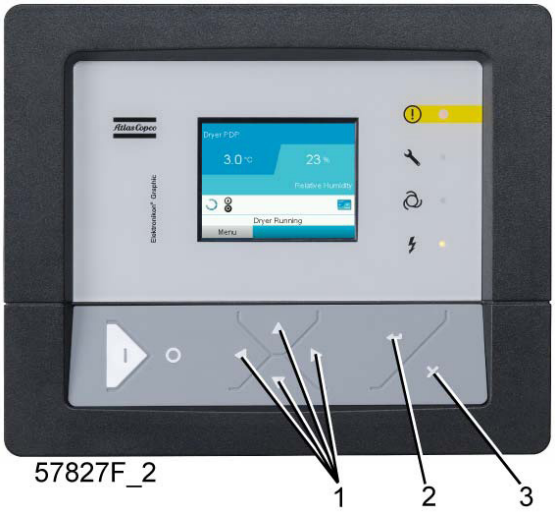




| | |
|---|---|
| (i) | Set as main chart signal |

# 3 Elektronikon® Graphic Controller

## 3.7 Outputs menu

### Control panel




### Menu icon, inputs


### Function

To call up Information regarding the actually measured data and the status of some outputs such as the motor overload protection.

### Procedure

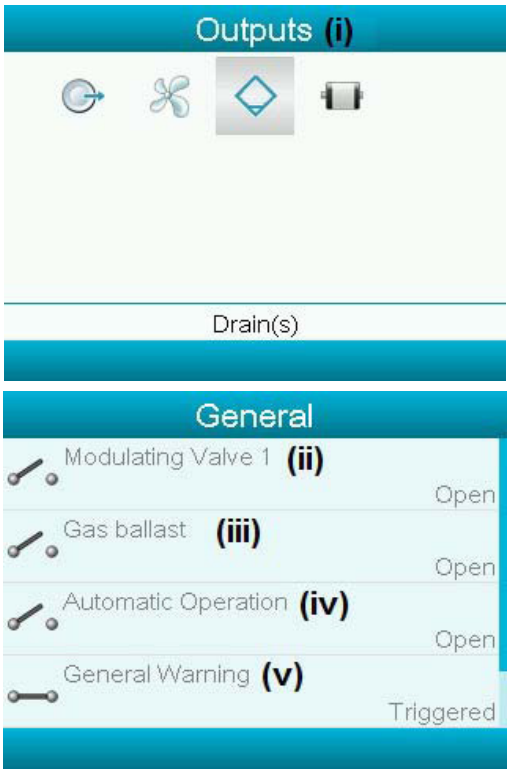
Starting from the Main screen (see Main screen):

- Move the cursor to the action button Menu and press the enter key (2), following screen appears:


Text on figures

| | |
|---|---|
| (i) | Menu |
| (ii) | Regulation |

- Move the cursor to the outputs icon (see above, section Menu icon, using the scroll keys(1)
- Press the enter key (2), a screen similar to the one below appears:



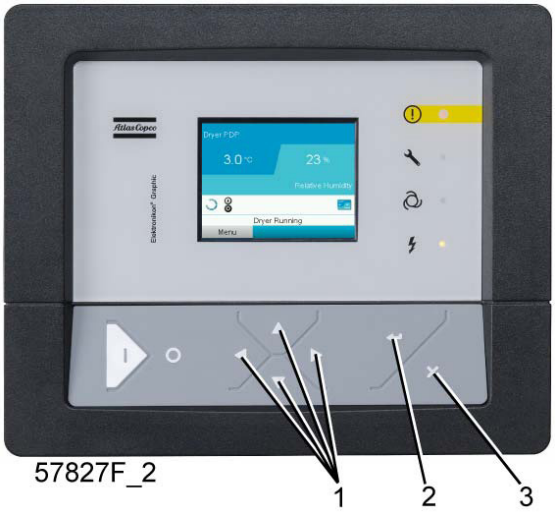

| | |
|---|---|
| (i) | Outputs |
| (ii) | Modulating valve |
| (iii) | Gas ballast |
| (iv) | Automatic operation |
| (v) | General warning |

- The screen shows a list of all output switches and their corresponding icons and readings.
- If an input is in warning or shut down, the original icon is replaced by the warning or shut down icon respectively.

# 3 Elektronikon® Graphic Controller

## 3.8 Counters

### Control panel




| | |
|---|---|
| 1 | Scroll keys |
| 2 | Enter keys |
| 3 | Escape key |

### Menu icon, counter


### Function

To call up:

- The running hours
- The number of motor starts
- The number of hours that the regulator has been powered up
- Fan starts
- Emergency stops

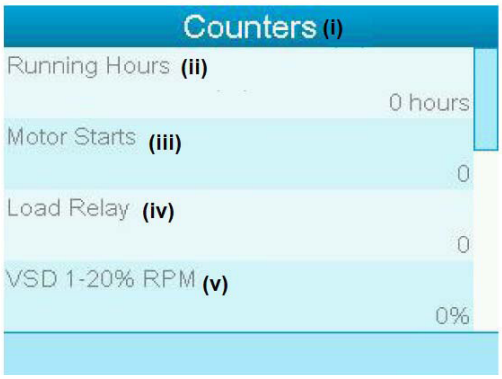
### Procedures

- Starting from the Main screen (see Main screen): The number of motor starts
- Move the cursor to the action button Menu and press the enter key (2), following screen appears:


Text on figures

| | |
|---|---|
| (i) | Menu |
| (ii) | Regulation |

- Using the scroll keys, move the cursor to the counters icon (see above, section Menu icon)
- Press the enter key, following screen appears:



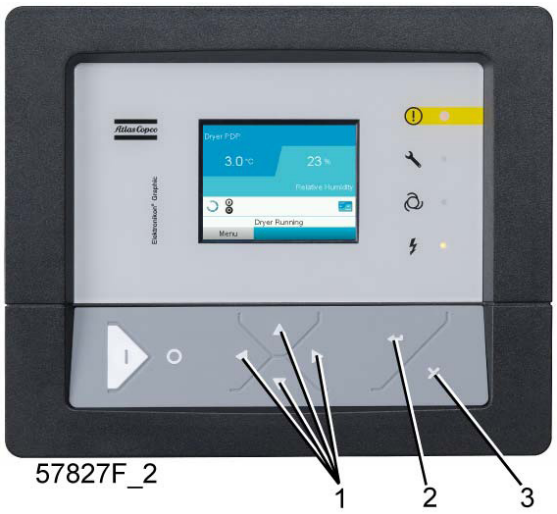

| | |
|---|---|
| (i) | Counters |
| (ii) | Running hours |
| (iii) | Motor starts |
| (iv) | Load relay |
| (v) | VSD 1-20 % rpm in % (the percentage of the time during which the motor speed was between 1 and 20 %) |

- The screen shows a list of all counters with their actual readings.

# 3 Elektronikon® Graphic Controller

## 3.9 Control mode selection

### Control panel



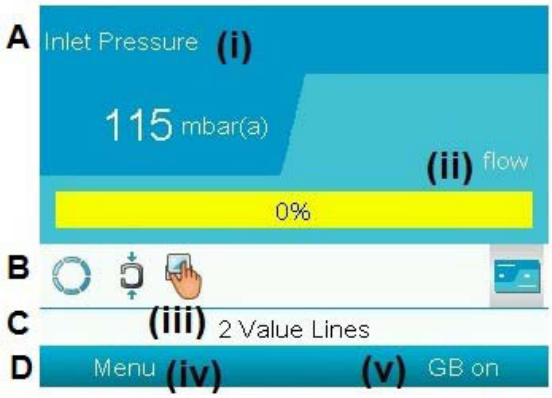

| | |
|---|---|
| 1 | Scroll keys |
| 2 | Enter keys |
| 3 | Escape key |

### Function

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

### Procedures

Starting from the main screen, make sure the button Menu (iv) is selected:




Next, use the scroll buttons to go to the regulation icon (ii) and press the enter button:


There are 3 possibilities:

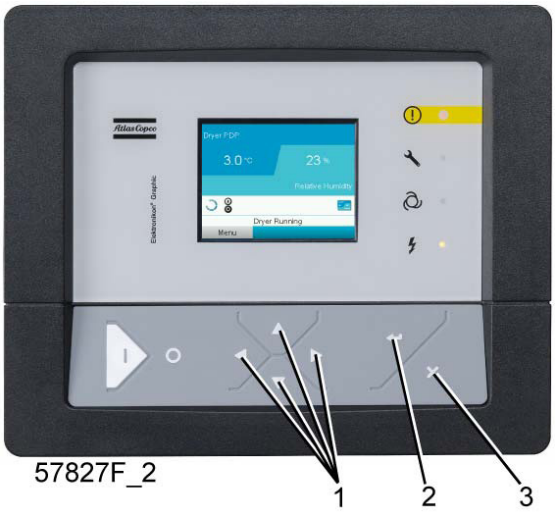
- Local control
- Remote control
- LAN (network) control


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

# 3 Elektronikon® Graphic Controller

## 3.10 Service menu

### Control panel




| | |
|---|---|
| 1 | Scroll keys |
| 2 | Enter keys |
| 3 | Escape key |

### Menu icon, Service


### Function

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

### Procedures

Starting from the Main screen,

- Move the cursor to the action button Menu and press the Enter key. Following screen appears:


- Using the Scroll keys, move the cursor to the Service icon (see above, section Menu icon).
- Press the Enter key. Following screen appears:


| | |
|---|---|
| (i) | Service |
| (ii) | Overview |
| (iii) | Service plan |
| (iv) | Next service |
| (v) | History |

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

# 3 Elektronikon® Graphic Controller

### Overview

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Text on figures

| | |
|---|---|
| (i) | Overview |
| (ii) | Running hours |
| (iii) | Real time hours |
| (iv) | Reset |

Example for service level (A):

The figures at the left are the programmed service intervals. For Service interval A, the programmed number of running hours is 4000 hours (upper row) and the programmed number of real time hours is 8760 hours, which corresponds to one year (second row). This means that the controller will launch a service warning when either 4000 running hours or 8760 real hours are reached, whichever comes first. Note that the real time hours counter keeps counting, also when the controller is not powered.

The figures within the bars are the number of hours to go till the next service intervention. In the example above, the Vacuum pump was just started up, which means it still has 4000 running hours or 8280 hours to go before the next Service intervention.

### Service plans

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

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

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

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

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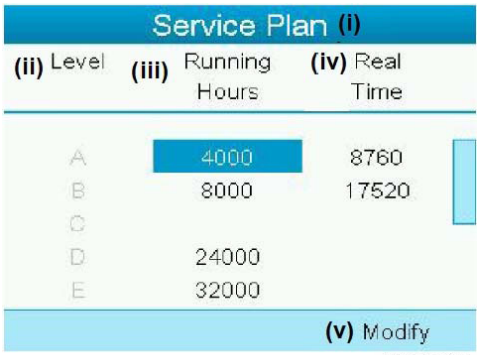
Text on figures

| | |
|---|---|
| (i) | Service plan |
| (ii) | Level |
| (iii) | Running hours |
| (iv) | Real time hours |
| (v) | Modify |

### Modifying a service plan

Dependant on the operating conditions, it can be necessary to modify the service intervals. (By default the service plan in Electronikon controller is for normal application and needs to be changed when running in medium or harsh applications). To do so, use the Scroll keys to select the value to be modified. A screen similar to the one below appears:

# 3 Elektronikon® Graphic Controller



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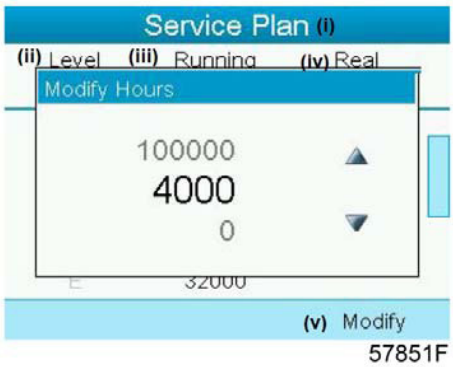
Press the Enter key. Following screen appears:



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Modify the value as required using the ↑ or ↓ scroll key and press the Enter key to confirm.

**Note:** Running hours can be modified in steps of 100 hours, real time hours can be modified in steps of 1 hour.

### Next Service

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Text on figures

| | |
|---|---|
| (i) | Next service |
| (ii) | Level |
| (iii) | Real hours |
| (iv) | Actual |

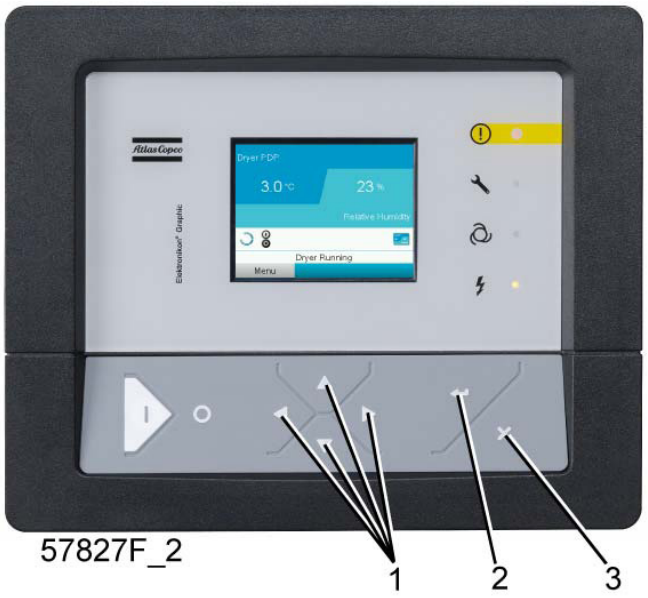
In the example above, the A Service level is programmed at 4000 running hours, of which 0 hours have passed.

### History

The History screen shows a list of all service actions done in the past, sorted by date. The date at the top is the most recent service action. To see the details of a completed service action (e.g. Service level, Running hours or Real time hours), use the Scroll keys to select the desired action and press the Enter key.

## 3.11 Modifying the setpoint

### Control panel




### Menu icon, setpoint


| | |
|---|---|
| 1 | Scroll keys |
| 2 | Enter keys |
| 3 | Escape key |

# 3 Elektronikon® Graphic Controller

### Function

On vacuum pumps with a frequency converter driven main motor, it is possible to program two different setpoints. This menu is also used to select the active setpoint.

### Procedure

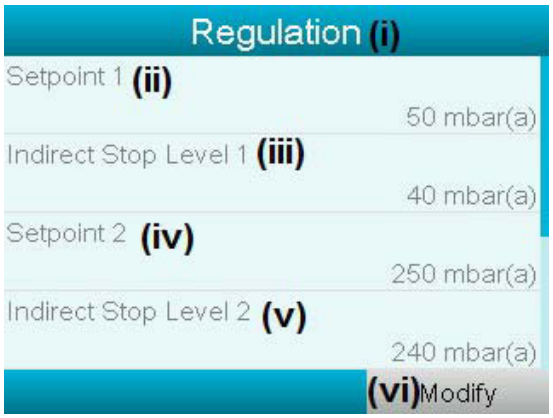
Starting from the Main screen,

- Highlight the action key Menu using the Scroll keys and press the Enter key. Following screen appears:


Text on figures

| | |
|---|---|
| (i) | Menu |
| (ii) | Regulation |

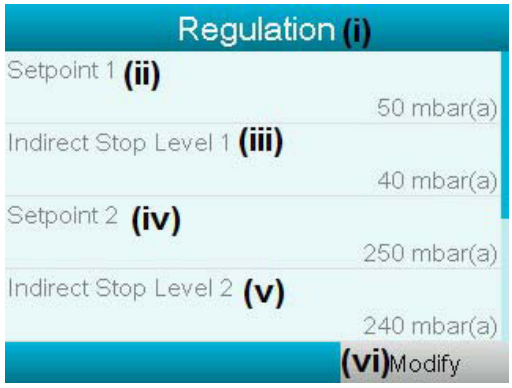
- Activate the menu by pressing the enter key. A screen similar to the one below appears:



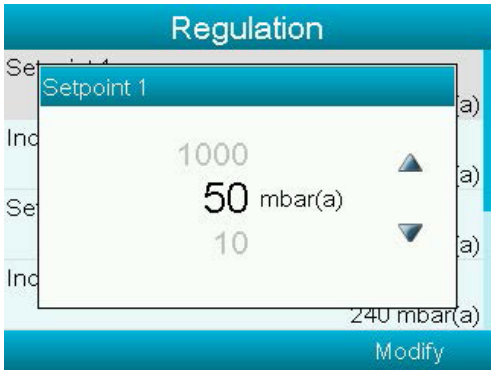

Text on figures

| | |
|---|---|
| (i) | Regulation |
| (ii) | Setpoint 1 |
| (iii) | Indirect stop level 1 |
| (iv) | Setpoint |
| (v) | Indirect stop level 2 |
| (vi) | Modify |

- The screen shows the actual settings. To modify the settings, move the cursor to the action button Modify and press the Enter key. Following screen appears:




- The first line of the screen is highlighted. Use the Scroll keys (1) to highlight the setting to be modified and press the Enter key (2). Following screen appears:




The upper and lower limit of the setting is shown in grey, the actual setting is shown in black. Use the ↑ or ↓ key of the Scroll keys to modify the settings as required and press the Enter key to accept.

# 3 Elektronikon® Graphic Controller

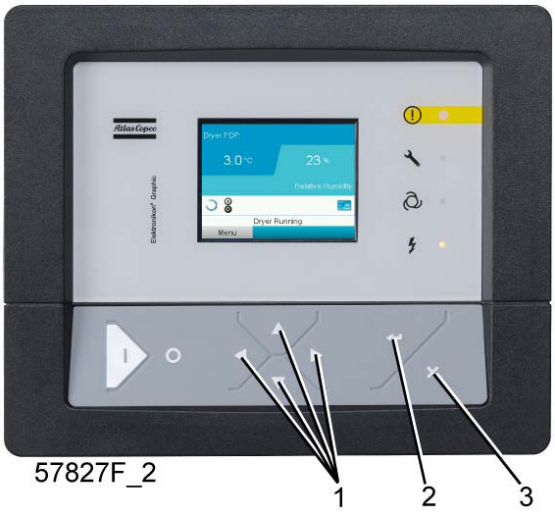
If necessary, change the other settings as required in the same way as described above.

Indirect stop: occurs when the pressure decreases to the pre-set Indirect stop setpoint (= setpoint minus Indirect stop level). The motor will decelerate to minimum speed and the inlet valve will close.

Both settings (Indirect stop level and direct stop level) are programmable, see section Programmable settings.

## 3.12 Event history menu

### Control panel




| | |
|---|---|
| 1 | Scroll keys |
| 2 | Enter keys |
| 3 | Escape key |

### Menu icon, Service


### Function

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

### Procedure

Starting from the Main screen,

- Move the cursor to the action button Menu and press the Enter key. Following screen appears:

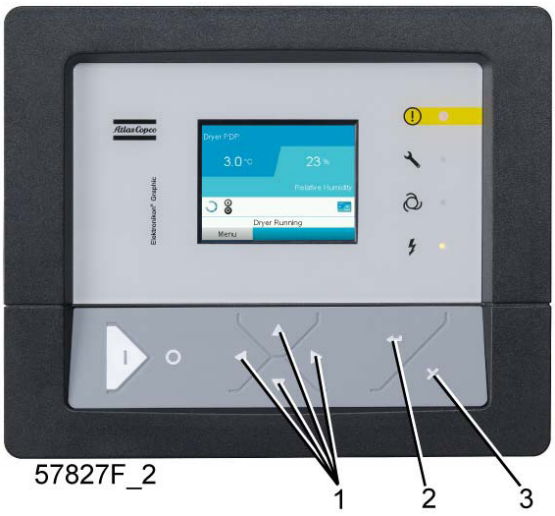

- Using the Scroll keys, move the cursor to the Event History icon (see above, section Menu icon)
- The list of last shut-down and emergency stop cases is shown.


- Scroll through the items to select the desired shut-down or emergency stop event.
- Press the Enter key to find the date, time and other data reflecting the status of the vacuum pump when that shut-down or emergency stop occurred.

# 3 Elektronikon® Graphic Controller

## 3.13 Modifying general settings

### Control panel




| | |
|---|---|
| 1 | Scroll keys |
| 2 | Enter keys |
| 3 | Escape key |

### Menu icon, Service


### Function

To display and modify a number of settings.

### Procedure

Starting from the Main screen,

- Move the cursor to the action button Menu and press the Enter key. Following screen appears:


- Next, move the cursor to the Settings icon (see above, section menu icon).using the Scroll keys.
- Press the Enter key. Following screen appears:

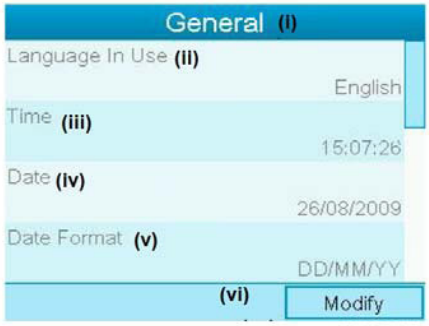

This screen shows again a number of icons. By default, the User Password icon is selected. The status bar shows the description that corresponds with the selected icon. Each icon covers one or more items, such as

- Access level
- Elements
- Fan
- Converter(s)
- Motor/Starter
- General
- Automatic restart after voltage failure (ARAVF)
- Network
- Regulation
- Remote:

For adapting certain parameters, a password may be necessary.

Example: Selecting the General Settings icon gives the possibility to change e.g. the language, the date, the date format, etc.:

# 3 Elektronikon® Graphic Controller



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**Text on figures**

| | |
|---|---|
| (i) | General |
| (ii) | Language used |
| (iii) | Time |
| (iv) | Date |
| (v) | Date format |
| (vi) | Modify |

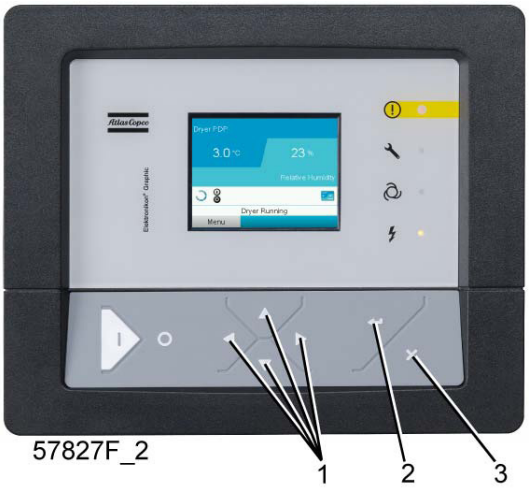
- To modify, select the Modify button using the Scroll keys and press the Enter key.
- A screen similar to the one above is shown, the first item (Language) is highlighted. Use the ↓ key of the Scroll keys to select the setting to be modified and press the Enter key.
- A pop-up screen appears. Use the ↓ or ↑ key to select the required value and press the Enter key to confirm.

  In the setting menu, it is possible to adjust:
  - Runtime at minimum pressure
  - Gas Ballast (Automatic - Manual)

  For Humid version pumps:
  - Maximum Pre Purge Time
  - Maximum Pre Purge Time during Operation
  - Post Purge Time
  - Manual Purge Time


## 3.14 Info menu

**Control panel**



57827F_2

| | |
|---|---|
| 1 | Scroll keys |
| 2 | Enter keys |
| 3 | Escape key |

**Menu icon, Info**


57867F

**Function**

To show the BeaconMedaes internet address.

**Procedure**

Starting from the Main screen,

- Move the cursor to the action button Menu

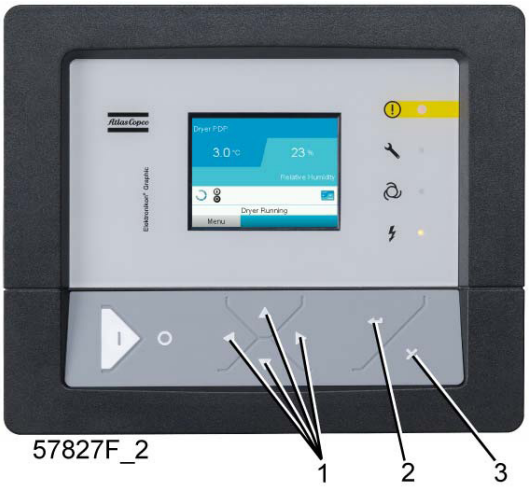
# 3 Elektronikon® Graphic Controller

and press the Enter key. Following screen appears:


- Using the Scroll keys, move the cursor to the Info icon (see above, section Menu icon).
- Press the Enter key. The BeaconMedaes internet address appears on the screen.

## 3.15 Week timer menu

### Control panel




| | |
|---|---|
| 1 | Scroll keys |
| 2 | Enter keys |
| 3 | Escape key |

**Menu icon, Weak timer**


### Function

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

**Important remark:**

In the Elektronikon you can select different timers on one day.(up to 8 actions). It is however not possible to program 2 actions at the same time. The solution: leave at least 1 minute in between 2 actions.

Example: Start Vacuum pump: 5.00 AM, Pressure setpoint 2: 5.01 AM (or later).

### Procedure

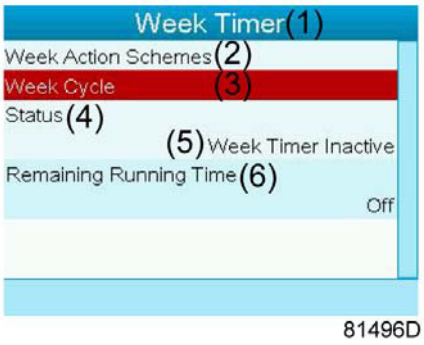
Starting from the Main screen, (see Main screen)

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


| | |
|---|---|
| 1 | Menu |
| 2 | Week timer |

# 3 Elektronikon® Graphic Controller

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




| | |
|---|---|
| 1 | Week timer |
| 2 | Week action schemes |
| 3 | Week cycle |
| 4 | Status |
| 5 | Week timer inactive |
| 6 | Remaining running time |

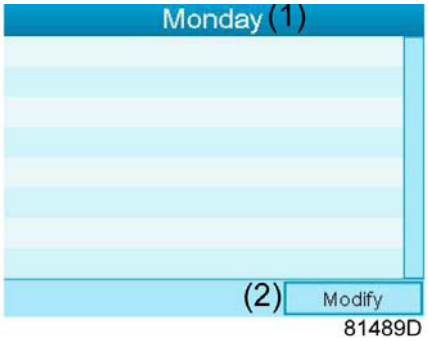
The first item in this list is highlighted in red. Select the item requested and press the Enter key on the controller to modify.

### Programming week schemes

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

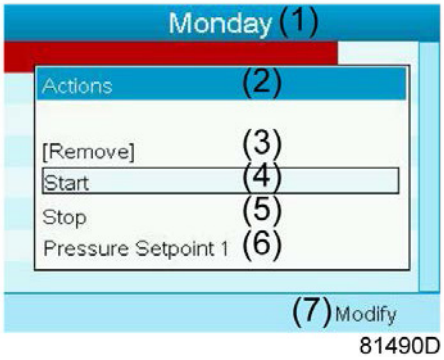

| | |
|---|---|
| 1 | Week Action Scheme 1 |
| 2 | Monday |
| 3 | Tuesday |
| 4 | Wednesday |
| 5 | Thursday |
| 6 | Friday |
| 7 | Saturday |
| 8 | Sunday |

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




| | |
|---|---|
| 1 | Menu |
| 2 | Modify |

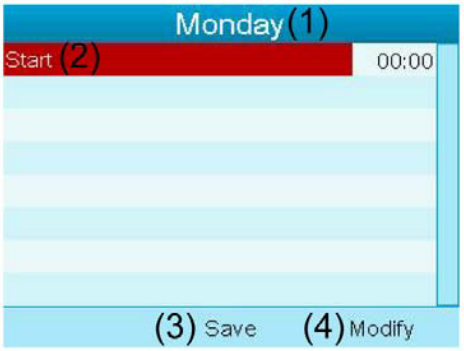
- A new pop-up window opens. Select an action from this list by using the Scroll keys on the controller. When ready press the Enter key to confirm.




| | |
|---|---|
| 1 | Monday |
| 2 | Actions |
| 3 | Remove |
| 4 | Start |
| 5 | Stop |
| 6 | Pressure setpoint 1 |
| 7 | Modify |

# 3 Elektronikon® Graphic Controller

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



81491D

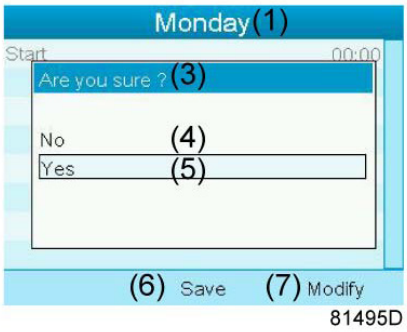
| | |
|---|---|
| 1 | Monday |
| 2 | Start |
| 3 | Save |
| 4 | Modify |

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

81493D

| | |
|---|---|
| 1 | Monday |
| 2 | Start |
| 3 | Save |
| 4 | Modify |

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



81495D

| | |
|---|---|
| 1 | Monday |
| 3 | Are you sure? |
| 4 | No |
| 5 | Yes |
| 6 | Save |
| 7 | Modify |

Press the Escape key to leave this window.

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

81497D

| | |
|---|---|
| 1 | Week action scheme 1 |
| 2 | Monday |
| 3 | Tuesday |
| 4 | Wednesday |
| 5 | Thursday |
| 6 | Friday |
| 7 | Saturday |
| 8 | Sunday |

Press the Escape key to leave this window.

# 3 Elektronikon® Graphic Controller

### Programming the week cycle

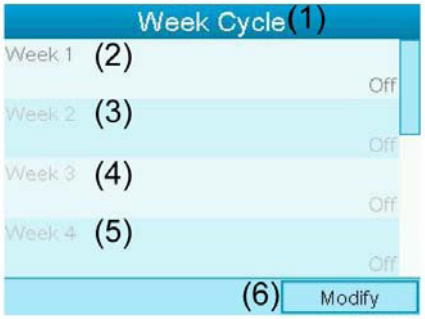
A week cycle is a sequence of 10 weeks. For each week in the cycle, one of the four programmed week schemes can be chosen.

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


81496D

| | |
|---|---|
| 1 | Week timer |
| 2 | Week action scheme |
| 3 | Week cycle |
| 4 | Status |
| 5 | Week timer inactive |
| 6 | Remaining running time |

- A list of 10 weeks is shown.

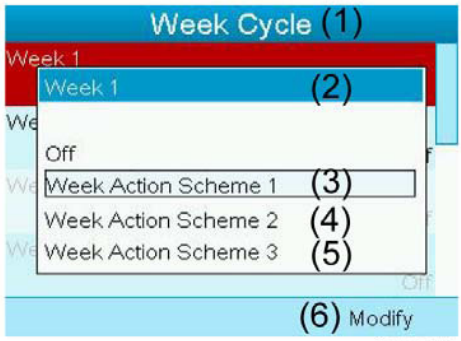



81498D

| | |
|---|---|
| 1 | Week cycle |
| 2 | Week 1 |
| 3 | Week 2 |
| 4 | Week 3 |
| 5 | Week 4 |
| 6 | Modify |

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

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




81500D

| | |
|---|---|
| 1 | Week cycle |
| 2 | Week 1 |
| 3 | Week action scheme 1 |
| 4 | Week action scheme 2 |
| 5 | Week action scheme 3 |
| 6 | Modify |

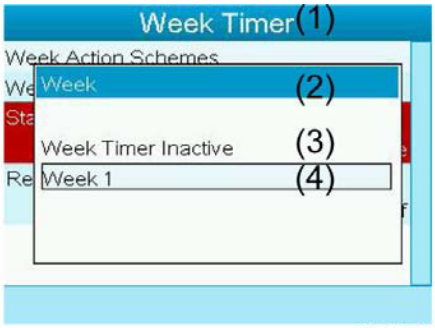
- Check the status of the Week Timer. Use the Escape key on the controller to go back to the main Week Timer menu. Select the status of the Week Timer.


81501D

| | |
|---|---|
| 1 | Week timer |
| 2 | Week action scemes |
| 3 | Week cycle |
| 4 | Status |
| 5 | Week timer inactive |
| 6 | Remaining running time |

# 3 Elektronikon® Graphic Controller

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




81502D

| | |
|---|---|
| 1 | Week timer |
| 2 | Week |
| 3 | Week timer inactive |
| 4 | Week 1 |

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


81503D

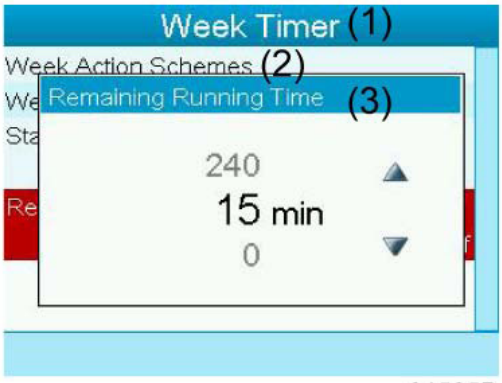
| | |
|---|---|
| 1 | Week timer |
| 2 | Week action schemes |
| 3 | Week cycle |
| 4 | Status |
| 5 | Remaining running time |

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


81504D

| | |
|---|---|
| 1 | Week timer |
| 2 | Week action schemes |
| 3 | Week cycle |
| 4 | Status |
| 5 | Remaining running time |

- This timer is used when the week timer is set and for certain reasons the Vacuum pump must continue working, for example, 1 hour, it can be set in this screen. This timer is prior to the Week Timer action.



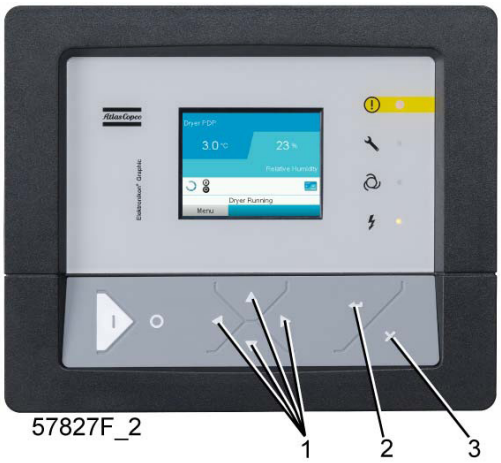

81505D

| | |
|---|---|
| 1 | Week timer |
| 2 | Week action schemes |
| 3 | Remaining running time |

# 3 Elektronikon® Graphic Controller

## 3.16 User password menu

### Control panel




| | |
|---|---|
| 1 | Scroll keys |
| 2 | Enter keys |
| 3 | Escape key |

### Menu icon, Password


### Function

If the password option is activated, it is impossible for not authorized persons to modify any setting.

### Procedure

Starting from the Main screen,

- Move the cursor to Menu and press the Enter key (2). Following screen appears:


- Using the Scroll keys, select the Settings icon (see section Modifying general settings).
- Press the Enter key. Following screen appears:


- Move the cursor to the Password icon (see above, section Menu icon).
- Select Modify using the Scroll keys and press the Enter key. Next, modify the password as required.

## 3.17 Web server

All Elektronikon controllers have a built-in web server that allows direct connection to the company network or to a dedicated PC via a local area network (LAN). This allows to consult certain data and settings via a PC instead of via the display of the controller.

If the vacuum pump is equipped with a SMARTBOX, the network connection of the Electronikon is already in use. To allow the web server functionality, the network cable that is connected to the SMARTBOX should be unplugged and replaced by the cable of the company network.

If both the web server functionality and SMARTBOX are required, please contact your BeaconMedaes Customer Center for support.

Make sure you are logged in as administrator.

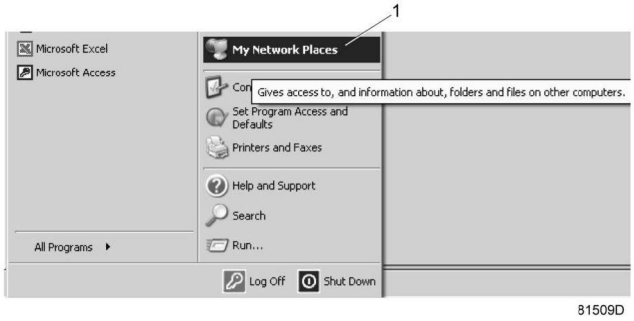
# 3 Elektronikon® Graphic Controller

- Use the internal network card from your computer or a USB to LAN adapter (see picture below).


- Use a UTP cable (CAT 5e) to connect to the controller (see picture below).

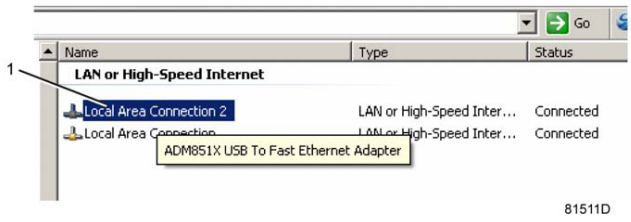

### Configuration of the network card

- Go to My Network places (1).

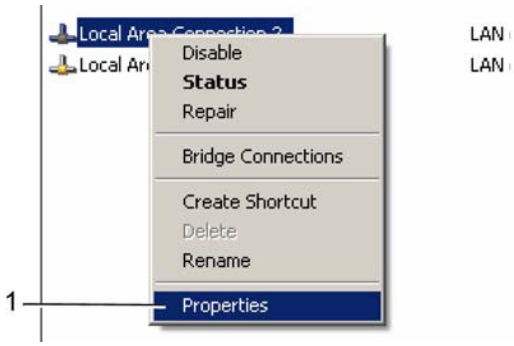



- Click on View Network connections (1).


- Select the Local Area connection (1), which is connected to the controller.



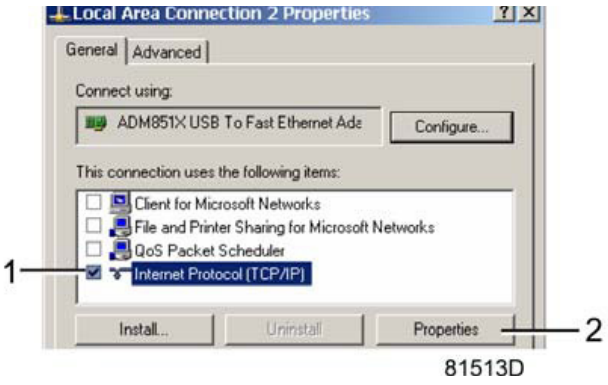

- Click with the right button and select properties (1).




- Use the check box Internet Protocol (TCP/IP) (1) (see picture). To avoid conflicts, uncheck other properties if they are checked. After selecting TCP/IP, click on

# 3 Elektronikon® Graphic Controller

the Properties button (2) to change the settings.




- Use the following settings:
  - IP Address 192.168.100.200
  - Subnet mask 255.255.255.0

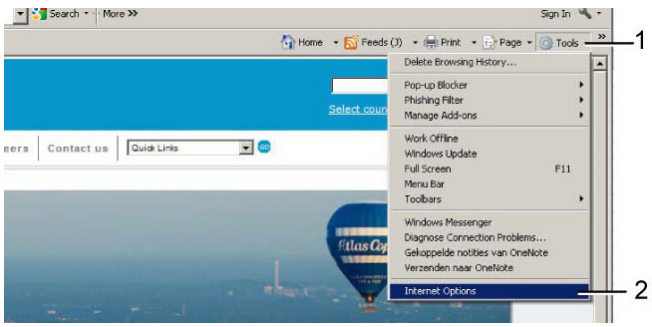
Click OK and close network connections.

### Configuration of the web server

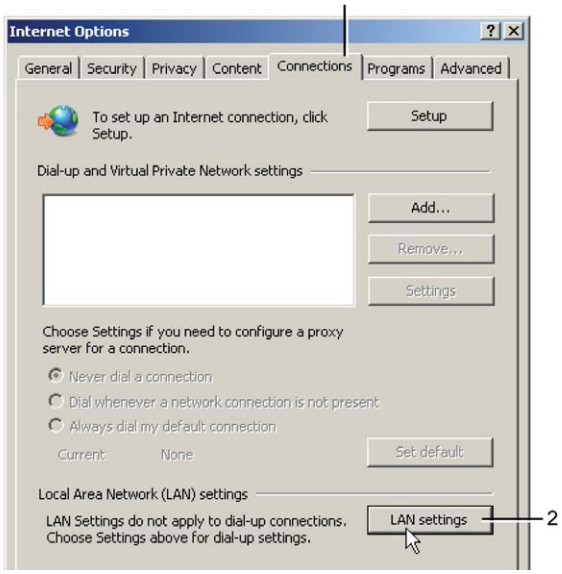
### Configure the web interface

The internal web server is designed and tested for Microsoft® Internet Explorer 6, 7 and 8. Other web browsers like Opera and Firefox do not support this internal web server. When using Opera or Firefox, a redirect page opens. Click on the hyperlink to connect to the download server from Microsoft® to download the latest version of Internet Explorer, and install this software.

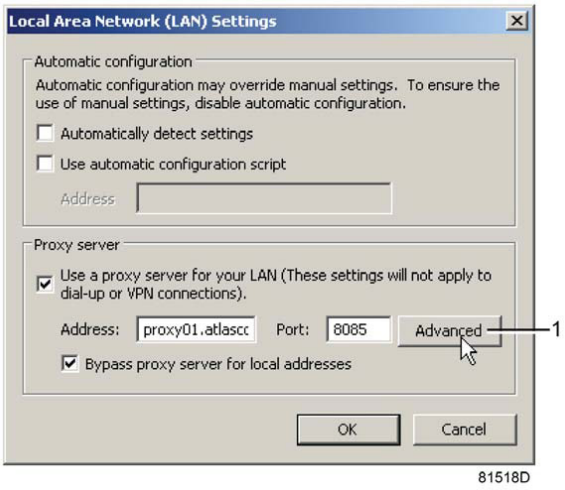
- When using Internet Explorer:
  Open Internet Explorer and click on Tools - Internet options (2).




Click on the Connections tab (1) and then click on the LAN settings button (2).



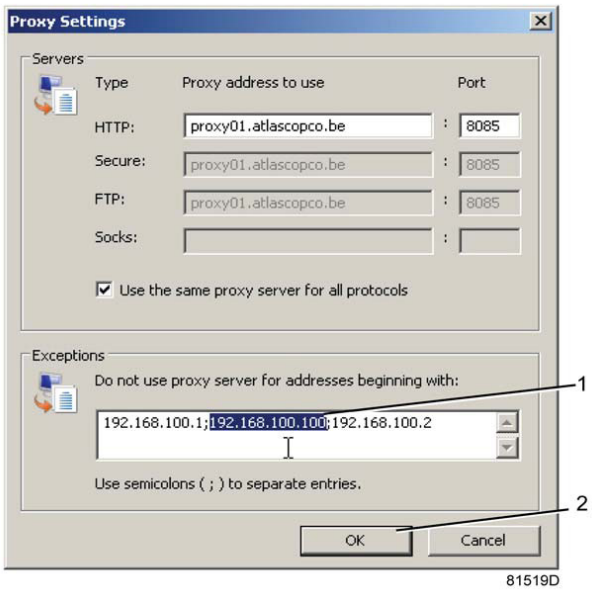

- In the Proxy server Group box, click on the Advanced button (1).



# 3 Elektronikon® Graphic Controller

In the Exceptions Group box, enter the IP address of your controller. Multiple IP addresses can be given but they must be separated with semicolons (;).

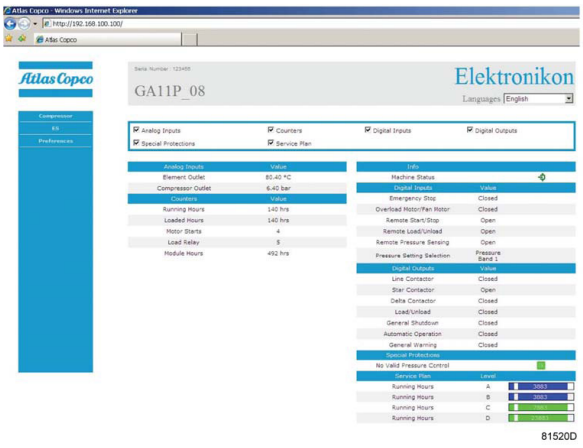
Example: Suppose that you already added two IP addresses (192.168.100.1 and 192.168.100.2). Now you add 192.168.100.100 and separate the 3 IP addresses by putting semicolons between them (1) (see picture). Click OK (2) to close the window.




## Viewing the controller data

All screen shots are indicative. The number of displayed fields depends on the selected options.

- Open your browser and type the IP address of the controller you want to view in your browser (in this example http://192.168.100.100). The interface opens:




## Navigation and options

- The banner shows the vacuum pump type and the language selector. In this example, three languages are available on the controller.


- On the left side of the interface you can find the navigation menu (see picture below). If a license for ESi is foreseen, the menu contains 3 buttons.
- Vacuum pump (or machine): shows all vacuum pump settings.
- ES: shows the ESi status (if a license is provided).
- Preferences: allows to change temperature and pressure units.

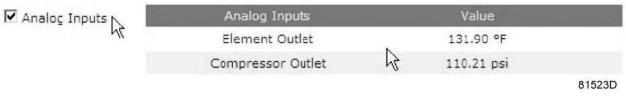
# 3 Elektronikon® Graphic Controller

### Vacuum pump settings

All vacuum pump settings can be displayed or hidden. Put a check mark in front of each point of interest and it will be displayed. Only the machine status is fixed and cannot be removed from the main screen.

### Analog inputs

Lists all current analog input values. The measurement units can be changed in the preference button from the navigation menu.




### Counters

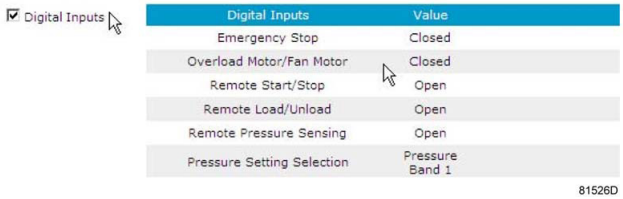
Lists all current counter values from controller and vacuum pump.


### Info status

Machine status is always shown on the web interface.

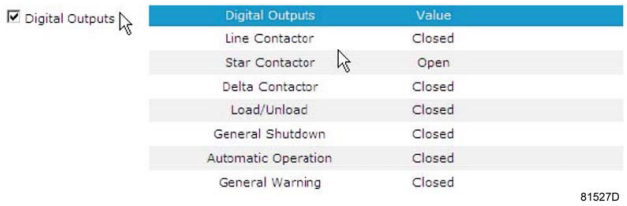

### Digital inputs

Lists all Digital inputs and their status.




### Digital Outputs

Lists all Digital outputs and their status.




### Special protections

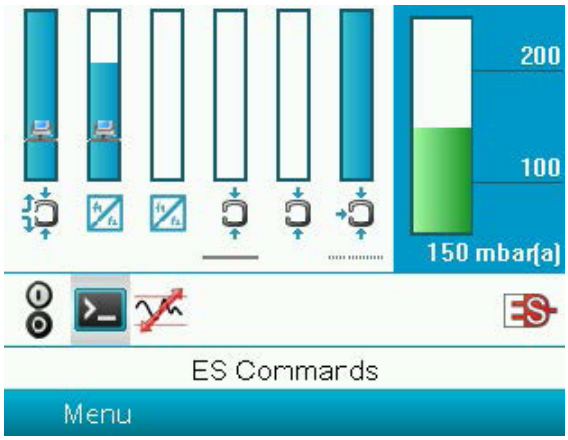
Lists all special protections of the vacuum pump.


### Service plan

Displays all levels of the service plan and their status. This screen shot underneath only shows the running hours. It is also possible to show the current status of the service interval.


### ES screen controller

If an ESi license is provided, the ES button is displayed in the navigation menu. At the left all vacuum pumps in the ES are shown. At the right the ES status is shown.



# 3 Elektronikon® Graphic Controller

## 3.18 Programmable settings

### Vacuum pump/motor

| | | Minimum setting | Factory setting | Maximum setting |
|---|---|---|---|---|
| Set-point 1 and 2, Workplace vacuum pumps | mbar(a) | 0 | 50 | 1000 |
| Set-point 1 and 2, Workplace vacuum pumps | Torr | 0 | 37.5 | 750 |
| Indirect stop level | mbar | 5 | 10 | 100 |
| Indirect stop level | Torr | 3.75 | 7.5 | 75 |
| Proportional band | % | 5 | 11 | 15 |
| Integration time | sec | 0.5 | 5 | 10 |

### Parameters

| | | Minimum setting | Factory setting | Maximum setting |
|---|---|---|---|---|
| Run time at minimum pressure | sec | 0 | 5 | 10 |
| Maximum pre purge time | min | 1 | 15 | 20 |
| Maximum post purge time | min | 1 | 30 | 180 |
| Maximum pre purge time during operation | sec | 1 | 120 | 600 |
| Fan motor starts per day (air-cooled vacuum pumps) | min | 1 | 30 | 120 |
| Integration time | | 100 | 720 | 1440 |
| ES post purge time | min | 1 | 30 | 180 |

### Protections

| | | Minimum setting | Warning | Shutdown | Maximum setting |
|---|---|---|---|---|---|
| Vacuum pump element outlet temperature (shut-down warning level) | °C | 110 | 112 | 120 | 120 |
| Vacuum pump element outlet temperature (shut-down warning level) | °F | 230 | 234 | 248 | 248 |

### Service plan

The built-in service timers will give a Service warning message after their respective pre-programmed time interval has elapsed.

For specific data, see section Preventive Maintenance.

Consult BeaconMedaes if a timer setting needs to be changed. The intervals must not exceed the nominal intervals and must coincide logically. See section Modifying general settings. 18 Programmable settings.

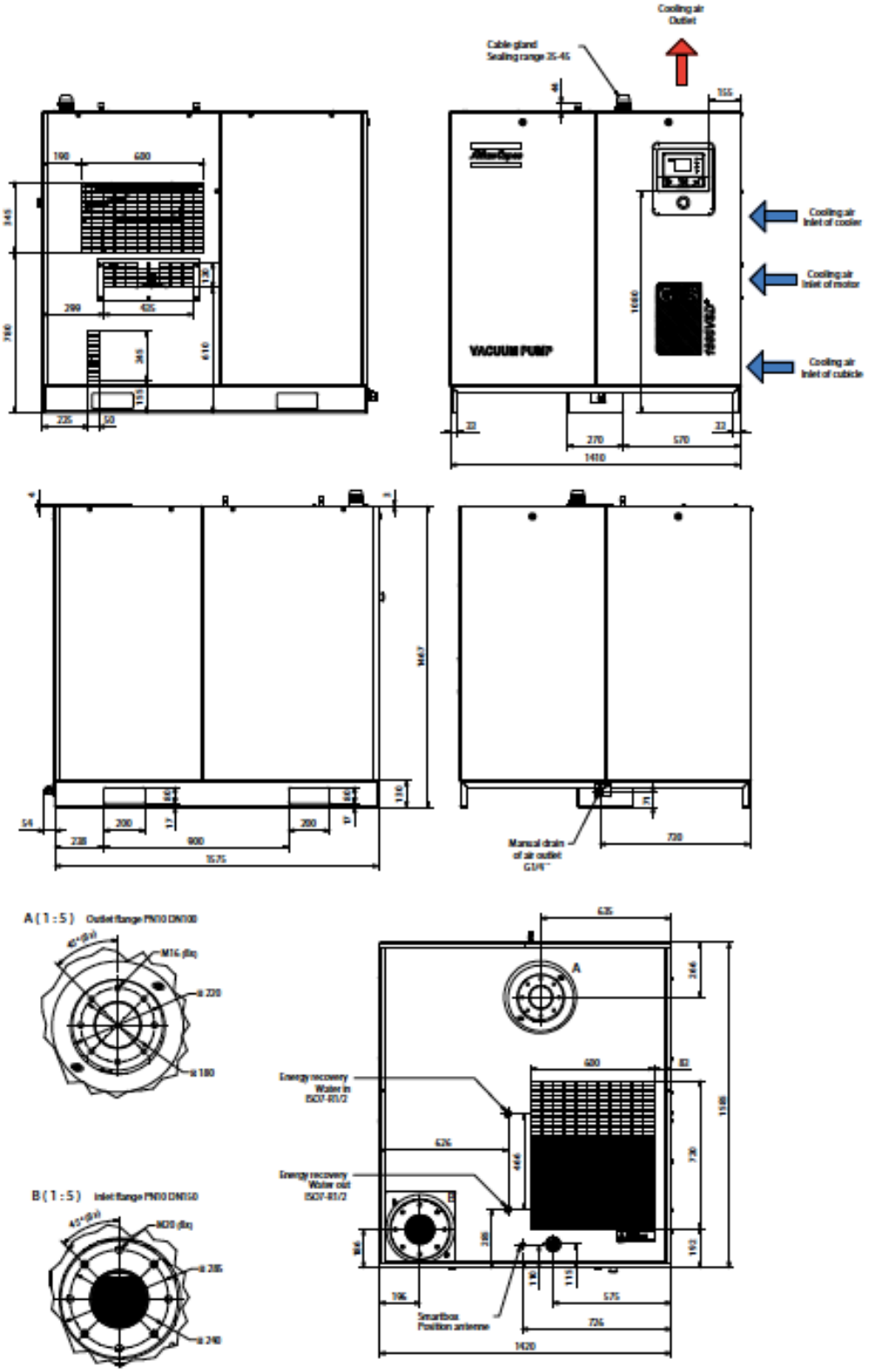
# 3 Elektronikon® Graphic Controller

**Terminology**

| Term | Explanation |
|---|---|
| ARAVF | Automatic Restart After Voltage Failure. See section Elektronikon regulator. |
| Power recovery time | Is the period within which the voltage must be restored to have an automatic restart. Is accessible if the automatic restart is activated.<br>To activate the automatic restart function, consult BeaconMedaes. |
| Restart delay | This parameter allows to programme that not all Vacuum pumps are restarted at the same time after a power failure (ARAVF active). |
| Vacuum pump element outlet | The recommended minimum setting is 110 °C (230 °F). For testing the temperature sensor, the setting can be decreased to 50 °C (122 °F). Reset the value after testing. The regulator does not accept inconsistent settings, e.g. if the warning level is programmed at 95 °C (203 °F), the minimum limit for the shut-down level changes to 96 °C (204 °F). The recommended difference between the warning level and shut-down level is 10 °C (18 °F). |
| Delay at signal | Is the time period during which the warning signal must exist before the warning message appears. |
| Delay at start | Is the time period after starting which must expire before generating a warning. The setting should be less than the setting for the delay at signal. |
| Minimum stop time | Once the Vacuum pump has automatically stopped, it will remain stopped for the minimum stop time, whatever happens with the system pressure. |
| Proportional band and integration time | The settings for the Proportional band and integration time are determined by experiment.<br>Altering these settings may damage the Vacuum pump. Consult BeaconMedaes. |

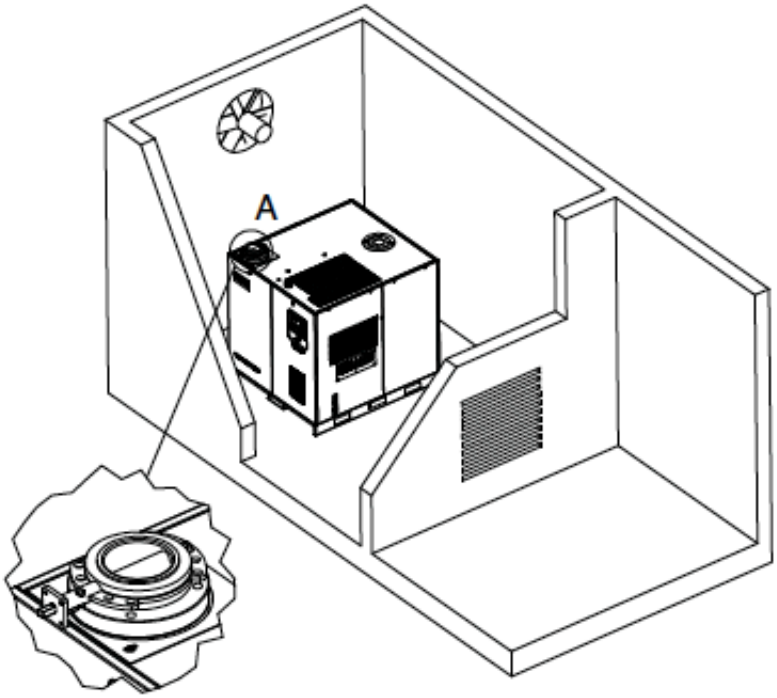
# 4 Installation

## 4.1 Dimension drawings



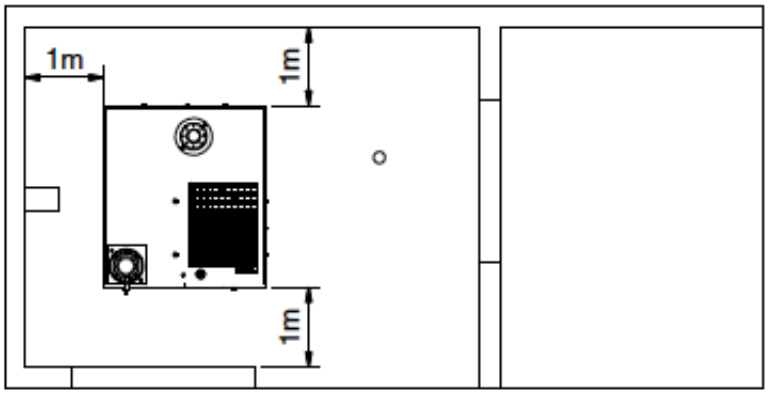
# 4 Installation

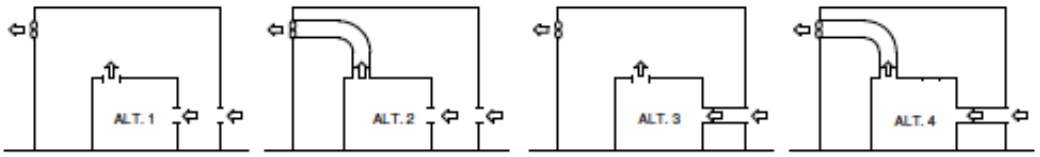
## 4.2 Installation proposal




A ( 1 : 10 )
ISOLATION VALVE

Allow sufficient space (1m of clearance on all sides and top of the vacuum pump) for safe and proper installation, daily inspection and maintenance.



# 4 Installation

1. Location:
   Locate the vacuum pump on a level surface that is clean, well lit, well ventilated and capable taking the weight of the pump. The entire length of the frame base must be supported. Shim where necessary (do not use wood). Ambient temperature should not exceed temperatures listed on the specifications.
   All models are intended for indoor installation.
   Do not locate the unit where the hot exhaust air from other vacuum pumps or heat generating equipment may be drawn into the unit. Never restrict the flow of exhaust air from the fluid cooler.
   The heated exhaust air must be exhausted to the outside to prevent high ambient conditions in the room.
2. Piping connections:
   The vacuum distribution and piping system, including the vacuum pump and all related components, must be designed in accordance with generally accepted engineering practices. For instance, inlet pipe work should slope away from the vacuum pump. Improperly designed distribution systems can cause damage to the vacuum pump. Exhaust piping should be installed in such a manner as to not create additional back pressure on the vacuum pump. Also, the exhaust piping should be installed sloping away from the vacuum pump.
   A drip leg with drain point provision is foreseen available inside the vacuum pump, to prevent condensate from running back into the fluid reservoir.
   Care must be taken to avoid assembling the piping in a strain with the vacuum pump.
   It is very important to use adequate pipe diameter for the vacuum network. The combination of restrictive pipe diameter and long pipe runs can create significant pressure drop. A rule of thumb on single vacuum pump installations: maintain the diameter of the vacuum pump inlet as far into the process as possible.
   It is recommended to install an isolation valve at the inlet of the vacuum pump, to isolate the pump from vacuum distribution and piping system before performing maintenance.
   The discharge air can run up to 120 °C (248 °F), piping should be suitable to handle this temperature.
3. Ventilation:
   The inlet grid(s) and ventilation fan should be installed in such a way that any recirculation of cooling air to the inlet grating of the vacuum pump is avoided. The air velocity to the grid(s) has to be limited to 5m/s.
   The maximum air temperature at intake opening is 46 °C (115 °F), ( minimum 0 °C / 32 °F ) Ventilation alternative 1 and 3 : The required ventilation to limit vacuum pump room temperature can be calculated from :
   $Qv = 1.06\ N / T$
   Where,
   Qv = Required cooling air flow ($m^3/s$)
   N = Nominal motor power of vacuum pump (kW)
   T = Temperature increase in vacuum pump room. ( °C)
   Ventilation alternative 2 and 4 : The fan capacity should match the vacuum pump-fan capacity at a pressure head equal to the pressure drop caused by cooling air ducts. Max. allowable pressure drop in ducting before or after the vacuum pump = 10 Pa

**Safety**

Apply all relevant safety precautions, including those mentioned in this book.

**Outdoor/altitude operation**

The vacuum pumps are designed according to IP2X classification. The electrical cabinet and motor are designed according to IP54 classification. If the unit is installed outdoors, special precautions must be taken; consult

# 4 Installation

BeaconMedaes. **Function**

To call up Information regarding the actually measured data and the status of some outputs The vacuum pumps can only be used in temperatures above 0 °C (+32 °F). If frost might occur, the appropriate measures should be taken to avoid damage to the machine and its ancillary equipment. In this case, consult BeaconMedaes.

Also, if operating above 1000 m (3300 ft), consult BeaconMedaes.

### Moving/lifting

The vacuum pumps can be moved by a lift truck using the slots in the frame. Take care not to damage the bodywork during lifting or transport.

Before lifting, reinstall the transport securing bolts. Make sure that the forks protrude from the other side of the frame. The vacuum pumps can also be lifted after inserting beams in the slots.

Make sure that the beams cannot slide and that they protrude from the frame equally. The chains must be held parallel to the bodywork by chain spreaders in order not to damage the Vacuum pump. The lifting equipment must be placed in such a way that the vacuum pump is lifted perpendicularly. Lift gently and avoid twisting.

It is not allowed to lift the Vacuum pump if the canopy parts or lifting supports are not completely installed. When the vacuum pump is being lifted, it is also forbidden to come under the load or to perform maintenance activities to it.

### Acclimatization

When moving the vacuum pump into an installation room, condensation can occur on some components.

To avoid the dew from harming the electrical components, ensure at least 2 hours of acclimatization before switching on the vacuum pump.

## 4.3 Electrical connections

Working with machinery controlled by a frequency converter requires special safety precautions. These safety precautions depend on the kind of network used (TN, TT, IT system). Consult BeaconMedaes.

### Acclimatization

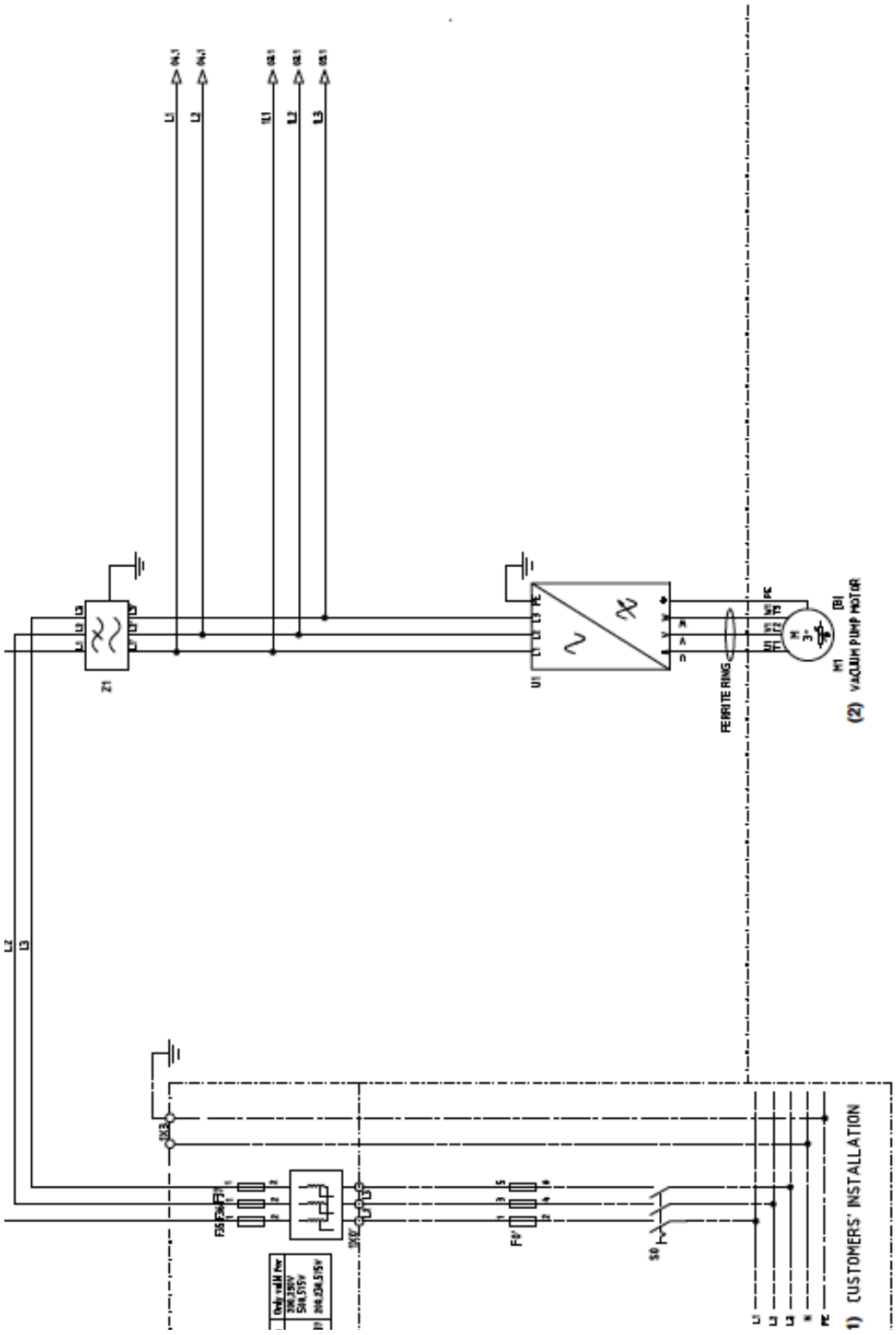
Most vacuum pump are designed for use in TT/TN networks and are intended for industrial environments where the electrical supply is separated from the residential/ commercial supply network.

To use the machine in light industrial, commercial or residential environments with a shared supply network or in an IT network, extra measures can be required: contact BeaconMedaes.

### Electrical connections for MSV 030 up to MSV 050

# 4 Installation

## Service diagram



# 4 Installation

| Ref | Designation |
|---|---|
| 1 | Customer’s installation |
| 2 | Vacuum pump motor |

**Notes**
The complete electrical diagram can be found in the electrical cubicle.

**Description**

You find the correct position for the electrical connection on the Dimension drawings.

1. Provide an isolating switch.
2. Check that the motor cables and wires inside the electric cabinet are clamped tight to their terminals.
3. Check the fuses. See section Electric cable size and fuses
4. Connect the power supply cables to terminals (1, 3 and 5)
5. Connect the earth conductor to the earth bolt (PE)

To preserve the protection degree of the electric cubicle and to protect its components from dust from the environment, it is mandatory to use a proper cable gland when connecting the supply cable to the vacuum pump.

**Vacuum pump control mode**
See also section Control mode selection.

The following control modes can be selected:

- Local control: The vacuum pump will react to commands entered by means of the buttons on the control panel. Vacuum pump start/stop commands via Clock function are active, if programmed.
- Remote control: The vacuum pump will react to commands from external switches. Emergency stop remains active. Vacuum pump start/stop commands via Clock function are still possible.

Have the modifications checked by BeaconMedaes.
Stop the vacuum pump and switch off the voltage before connecting external equipment.
Only potential-free contacts are allowed

- LAN control: The vacuum pump is controlled via a local network. Consult BeaconMedaes.

**Vacuum pump status indication**

The Elektronikon controller is provided with potential-free auxiliary NO contacts (NO = normally open) (K07, K08 and K09) for remote indication of:

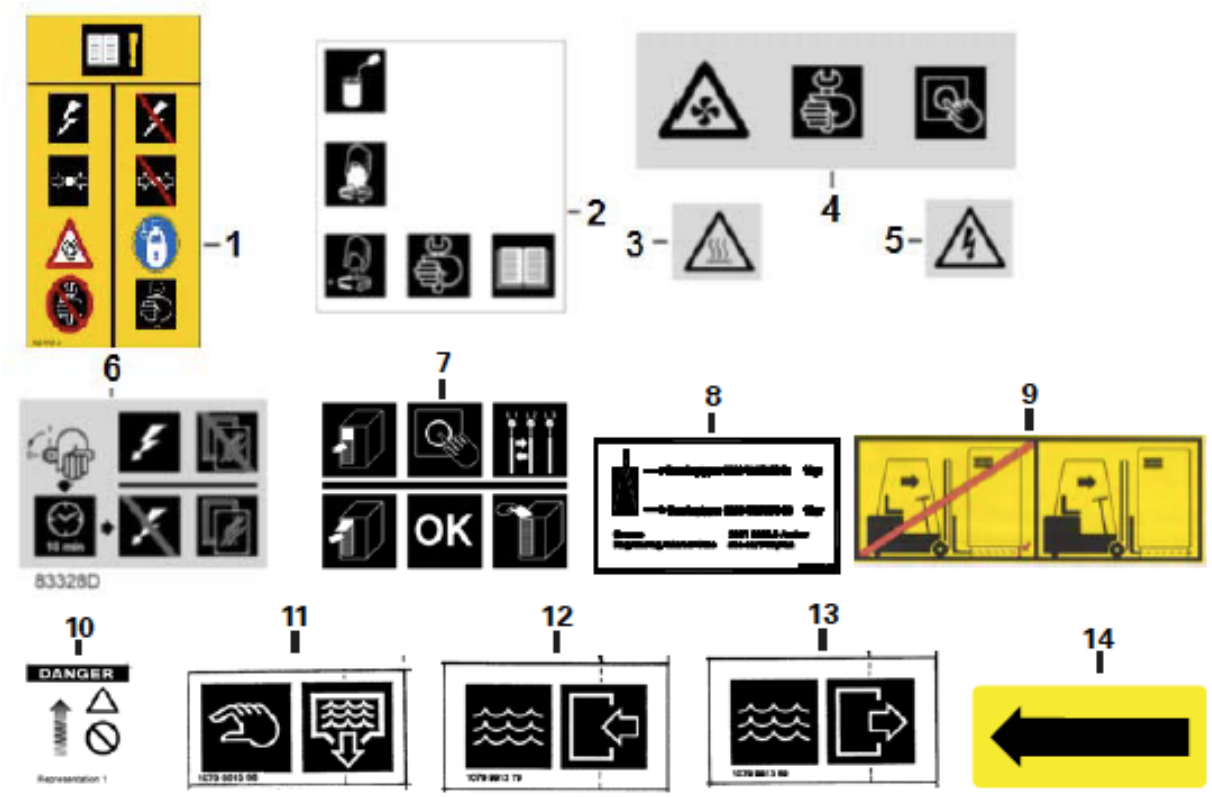
- Manual or automatic operation (K07)
- Warning condition (K08)
- Shut-down condition (K09)

Maximum contact load: 10 A / 250 V AC

Stop the vacuum pump and switch off the voltage before connecting external equipment. Consult BeaconMedaes.

# 4 Installation

## 4.4 Pictographs




| Reference | Designation |
|---|---|
| 1 | Switch off the voltage and depressurize the vacuum pump before starting maintenance or Repairs |
| 2 | Lightly oil the gasket of the oil filter, screw it on and tighten by hand (approx. half a turn) |
| 3 | Warning, hot surface |
| 4 | Stop the vacuum pump before cleaning the coolers |
| 5 | Warning, voltage |
| 6 | Switch off the voltage and wait at least 10 minutes before maintenance |
| 7 | If the rotation direction is wrong, open the isolating switch in the voltage supply line and reverse two incoming electric lines |
| 8 | Motor regreasing instructions |
| 9 | Lifting instruction |
| 10 | Warning, loaded spring |
| 11 | Manual drain |
| 12 | Water in |
| 13 | Water out |
| 14 | Motor rotation arrow |

# 5 Options

## 5.1 Energy recovery unit

### Description

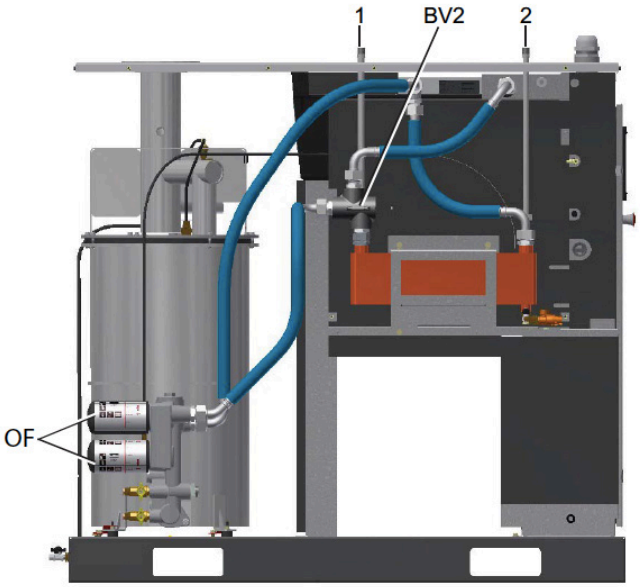
A large part of the energy required for any compression process is transformed into heat. For MSV oil-injected screw vacuum pump, the major part of the compression heat is dissipated through the oil system. The BeaconMedaes energy recovery (ER) systems are designed to recover most of the above-mentioned heat by transforming it into warm or hot water without any adverse influence on the vacuum performance. The water can be used for diverse applications.

### Components

**The energy recovery system is completely integrated and mainly comprises:**

- Stainless steel oil/water heat exchanger
- Thermostatic by-pass valve for energy recovery heat exchanger (BV2)
- The necessary bolts, flexibles, etc.
- Pressure relieve valve with pressure setting of 10 bar
- Oil drain valve

### Energy recovery unit (ER-unit)




Main components of the ER unit (typical installation)

| Reference | Designation |
|---|---|
| 1 | Water inlet pipe |
| 2 | Water outlet pipe |
| 3 | Oil drain valve |
| 4 | Oil line from vacuum pump oil separator vessel to ER unit |
| 5 | Oil line from ER unit to oil filter housing |
| BV2 | Location of heat exchanger by-pass valve (BV2) |
| HE | Heat exchanger |
| AR | Oil separator vessel |

### Field installation

The main components are assembled ex-factory as a compact unit which fits inside the bodywork of the vacuum pump. Consult BeaconMedaes for installing and connecting the energy recovery unit.

## 5.2 Energy recovery systems

### General

The energy recovery systems can be applied as low temperature rise/high water flow systems or as high temperature rise/low water flow systems.

### Low temperature rise/high water flow systems

For this type of application, the temperature difference between the water in the energy recovery system and the vacuum pump oil is low. As a consequence, a high water flow is needed for maximum energy recovery.

### High temperature rise/low water flow systems

For this type of application, a high water temperature rise in the energy recovery system is obtained, which consequently brings on a low flow rate.

Example: An open circuit where cold water from a main supply is heated by the energy recovery system for use in a factory, e.g. pre-heating of boiler feed water.

# 5 Options

### Recovery water flow

The recovery water enters the unit at inlet connection (1). In heat exchanger (HE) the compression heat is transferred from the vacuum pump oil to the water. The water leaves heat exchanger (HE) via outlet connection (2).

### Water requirements for closed water circuits

The use of a closed water circuit minimises make-up water requirements. Therefore, the use of soft or even demineralised water is economically feasible and eliminates the problem of scale deposits. Although the heat exchanger is made of stainless steel, the water circuit connected to the vacuum pump may require corrosion inhibitors. Consult section Cooling water requirements to minimise problems due to bad water quality. If in any doubt, consult BeaconMedaes.

Add an anti-freeze product such as ethylene-glycol to the water in proportion to the expected temperature to avoid freezing.

### Water requirements for open water circuits

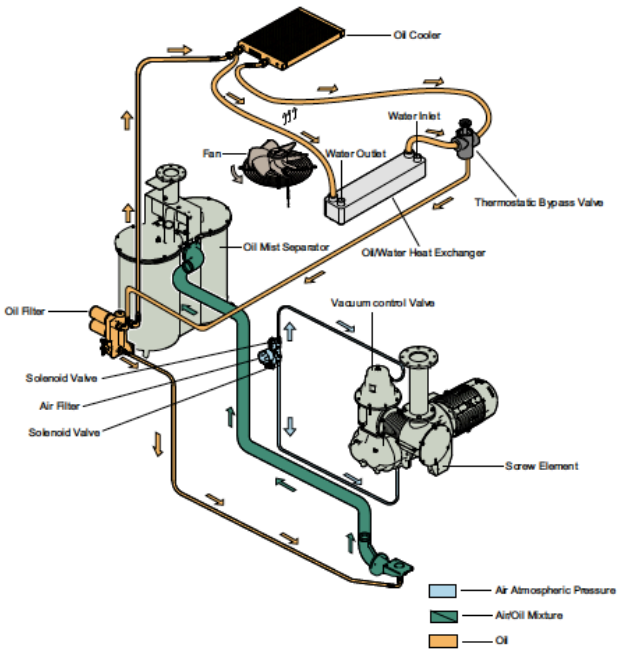
For open, non-recirculation water circuits, the major problems usually encountered are related to deposit control, corrosion control and microbiological growth control. To minimize these problems, the water should meet a number of requirements. See section Cooling water requirements. If in any doubt, consult BeaconMedaes.

## 5.3 Operation

### Description

The vacuum pump oil flow is controlled by two thermostatic valves (BV1 and BV2), ensuring reliable vacuum pump operation and optimum energy recovery.

Bypass valve (BV1) is integrated in the oil filter housing of the vacuum pump and controls the oil flow to the heat exchanger (HE) and the main oil cooler (Co) of the vacuum pump. Bypass valve (BV2) controls the oil flow through the oil/water heat exchanger (HE) of the ER unit. Both valves consist of an insert (thermostat) mounted in a housing.




BV1 starts closing the bypass line over the oil cooling circuit at the lower limit of its temperature range. At the upper limit of its temperature range, the bypass line is completely closed and all the oil flows through the oil cooling circuit.

BV2 starts closing the bypass line over the ER heat exchanger (HE) at the lower limit of its temperature range. At the upper limit of its temperature range, the bypass line is completely closed and all the oil flows through the main oil cooler (Co).

Bypass valve BV1 starts opening at 80 ºC (176 ºF) and is completely open at 95 ºC (203 ºF). Bypass valve BV2 starts opening at 83 ºC (181 ºF) and is completely open at 98 ºC (208 ºF). The ER system can be provided with bypass valves at the water side.

BV1 must have a higher opening temperature (set point) than BV2 in order to prevent the heat from being dissipated in the vacuum pump oil cooler

# 5 Options

(Co) rather than in the oil/water heat exchanger (HE) when using the compression heat as source for energy recovery.

**Energy recovery system in use**

- Vacuum pump start-up

When the vacuum pump is started up from cold, the oil temperature will be low. Bypass valve (BV1) shuts off the oil supply to the oil cooling system to prevent the vacuum pump oil from being cooled. The oil flows from the oil separator vessel (AR) through the oil filter(s) (OF) back to vacuum pump element (E).

All energy input is used to rapidly warm up the vacuum pump oil. No energy is recovered.

- Maximum energy recover

As soon as the oil temperature reaches the set point (opening temperature) of bypass valve (BV1), the valve starts closing off the bypass over the oil cooling system, gradually allowing the oil to flow through the heat exchanger (HE). As the oil temperature rises to approx. 83 ºC (181 ºF), all the oil passes through the cooling system. The exchange of heat between the vacuum pump oil and the heat recovery water is maximum. The oil from the heat exchanger outlet flows via oil filter (OF), vacuum pump element (E) and separator (AR) back to the inlet of heat exchanger (HE). Bypass valve (BV2) bypasses the main oil cooler (Co) as long as the oil temperature remains below its set point.

Operation principle at different loads:

- Low consumption of recovered energy

The temperature of the oil leaving heat exchanger (HE) rises. When the temperature rises above its set point, oil cooler bypass valve (BV2) will gradually allow the oil to be cooled in the oil cooler (Co).

- Recovery water flow too high/temperature too low

In this case, bypass valve (BV1) will open the bypass line allowing oil from heat exchanger (HE) to be mixed with oil from separator (AR). Energy is transferred from the vacuum pump oil to the water, but at a relatively low temperature level.

**No energy recovered**

This situation should be considered as exceptional, e.g. in case of maintenance of the energy recovery system or when no energy is required for a long period.

**Stopping the unit for a long period**

In case of an open water system and/or if freezing temperatures can be expected, isolate the vacuum pump water system and blow it through with compressed air.

## 5.4 Maintenance

**Vacuum pump oil**

For references used consult section Energy recovery unit

**Oil change:**

1. Run the unit until warm. Stop the unit, switch off the isolating switch and close the air outlet valve of the vacuum pump
2. Depressurize the vacuum pump and drain the oil by opening the drain valve. Also drain the oil from the heat exchanger by opening the drain valve on the heat exchanger (HE). Close the valve after draining
3. Resume oil change as described in section Oil and Filter Change in this book.

**Thermostatic bypass valves**

Change the thermostat of the ER system at the same interval as the thermostat of the unit.

**Heat exchanger (HE)**

If the temperature rise over the energy recovery system declines over a period of time with the same basic working conditions, the heat exchanger should be inspected. To clean the oil side, soak the heat exchanger in a degreasing solution. To remove scale formation in the water compartment, a proper descaling process should be applied. Consult BeaconMedaes.

# 5 Options

## 5.5 Cooling water requirements

### General

Cooling water needs to fulfill certain requirements in order to avoid problems of scaling, fouling, corrosion or bacterial growth.

In open circuit cooling towers, protective measures must be taken to avoid the growth of harmful bacteria such as legionella pneumophila when there is a risk of inhalation of the water droplets.

No general recommendation can encompass the effects of all combinations of the various compounds, solids and gases typically found in cooling water in interaction with different materials. Therefore the recommendations formulated in our Cooling Water Specifications are a general guide line for acceptable coolant quality. However, where strict limits apply, a statement is made in the specification.

The water requirements refer to untreated water. When water is treated, some parameters will change. Water treatments should be carried out by a specialized water treatment company, taking the responsibility for the performance of the treated cooling water and the compatibility with the materials in the cooling circuit. This includes not only the selection of the appropriate additives, but also the correct application, monitoring of concentrations and properties, prevention of sludge formation and maintenance of the system. This applies also to treatment with antifreeze products. They must be provided with suitable stabilizers and inhibitors. Specifications are also depending on the type of cooling circuit (open, once through / recirculating with tower / closed) and on the application (Standard - max 65 °C cooling water temperature at the outlet) or Energy Recovery (water temperature up to 95 °C).

In case water is not in line with recommended values or if any doubt, consult the manufacturer.

### Cooling water parameters

#### 1. pH

The effect of pH is already included in the Ryznar Stability Index (RSI - see item 4 below), but also the pH itself is subject to limitations:

| | | pH | |
|---|---|---|---|
| Type of cooling system | Materials | Standard | Energy recovery |
| Single pass | Containing copper | 6.8 - 9.3 | 6.8 - 9.3 |
| | Stainless steel with carbon steel and / or cast iron | 6.8 - 9.3 | 6.8 - 9.3 |
| | Stainless steel only | 6 - 9.3 | 6 - 9.3 |
| Recirculating (with tower) | Containing copper | 6.8 - 9.3 | not applicable |
| | Stainless steel with carbon steel and / or cast iron | 6.8 - 9.3 | |
| | Stainless steel only | 6 - 9.3 | |
| | Containing copper | 7.5 - 9.3 | 7.5 - 9.3 |
| | Stainless steel with carbon steel and / or cast iron | 7.5 - 9.3 | 7.5 - 9.3 |
| | Stainless steel only | 6 - 9.3 | 6 - 9.3 |

# 5 Options

The values in bold are rejection limits.

When the system contains Zn or Al, the pH must be < 8.5.

**2. Total dissolved solids (TDS) and conductivity**

The conductivity is expressed in S/cm, the TDS in ppm.

Both parameters are related with each other. The conductivity is convenient for quick monitoring of general water quality, but the TDS is required for calculating the RSI. If only one of both parameters is measured, an estimation can be obtained by using a theoretical conversion factor (0.67):

TDS = conductivity x 0.67

**3. Hardness**

Different types of hardness are in relation with each other and together with the pH and the alkalinity of the water they determine the equilibrium situation of the water, determined and specified by the RSI.

In addition, the calcium hardness must be limited to:

| | Ca (ppm Ca CO3) | |
|---|---|---|
| **Type of cooling system** | **Standard** | **Energy recovery** |
| Single pass | < 500 | < 2 |
| Recirculating (with tower) | < 500 | not applicable |
| Closed loop | < 1000 | < 50 |

**4. The Ryznar Stability Index (RSI)**

The Ryznar Stability Index is a parameter for predicting whether water will tend to dissolve or precipitate calcium carbonate. The adhesion of scaling depositions and their effect are different on different materials, but the equilibrium of the water (scaling or corrosive) is only determined by its actual pH value and by the saturation pH value (pHs). The saturation pH value is determined by the relationship between the calcium hardness, the total alkalinity, the total solids concentration and the temperature.

The Ryznar Stability Index is calculated as follows:

RSI = 2*pHs - pH,

in which

- pH = measured pH (at room temp) of the water sample
- pHs= pH at saturation

pHs is calculated from:

pHs = (9.3 + A + B) - (C + D),

in which

- A : depends on the total solids concentration
- B : depends on the water temperature at the outlet of the heat exchanger
- C : depends on the calcium hardness (CaCO3)
- D : depends on the HCO3 concentration or M-alkalinity

# 5 Options

The values of A, B, C and D can be found in below table:

| Total dissolved solids (mg/l) | A | Temperature (°C) | B | Ca hardness (ppm CaCO3) | C | M- Alkalinity (ppm CaCO3) | D |
|---|---|---|---|---|---|---|---|
| < 30 | 0.1 | 0 - 1 | 2.3 | 9 - 11 | 0.6 | 10 - 11 | 1.0 |
| 30 - 320 | 0.2 | 2 - 6 | 2.2 | 12 - 14 | 0.7 | 12 - 14 | 1.1 |
| > 320 | 0.3 | 7 - 11 | 2.1 | 15 - 17 | 0.8 | 15 - 17 | 1.2 |
| | | 12 - 16 | 2.0 | 18 - 22 | 0.9 | 18 - 22 | 1.3 |
| | | 17 - 22 | 1.9 | 23 - 28 | 1.0 | 23 - 28 | 1.4 |
| | | 23 - 27 | 1.8 | 29 - 35 | 1.1 | 29 - 35 | 1.5 |
| | | 28 - 32 | 1.7 | 36 - 44 | 1.2 | 36 - 44 | 1.6 |
| | | 33 - 38 | 1.6 | 45 - 56 | 1.3 | 45 - 56 | 1.7 |
| | | 39 - 43 | 1.5 | 57 - 70 | 1.4 | 57 - 70 | 1.8 |
| | | 44 - 49 | 1.4 | 71 - 89 | 1.5 | 71 - 89 | 1.9 |
| | | 50 - 55 | 1.3 | 90 - 112 | 1.6 | 90 - 112 | 2.0 |
| | | 56 - 61 | 1.2 | 113 - 141 | 1.7 | 113 - 141 | 2.1 |
| | | 62 - 67 | 1.1 | 142 - 177 | 1.8 | 142 - 177 | 2.2 |
| | | 68 - 73 | 1.0 | 178 - 223 | 1.9 | 178 - 223 | 2.3 |
| | | 74 - 79 | 0.9 | 224 - 281 | 2.0 | 224 - 281 | 2.4 |
| | | 80 - 85 | 0.8 | 282 - 355 | 2.1 | 282 - 355 | 2.5 |
| | | 86 - 91 | 0.7 | 356 - 446 | 2.2 | 356 - 446 | 2.6 |
| | | 92 - 95 | 0.6 | 447 - 563 | 2.3 | 447 - 563 | 2.7 |
| | | | | 564 - 707 | 2.4 | 564 - 707 | 2.8 |
| | | | | 708 - 892 | 2.5 | 708 - 892 | 2.9 |
| | | | | 893 - 1000 | 2.6 | 893 - 1000 | 3.0 |

Interpretation of the values obtained:

- RSI < 6: boiler scale formation
- 6 < RSI < 7: neutral water
- RSI > 7: corrosive water

As a general rule, the RSI index should be between 5.6 and 7.5. If that is not the case, contact a specialist

**5. Free chlorine (Cl2)**

Disinfecting with chlorine is not done in closed systems, neither in energy recovery systems. A continuous level of 0.5 ppm should not be exceeded. For shock treatments, a maximum limit of 2 ppm for maximum 30 minutes/day applies.

# 5 Options

### 6. Chlorides (Cl-)

Chloride ions will create pitting corrosion on stainless steel. Their concentration should be limited, depending from the RSI value.

| | RSI < 5.5 | 5.6 < RSI < 6.2 | 6.3 < RSI < 6.8 | 6.9 < RSI < 7.5 | 7.6 < RSI |
|---|---|---|---|---|---|
| Cl- (ppm) | 200 | 350 | 500 | 350 | 200 |

### 7. For energy recovery systems, the limit is 100 ppm.

| | Sulphate (ppm) | |
|---|---|---|
| **Type of cooling system** | **Standard** | **Energy recovery** |
| Single pass | < 1000 | < 200 |
| Recirculating (with tower) | < 1000 | not applicable |
| Closed loop | < 400 | < 200 |

### 8. Iron and Manganese

Type of cooling system

| | Dissolved iron (ppm) | | Dissolved manganese (ppm) | |
|---|---|---|---|---|
| **Type of cooling system** | **Standard** | **Energy recovery** | **Standard** | **Energy recovery** |
| Single pass | < 1 | < 0.2 | < 0.2 | < 0.05 |
| Recirculating (with tower) | < 1 | not applicable | < 0.2 | not applicable |
| Closed loop | < 1 | < 0.2 | < 0.2 | < 0.05 |

The values in bold are rejection limits.

### 9. Copper

| | Copper (ppm) | |
|---|---|---|
| **Type of cooling system** | **Standard** | **Energy recovery** |
| Single pass | < 1 | < 0.2 |
| Recirculating (with tower) | < 1 | not applicable |
| Closed loop | < 1 | < 0.2 |

### 10. Ammonium

The limit of 0.5 ppm is a rejection limit. The limitation only applies for copper containing systems.

# 5 Options

### 11. Suspended solids

Large particles (size > 10 µm) should not be present as they can be filtered out. Small particles (< 0.5 µm) are not taken into account. For particles between 0.5 µm and 10 µm, the following limits apply:

| | Suspended solids (ppm) | |
|---|---|---|
| **Type of cooling system** | **Standard** | **Energy recovery** |
| Single pass | < 10 | < 1 |
| Recirculating (with tower) | < 10 | not applicable |
| Closed loop | < 10 | < 1 |

### 12. Oil or grease

< 1 ppm (rejection value)

### 13. Biology

If biology is present, it must be aerobic. Anaerobic biology (in closed systems) must be avoided.

| | Biology (CFU/ml) | |
|---|---|---|
| **Type of cooling system** | **Standard** | **Energy recovery** |
| Single pass | $< 10^5$ / $< 10^7$ | $< 10^3$ / $< 10^5$ |
| Recirculating (with tower) | $< 10^5$ / $< 10^7$ | not applicable |
| Closed loop | $< 10^3$ / $< 10^5$ | $< 10^3$ / $< 10^5$ |

The table shows the recommended values. The values in bold are rejection limits.

## 5.6 Energy recovery data

### Reference conditions

See section Reference conditions and limitations.

### Effective working pressure

Consult section vacuum pump data for the normal working pressure.

### Maximum allowed pressure of the heat exchanger

| | |
|---|---|
| Oil side | 15 bar (217 psi) |
| Water side | 10 bar (145 psi) |

### Reading settings

In addition to other data, the following temperatures can be read on the Elektronikon display: For air-cooled units:

- The water inlet temperature of the energy recovery system
- The water outlet temperature of the energy recovery system

# 5 Options

### Modifying settings

If the programmed warning settings for the water temperatures are exceeded, a warning indication is shown on the Elektronikon:

| Temperature input | | Minimum setting | Nominal setting | Maximum setting |
|---|---|---|---|---|
| Water inlet temperature of energy recovery | ºC | 0 | 50 | 99 |
| Water inlet temperature of energy recovery | ºF | 32 | 122 | 210 |
| Energy recovery water outlet temperature | ºC | 0 | Depends on application | 99 |
| Energy recovery water outlet temperature | ºF | 32 | Depends on application | 210 |

To modify a setting, consult the relevant section in the description of the Elektronikon controller.

### Recoverable energy

The recoverable energy can be calculated from:

RECOVERED ENERGY (kW) = 4.2 x water flow (l/s) x water temperature rise (ºC) In the tables below, typical examples are given.

### Data for low temperature rise/high water flow systems

| Parameter | Unit | MSV 050 |
|---|---|---|
| Recoverable energy | kW | 20.6 |
| Recoverable energy | hp | 27.6 |
| Temperature at inlet | ºC | 40 |
| Temperature at inlet | ºF | 104 |
| Temperature at outlet | ºC | 50 |
| Temperature at inlet | ºF | 122 |

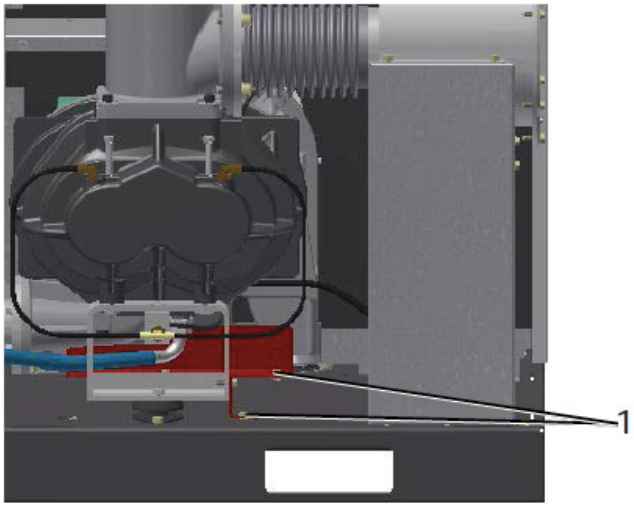
### Data for high temperature rise/low water flow systems

| Parameter | Unit | MSV 050 |
|---|---|---|
| Recoverable energy | kW | 21.3 |
| Recoverable energy | hp | 28.5 |
| Temperature at inlet | ºC | 20 |
| Temperature at inlet | ºF | 68 |
| Temperature at outlet | ºC | 40 |
| Temperature at inlet | ºF | 104 |

# 6 Operating Instructions

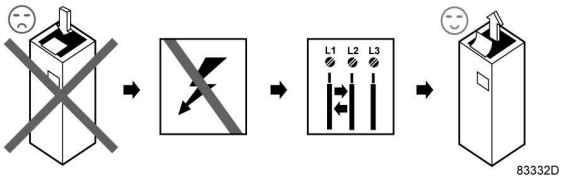
## 6.1 Initial start-up

The operator must apply all relevant Safety precautions. Also consult section Problem solving.





- Remove the service canopy panel(s) in order to get access to the internal components.
- Remove the red transport spacers and the related bolts under element (1) and oil separator tank (2).
- Check that the electrical connections correspond to the local codes and that all wires are clamped tight to their terminals.
- The installation must be earthed and protected against short circuits by fuses of the inert type in all phases. It is advised to install an isolating switch near the vacuum pump.
- Check the process lines for the correct size to prevent high pressure drop and for cleanliness to protect the vacuum pump. Also check for leaks.
- Make sure the pump outlet is not obstructed.
- Fit inlet isolation valve (IV); see section Installation proposal for the position of the valve.
- Close the valve.
- Connect the inlet pipework to the valve.
- Check the oil level, the oil level should reach the top of the oil sight glass (GI).
- If needed, top up the oil via the oil filler plug (FC).
- Take care that no dirt drops into the oil system.
- Provide labels, warning the operator that:
- The vacuum pump may automatically restart after voltage failure (if activated, consult BeaconMedaes).
- The vacuum pump is automatically controlled and may be restarted automatically.
- The vacuum pump may be remotely controlled




- Check the programmed settings. Consult section Programmable settings.
- Close the isolation valve.
- Start and run the vacuum pump for a few minutes. Check that the vacuum pump operates normally.
- Open the inlet isolation valve (IV).

# 6 Operating Instructions

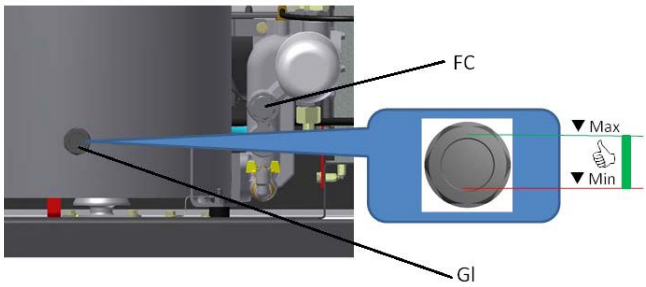
## 6.2 Starting


| Step | Action |
|---|---|
| 1 | Switch on the voltage. Check that voltage on LED (6) lights up. |
| 2 | Press start button (1) on the control panel. The vacuum pump starts running and the automatic operation LED (8) lights up. |
| 3 | Open the inlet isolation valve (IV). |

## 6.3 During operation

| | |
|---|---|
|  | Keep the panels closed during operation |
|  | When the motors are stopped and LED (8) (automatic operation) is alight, the motors may start automatically |
|  | When the automatic operation LED (8) is lit, the regulator is automatically controlling the vacuum pump, i.e. loading, purging, stopping of the motors and restarting! |

Regularly check the oil level during operation.



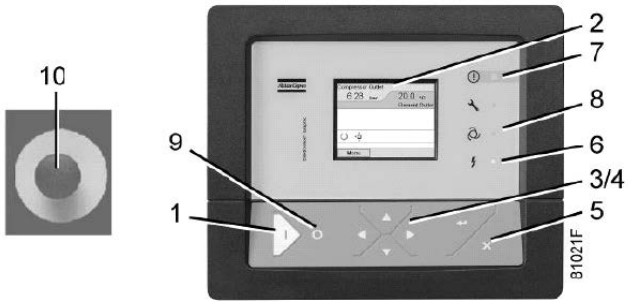

A few minutes after stopping, the oil level should reach the top of the oil sight glass (GI).

If the oil level is too low, wait until the vacuum pump has vented. Push the emergency stop button (10) to avoid the vacuum pump to start unexpectedly. Next, close the inlet isolation valve (IV).

Remove the oil filler plug (FC) and add oil until the level reaches the top of the oil sight glass. Fit and tighten the plug (FC).

Unlock the emergency stop button (10), select the STOP icon on the display and press reset before restarting.

### Checking the display




*Control panel Elektronikon® Graphic*

Check the display (2) regularly for readings and messages. The display normally shows the vacuum pump vacuum pressure, while the status of the vacuum pump is indicated by means of a number of icons. Remedy the trouble if alarm LED (7) is lit or flashes, see section Icons used. The display (2) will show a service message if a service plan interval has been exceeded or if a service level for a monitored component has been exceeded.

Carry out the service actions of the indicated plans or replace the component and reset the relevant timer, see section Service menu.

## 6.4 Taking out of operation

- Disconnect the vacuum pump from the mains.
- Shut off and vent the part of the system

# 6 Operating Instructions

which is connected to the vacuum pump by opening the plug located on the lit of the air inlet filter. Isolate the vacuum pump from the vacuum system.

- Drain the oil.

## 6.5 Stopping

- Press stop button (9). Automatic operation LED (8) goes out and the vacuum pump stops.
- To stop the vacuum pump in the event of an emergency, press emergency stop button (10).
- Alarm LED flashes (7).
- Remedy the problem cause, unlock the button by pulling it out.
- Navigate to the Stop icon on the display by means of the navigation keys (3/4) or scroll keys and press the

*Select* key.

Press *Reset*.

**Do not use emergency stop button (10) for normal stopping!**

- Close the air inlet valve.
- Switch off the voltage.

# 7 Maintenance

## 7.1 Preventive maintenance schedule

### Control panel

### Warning

Before carrying out any maintenance, repair work or adjustments, proceed as follows:

- Stop the vacuum pump.
- Close the air inlet valve.
- Press the emergency stop button (10).
- Switch off the voltage.
- Vent the vacuum pump by opening the plug located on the cover of the air inlet filter.

For detailed instructions, see section Problem solving.

The operator must apply all relevant Safety precautions.

### Warranty - Product Liability

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

### Service kits

For overhauling or carrying out preventive maintenance, service kits are available (see section Service kits).

### Service contracts

BeaconMedaes offers several types of service contracts, relieving you of all preventive maintenance work. Consult your BeaconMedaes Customer Center.

### General

When servicing, replace all removed O-rings and washers.

### Intervals

The local BeaconMedaes Customer Center may overrule the maintenance schedule, especially the service intervals, depending on the environmental and working conditions of the vacuum pump.

The longer interval checks must also include the shorter interval checks.

Service plans for vacuum pump with an Elektronikon® Graphic controller.

Besides the daily and 3-monthly checks, preventive service operations are specified in the schedule below.

Each plan has a programmed time interval at which all service actions belonging to that plan are to be carried out. When reaching the interval, a message will appear on the screen indicating which service plans are to be carried out. After servicing, the intervals must be reset, see section Service menu.

### Preventive maintenance schedule

Daily and 3-monthly check list for normal applications

| Period | Operation |
|---|---|
| Daily | Check oil level and condition. (see section Operations instructions / During operation) Check readings on display. Drain outlet collector. |
| Monthly (1) | Remove the air filter elements and inspect. Replace damaged or heavily contaminated elements. Check for possible air and oil leakages. |
| 3-monthly (1) | Check coolers, clean if necessary. Check the filter elements of the electric cabinet. Replace if necessary. Check the silencer of the vacuum control valve, clean if necessary |

(1) Depending on type of application (normal, medium, harsh) this needs to be done more frequently. Consult your BeaconMedaes Customer Center.

# 7 Maintenance

**Preventive Maintenance schedule programmed in the Elektronikon for normal applications**

| Current instruction book situation | Type of application | | |
|---|---|---|---|
| Action | Normal | Medium | Harsh |
| Check oil level and condition | Daily | Daily | Daily |
| Check readings on display | | | |
| Drain outlet collector | | | |
| Remove the air filter elements and inspect Replace damaged or heavily contaminated elements | Monthly | Monthly | Monthly |
| Check for possible air and oil leakages | | | |
| Check coolers, clean if necessary | 3-Monthly | 3-Monthly | Monthly |
| Check the filter elements of the electric cabinet. Replace if necessary | | | |
| Check the silencer of the vacuum control valve, clean if necessary | | | |
| Change oil * | 4000 hrs (1) (4) | 2000 hrs (1) (4) | 1000 hrs (1) (4) |
| Change oil filter | | | |
| Replace the air filter elements | | | |
| Clean the scavange line and blow out the restriction nozzle | | | |
| Replace the oil seperator elements | 4000 hrs (1) | 4000 hrs (1) | 2000 hrs (1) |
| Check pressure and temperature readings | | | |
| Check operation of cooling fans of converter and clean heatsink | | | |
| Check vacuum control valve solenoid and gasballast solenoid valve | | | |
| Clean coolers | | | |
| Check and clean cooling fan assembly | | | |
| Regreasing of motor bearings | | | |
| Replace the filter element of electric cabinet | 8000 hrs (2) | 6000 hrs (2) | 4000 hrs (2) |
| Replace the thermostatic valve | | | |
| Test pressure switch | | | |
| Replace membrane of vacuum control valve (3) | | | |
| Motor overhaul | 24000 hrs | 24000 hrs | 24000 hrs |
| Change lipseal assembly | 24000 hrs | 24000 hrs | 24000 hrs |
| Element overhaul | 48000 hrs | 36000 hrs | 24000 hrs |

(1) : or yearly, whichever comes first

(2) : or every 2 years, whichever comes first

(3) : For turbo pumps; for non-turbo application every 48k hrs

# 7 Maintenance

(4) : When using sythentic oil the indicated number of running hours can be doubled

* In medium and harsh applications an optional 500 hrs oil sample is recommended.

HWHcap option always use sythentic oil and harsh service intervals

The indicated service exchange intervals are valid for standard operating conditions (see section Reference conditions and limitations) and nominal operating pressure (see section Vacuum pump data). Exposure of the vacuum pump to external pollutants, operation at high humidity combined with low duty cycles or operation at higher temperatures may require a shorter service exchange interval. Contact BeaconMedaes if in doubt.

Vacuum pumps with optional high water handling capability (humid version) are recommended for use with BeaconMedaes vacuum Synthetic fluid only.

**BeaconMedaes vacuum Mineral fluid**

| Ambient temperature | Element outlet temperature | Exchange interval * | Maximum time interval * |
|---|---|---|---|
| up to 25 °C | up to 90 °C | 4000 hours | 1 year |
| from 25 °C up to 35 °C | from 90 °C up to 100 °C | 3000 hours | 1 year |
| more than 35 °C | more than 100 °C | 2000 hours | 1 year |

**BeaconMedaes vacuum Synthetic fluid**

| Ambient temperature | Element outlet temperature | Exchange interval * | Maximum time interval * |
|---|---|---|---|
| up to 40 °C | up to 110 °C | 8000 hours | 2 year |
| more than 40°C | more than 110 °C | 6000 hours | 2 year |

**BeaconMedaes vacuum Foodgrade Fluid**

| Ambient temperature | Element outlet temperature | Exchange interval * | Maximum time interval * |
|---|---|---|---|
| up to 25 °C | up to 90 °C | 4000 hours | 1 year |
| from 25 °C up to 35 °C | from 90 °C up to 100 °C | 3000 hours | 1 year |
| more than 35 °C | more than 100 °C | 2000 hours | 1 year |

* Whichever comes first

**Important**

- Always consult BeaconMedaes if a timer setting has to be changed.
- For the change interval of oil and oil filter in extreme conditions of temperature, humidity or cooling air, consult your BeaconMedaes Customer Center.
- Any leakage should be attended to immediately. Damaged hoses or flexible joints must be replaced

# 7 Maintenance

## 7.2 Oil specifications

It is strongly recommended to use genuine BeaconMedaes vacuum Lubricants. They are the result of years of field experience and research. See section Preventive maintenance schedule for the advised replacement intervals and consult your Spare Parts list for part number information.

Avoid mixing lubricants of different brands or types as they may not be compatible and the oil mix may have inferior properties. A label, indicating the type of oil filled ex factory, is stuck on the air receiver/oil tank.

### BeaconMedaes vacuum mineral fluid

BeaconMedaes’s vacuum mineral Fluid is a specially developed lubricant for use in single stage oil-sealed screw vacuum pumps. Its specific composition keeps the vacuum pump in excellent condition. The vacuum mineral Fluid can be used for vacuum pumps operating at ambient temperatures between 0 °C (32 °F) and 40 °C (104 °F). If the vacuum pump is regularly operating in ambient temperatures above 35 °C (95 °F), oil lifetime is reduced significantly. In such case use BeaconMedaes’s vacuum synthetic Fluid for a longer interval for oil exchange.

If the vacuum pump is regularly operating in ambient temperatures above 35 °C (95 °F), oil lifetime is reduced (see table oil lifetime Preventive maintenance schedule).

### BeaconMedaes vacuum synthetic fluid

BeaconMedaes’s vacuum synthetic Fluid is a high quality synthetic lubricant for oil-sealed screw vacuum pumps which keeps the vacuum pump in excellent condition. Because of its excellent oxidation stability, vacuum synthetic Fluid can be used for vacuum pumps operating at ambient temperatures between 0 °C (32 °F) and 46 °C (115 °F).

If the vacuum pump is regularly operating in ambient temperatures above 40 °C (104 °F), oil lifetime is reduced (see table oil lifetime Preventive maintenance schedule).

### BeaconMedaes vacuum foodgrade Fluid

Special oil, delivered as an option.

BeaconMedaes’s vacuum Foodgrade Fluid is a unique high quality synthetic lubricant, specially created for oil sealed screw vacuum pumps that provide vacuum for the food industry. This lubricant keeps the vacuum pump in excellent condition. Vacuum Foodgrade Fluid can be used for vacuum pump operating at ambient temperatures between 0 °C (32 °F) and 40 °C (104 °F).

If the vacuum pump is regularly operating in ambient temperatures above 35 °C (95 °F), oil lifetime is reduced (see table oil lifetime Preventive maintenance schedule).

## 7.3 Drive motor

### Bearing maintenance

Attention

Never mix greases of different brands or types.

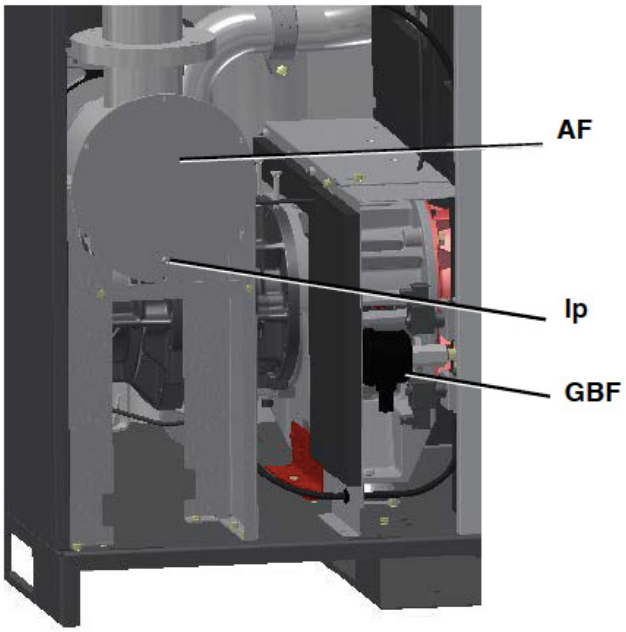
### Recommended grease:

Use 2901 0338.3 Amber
Quantity : 16g (0.56 oz) per bearing (@2000 rpm)

Do not use more grease than prescribed!

# 7 Maintenance

## 7.4 Air filter




**Procedure**

1. Stop the vacuum pump. Switch off the voltage.
2. Vent the vacuum pump by opening the plug (Ip) on the lit of the air inlet filter.
3. Remove the cover of the air filter (AF and GBF). Remove the filter element.
4. Fit the new element and the cover.
5. Reset the air filter service warning.

For vacuum pumps equipped with an Elektronikon® Graphic regulator, see section Service menu.

When placing the air filter element, verify that the seal is present and in good condition.

## 7.5 Oil and oil filter change

**Warning**

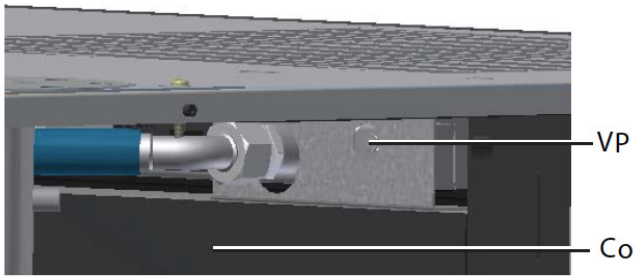
The operator must apply all relevant Safety precautions.

Always drain the vacuum pump oil at all drain points. Used oil left in the vacuum pump can contaminate the oil system and can shorten the lifetime of the new oil.

Never mix lubricants of different brands or types as they may not be compatible and the oil mix will have inferior properties. A label, indicating the type of oil filled ex-factory, is stuck on the air receiver/oil tank.

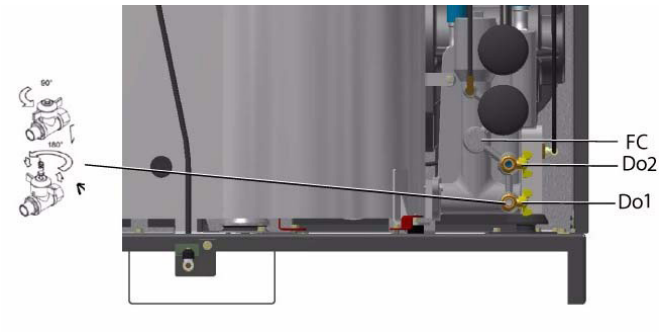
**Procedure**

1. Run the vacuum pump until warm and stop the vacuum pump.
   - Close the air inlet valve and switch off the voltage.
   - Vent the vacuum pump by opening the plug (Ip) on the cover of the air inlet filter.
2. Remove the vent plug (VP) of the oil cooler (Co).

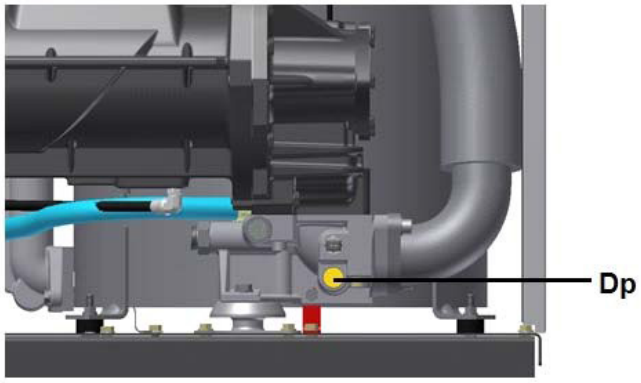



3. Open the oil drain valves (Do1 and Do2). Do1 drains the vessel and Do2 drains the vacuum pump element and the injection hose. Insert the tubes, delivered as loose parts, into the drain couplings.

# 7 Maintenance

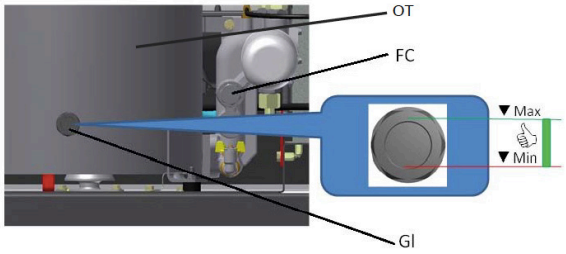



4. Collect the oil in a collector and deliver it to the local collection service. Refit the vent plugs after draining.
5. Close the oil drain valves (Do1 and Do2).
6. Clean the seat on the manifold. Lubricate the gasket of the new oil filters and screw them into place. Tighten firmly by hand.




- Unscrew the plug (Dp) in the outlet element housing and drain the oil from the vacuum pump element and outlet housing. Collect the oil in a collector and deliver it to the local collection service. Refit the vent plugs after draining.

7. Remove filler plug (FC).
   Fill the oil seperator vessel with oil until the level reaches the top of the oil sight glass.




   Take care that no dirt drops into the system. Refit and tighten filler plug (FC).
8. Run the vacuum pump loaded for a few minutes. Stop the vacuum pump.
9. Close the isolation valve and switch off the voltage.
   - Wait a few moments for the Vacuum pump to vent the vessel.
   - Unscrew the oil filler plug (FC) just one turn to permit any remaining pressure in the system to escape.
10. Fill the oil separator tank (OT) with oil until the level reaches the top of the oil sight glass. (see Operating instructions /During operation)
    - Refit and tighten filler plug (FC).
    - When the oil level is too low, go back to step 7.

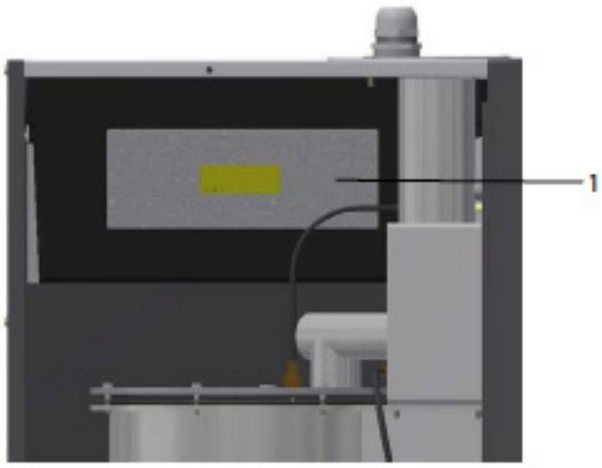
## 7.6 Coolers

### General

Keep the coolers clean to maintain their efficiency.

### Procedure

- Stop the vacuum pump, close the isolation valve and switch off the voltage.
- Cover all parts under the coolers.
- Remove the service plate (1) at the fan compartment.



# 7 Maintenance

Remove dirt from the coolers with a fiber brush. Brush in the direction of the cooling fins.

- Clean with an air jet in the reverse direction to normal flow.
- If it is necessary to wash the coolers with a cleaning agent, consult BeaconMedaes.

After maintenance on the fan and on the coolers: Remove the loose parts that are used as cover.

- Mount the service plate (1) at the fan compartment.

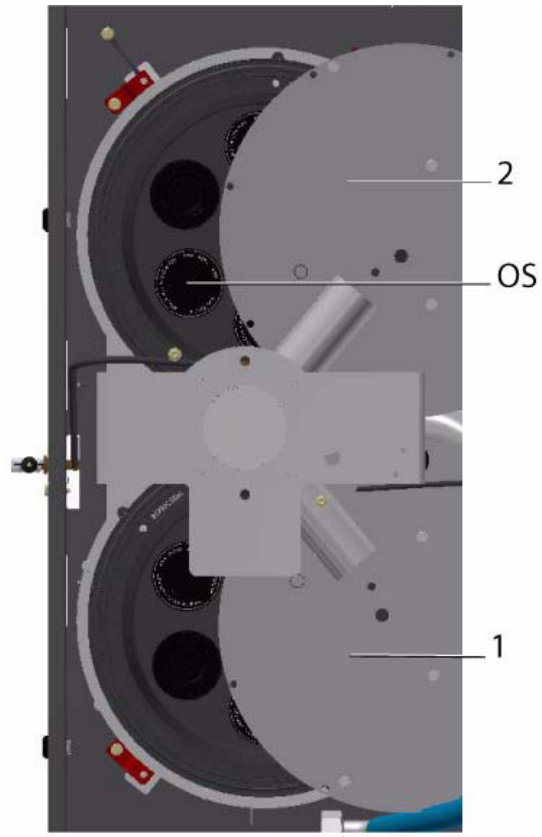
## 7.7 Oil separator change

**Warning**

The operator must apply all relevant Safety precautions.

**Procedure**

- Stop the vacuum pump, close the isolation valve and switch off the voltage.
- Wait a few moments for the vacuum pump to vent the vessel.
- Open the required service panels.
- Unscrew the bolts of the covers (1 & 2) of the oil separator tank
- Slide one cover (1) of the oil separator tank backwards
- Remove the oil separator elements (OS) by turning one quarter counter-clockwise
- Clean the seat on the shield. Lubricate the gasket of the new oil separator using vacuum pump oil and screw it into place. Tighten by hand.




Make sure all seperator elememts are assembled in the correct position. An arrow is printed on the cover of the seperator elements and the bottom of the shield; all arrows should be pointing in the same direction after assembly.

- Slide one cover (1) of the oil separator tank back in position. Caution not to squeeze the O-ring.
- Tighten bolts.
- Slide the other cover (2) of the oil separator tank backwards
- Remove the oil separator elements (OS) by turning one quarter counter-clockwise
- Clean the seat on the shield. Lubricate the gasket of the new oil separator using vacuum pump oil and screw it into place.

# 7 Maintenance

Tighten by hand.

Make sure all seperator elememts are assembled in the correct position. An arrow is printed on the cover of the seperator elements and the bottom of the shield; all arrows should be pointing in the same direction after assembly.

- Slide the cover (2) of the oil separator tank back in position. Caution not to squeeze the O-ring.
- Tighten bolts.

## 7.8 Pressure switch

### Testing

The pressure switch test can only be performed by authorized personnel and is protected by a security code Refer to Elektronikon® Graphic controller, Test menu.

If the pressure switch does not open at the set pressure of 1500mbar(a), it needs to be replaced.

### Warning

No adjustments are allowed. Never run the vacuum pump without pressure switch.

## 7.9 Service kits

### Service kits

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

Also a full range of extensively tested lubricants, suitable for your specific needs is available to keep the vacuum pump in excellent condition.

Consult the Spare Parts List for part numbers.

## 7.10 Storage after installation

### Procedure

Run the vacuum pump regularly, e.g. twice a week, until warm.

If the vacuum pump is going to be stored without running from time to time, protective measures must be taken. Consult your supplier.

## 7.11 Disposal of used material

Used filters or any other used material (e.g., 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 Problem solving

### Warning

Before carrying out any maintenance, repair work or adjustment, stop vacuum pump, close the isolation valve and wait 3 minutes.

Press the emergency stop button and switch off the voltage.

Vent the vacuum pump by opening the plug on the cover of the air inlet filter.

For location of components, see sections:

- Introduction.
- Operation instructions
- Maintenance.

Open and lock the isolating switch.

Lock the isolation valve during maintenance or repair.

The operator must apply all relevant Safety precautions

### Before electrical maintenance

Wait for at least 10 minutes before starting any electrical repairs as dangerous high voltage remains on the capacitors of the start and speed regulation unit during some minutes after switching off the voltage.

### Faults and remedies, vacuum pump

If the alarm LED is lit or flashes, consult sections Event history menu or Service menu.

| Condition | Fault | Remedy |
|---|---|---|
| The pump cannot reach ultimate pressure | Air leakage in the inlet piping connections | Check for leakages in the inlet filter assembly and piping. Check sealing between components |
| | Low oil level | Top-up oil |
| | Oil contaminated | Replace oil |
| | Solenoid-valve malfunctioning | Replace valve |
| | Membrane of vacuum control valve defect | Replace membrane |
| | Vacuum pump element out of order | Consult BeaconMedaes |

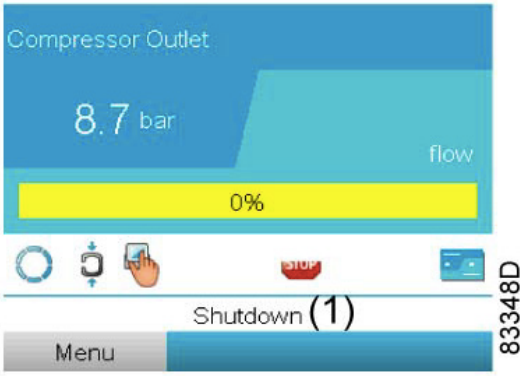
# 8 Problem solving

| Condition | Fault | Remedy |
|---|---|---|
| The pump cannot reach stated vacuum | Air consumption exceeds air delivery of vacuum pump | Check equipment connected |
| | Clogged air filter element | Replace the filter |
| | Too high pressure drop between process and pump inlet | Check the process lines for correct size and for leakage. Correct if necessary |
| | Low oil level | Top up oil |
| | Oil contaminated | Replace oil |
| | Solenoid valve malfunctioning | Replace valve |
| | Membrane of vacuum control valve defect | Replace membrane |
| | Vacuum pump element out of order | Consult BeaconMedaes |
| | Air leakage | Check the process lines for leakage |
| Pressure switch trips | Oil separator elements clogged | Have elements replaced |
| | Oil filter clogged | Have oil filter replaced |
| | Discharge clogged | Check couplings and outlet |
| | Bypass valve or oil injection system clogged | Have bypass valve cleaned or replaced. Clean oil injection system |
| | Pressure switch out of order | Replace pressure switch |
| Vacuum pump element outlet temperature above normal | Oil level too low | Check and correct, see Operation instructions / During operation |
| | Insufficient cooling air or cooling air temperature or relative humidity is too high | Check for cooling air restriction or improve ventilation of the vacuum pump room. Avoid recirculating of cooling air. If installed, check capacity of vacuum pump room fan |
| | Oil cooler clogged | Clean cooler |
| | Oil filter clogged | Replace oil filter |
| | Scavenge line clogged | Clean scavenge line |
| | By-pass valve malfunctioning | Have valve tested |
| | Degraded oil | Check service intervals, see Preventive maintenance schedule |
| | Temperature of pressure air too high | Check process air temperature |
| | Vacuum pump element out of order | Consult BeaconMedaes |

# 8 Problem solving

### Converter fault codes

If a problem is detected by the converter, a specific code (Main motor converter alarm) will appear on the Elektronikon display, together with a fault code.




*Typical display when the vacuum pump is stopped by a shutdown*

| | |
|---|---|
| (1) | Shutdown |

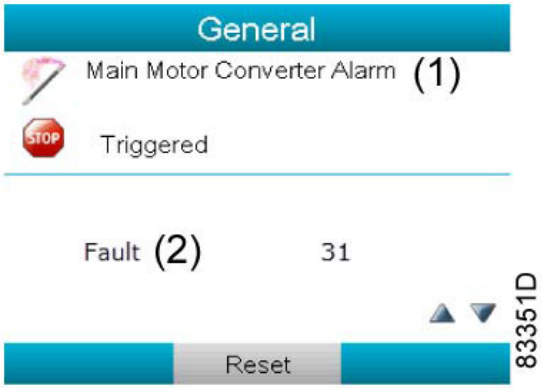
Navigate to the *Stop* icon or to the *Protections* icon and press Enter.


| | |
|---|---|
| (1) | Protections |



| | |
|---|---|
| (1) | General |

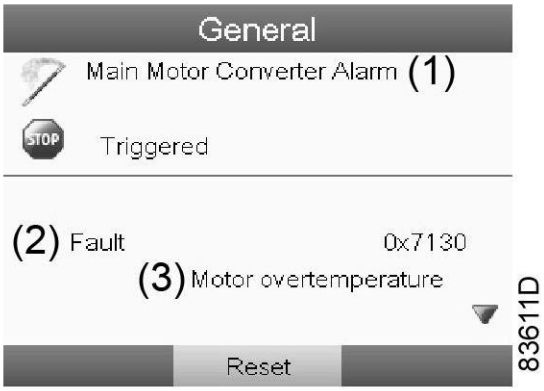
### The display shows the problem (Main Motor Converter Alarm) and a fault code (31 in this case).




| | |
|---|---|
| (1) | Main Motor Converter Alarm |
| (2) | Fault |

### Neos

If a problem is detected by the Neos converter, a specific code (Main motor converter alarm) will appearon the Elektronikon display, together with a fault code and a fault description.




*Typical display, Main Motor Converter Alarm (1) , Fault (2) Code (0x7130) and description (Motor overtemperature (3)) in this case.*

Below table lists the most important error codes. If another code appears, please contact BeaconMedaes.

# 8 Problem solving

| Fault code (Hexidecimal) aD | Fault code (Decimal) | Fault description | Cause | Actions |
|---|---|---|---|---|
| 0x1111 | 4369 | Undervoltage | Main Power supply voltage too low or missing links in the control panel | Check if main supply voltage is within specs. Check main fuses. Check for loose connectors at the control unit of the converter and Elektronikon. Check for tripped fuses at the secondary of the transformer T1 in the electrical panel. |
| 0x2312 | 8978 | Motor overcurrent | Overcurrent detected at motor side | Check if main supply voltage is within specs. |
| 0x2314 | 8980 | | | |
| 0x2315 | 8981 | Motor overcurrent | Short Circuit detected in U phase | Try to reset the error. If error returns, contact BeaconMedaes. |
| 0x2316 | 8982 | Motor overcurrent | Short Circuit detected in V phase | |
| 0x2317 | 8983 | Motor overcurrent | Short Circuit detected in W phase | |
| 0x3210 | 8976 | Overvoltage | Overvoltage detected | Check if main supply voltage is within specs. Check main fuses. |
| 0x3221 | 12817 | Undervoltage | Main Power supply voltage too low. | |
| 0x3223 | 12835 | Undervoltage | Phase loss detected | |
| 0x3224 | 12836 | Overvoltage | Maximum allowable voltage of the DC- link exceeded; Threshold is lowered in case of higher temperature | Let drive cool off<br>Check for excessive ambient temperature<br>Clean heatsink with compressed air Clean inlet filter cubicle<br>Ensure proper flow of cooling air in compressor room<br>Check if supply voltage is within specs |
| 0x3225 | 12837 | Undervoltage | Undervoltage detected | Check if main supply voltage is within specs.<br>Check main fuses. |

# 8 Problem solving

| Fault code (Hexidecimal) aD | Fault code (Decimal) | Fault description | Cause | Actions |
|---|---|---|---|---|
| 0x3226 | 12838 | Overvoltage | Overvoltage or overtemperature detected in IGBT (U phase) | Let drive cool off.<br>Check for excessive ambient temperature.<br>Clean heatsink with compressed air. Clean inlet filter cubicle.<br>Ensure proper flow of cooling air in compressor room<br>Check if supply voltage is within specs. |
| 0x3227 | 12839 | Overvoltage | Overvoltage or overtemperature detected in IGBT (V phase) | |
| 0x3228 | 12840 | Overvoltage | Overvoltage or overtemperature detected in IGBT (W phase) | |
| 0x4311 | 17169 | Drive overtemperature | Overtemperature detected in an IGBT | Let drive cool off.<br>Check for excessive ambient temperature.<br>Clean heatsink with compressed air. Clean inlet filter cubicle.<br>Ensure proper flow of cooling air in compressor room. |
| 0x4312 | 17170 | Drive overtemperature | Overtemperature detected in the heatsink | Let drive cool off.<br>Check for excessive ambient temperature.<br>Clean heatsink with compressed air. Clean inlet filter cubicle.<br>Ensure proper flow of cooling air in compressor room. |
| 0x4314 | 17172 | Drive overtemperature | Overtemperature detected in IGBT junction UH | |
| 0x4315 | 17173 | Drive overtemperature | Overtemperature detected in IGBT junction UL | |
| 0x4316 | 17174 | Drive overtemperature | Overtemperature detected in IGBT junction VH | |
| 0x4317 | 17175 | Drive overtemperature | Overtemperature detected in IGBT junction VL | |
| 0x4318 | 17176 | Drive overtemperature | Overtemperature detected in IGBT junction WH | |
| 0x4319 | 17177 | Drive overtemperature | Overtemperature detected in IGBT junction WL | |

# 8 Problem solving

| Fault code (Hexidecimal) aD | Fault code (Decimal) | Fault description | Cause | Actions |
|---|---|---|---|---|
| 0x4320 | 17184 | Drive overtemperature | Overtemperature detected in powerboard | Let drive cool off.<br>Check for excessive ambient temperature.<br>Clean heatsink with compressed air. Clean inlet filter cubicle.<br>Ensure proper flow of cooling air in compressor room. |
| 0x4321 | 17185 | Drive overtemperature | Overtemperature detected in control board | |
| 0x4322 | 17186 | Drive overtemperature | Overtemperature detected in IGBT board U phase | |
| 0x4323 | 17187 | Drive overtemperature | Overtemperature detected in IGBT board V phase | |
| 0x4324 | 17188 | Drive overtemperature | Overtemperature detected in IGBT board W phase | |
| 0x5020 | 20512 | Emergency off (STO) | Emergency stop circuit opened | Check emergency stop button. Check for loose connectors at the control unit of the converter. |
| 0x5021 | 20513 | Emergency off (STO) | Emergency stop circuit opened | |
| 0x5022 | 20514 | Emergency off (STO) | Emergency stop circuit opened Hardware fault detected | |
| 0x5114 | 20756 | Drive failure (hardware) | Internal power supply tripped | Try to reset the error.<br>If error returns, contact BeaconMedaes. |
| 0x5115 | 20757 | Drive failure (hardware) | Internal power supply tripped | |
| 0x5401 | 21505 | Drive failure (hardware) | General fault detected in power section | |
| 0x5402 | 21506 | Drive failure (hardware) | General fault detected in power section | |
| 0x6101 | 24833 | Drive failure (hardware) | Eeprom read failed Time-out communication | |
| 0x6102 | 24834 | Drive failure (hardware) | Failed temperature reading of power board Time-out communication at initialization | |
| 0x6103 | 24835 | Drive failure (hardware) | General fault detected | |
| 0x6104 | 24836 | Drive failure (hardware) | Internal checksum error detected | |

# 8 Problem solving

| Fault code (Hexidecimal) aD | Fault code (Decimal) | Fault description | Cause | Actions |
|---|---|---|---|---|
| 0x6105 | 24837 | Drive failure (hardware) | Internal communication timeout | Try to reset the error.<br>If error returns, contact BeaconMedaes. |
| 0x6106 | 24838 | Drive failure (hardware) | Internal checksum error detected | |
| 0x6107 | 24839 | Drive failure (hardware) | Internal communication timeout | |
| 0x6108 | 24840 | Drive failure (hardware) | Internal communication timeout | |
| 0x6109 | 24841 | Drive failure (hardware) | Internal checksum error detected | |
| 0x610A | 24842 | Drive failure (hardware) | Internal communication overload | |
| 0x610B | 24843 | Drive failure (hardware) | Internal control overload | |
| 24844 | 24844 | Drive failure (hardware) | CAN communication time-out | Check CAN-cable connection between Elektronikon and converter.<br>Check position of the CAN termination switch at both sides of the CAN cable. Both should be OFF. |
| 0x610D | 24845 | Drive failure (hardware) | Firmware not compatible | Try to reset the error.<br>If error returns, contact BeaconMedaes. |
| 0x610E | 24846 | Drive failure (hardware) | Not able to identify power board | |
| 0x610F | 24847 | Drive failure (hardware) | Not able to identify IGBT module | |
| 0x6110 | 24848 | Drive failure (hardware) | Power board not compatible with IGBT modules | |
| 0x6111 | 24849 | Drive failure (software) | Internal CAN state machine fault | Check CAN-cable connection between Elektronikon and converter.<br>Check position of the CAN termination switch at both sides of the CAN |
| 0x6112 | 24850 | Drive failure (software) | Requested command cannot be executed because of limited access level | Try to reset the error.<br>If error returns, contact BeaconMedaes. |

# 8 Problem solving

| Fault code (Hexidecimal) aD | Fault code (Decimal) | Fault description | Cause | Actions |
|---|---|---|---|---|
| 0x6113 | 24851 | Drive failure (software) | CAN communication overload | Check CAN-cable connection between Elektronikon and converter.<br>Check position of the CAN<br>termination switch at both sides of the CAN cable. Both should be OFF. |
| 0x6114 | 24852 | Drive failure (software) | The firmware version is not compatible with the parameter version | Try to reset the error.<br>If error returns, contact BeaconMedaes. |
| 0x7130 | 28976 | Motor overtemperature | Motor overtemperature detected | Let motor cool off. Ensure main fan and air flow in and out compressor is not obstructed. Ensure proper flow of cool air in compressor room.<br>Check for loose connectors at the control unit of the converter. |
| 0x8401 | 33793 | Overvoltage | Motor maximum speed exceeded | Try to reset the error.<br>If error returns, contact BeaconMedaes. |
| 0x8402 | 33794 | Overvoltage | Motor startup unsuccessful; requested speed not reached | Wait until the vessel depressurizes by blow off. (by not resetting the fault immediately). If the problem persists, contact BeaconMedaes. |
| 0x9001 | 36865 | Hardware run enable missing | Hardware enable signal missing | Check for loose connectors at the control unit of the converter and Elektronikon.<br>Check for tripped fuses at the secondary of the transformer T1 in the electrical panel. |
| 0x9065 to 91F4 | 36965 to 37364 | Drive failure (software) | Failure on attempt to write parameter Pyyy out of range | Try to reset the error.<br>If error returns, contact BeaconMedaes |

# 9 Technical Data

## 9.1 Readings on display


*Elektronikon® Graphic controller*

**Important**

The readings mentioned below are valid under the reference conditions (see section Reference conditions and limitations).

| Reference | Reading |
|---|---|
| Vacuum Pressure | Depends on the setpoint (desired net pressure). |
| Element Outlet Temperature | Approx. 80°C (176°F) (ambient temperature 20 °C + 63°C) |
| Discharge Pressure | Approx. 1020mbar(a) |

## 9.2 Electric cable size and fuses

**Important**

The voltage on the vacuum pump terminals must not deviate more than 10% of the nominal voltage. It is however highly recommended to keep the voltage drop over the supply cables at nominal current below 5% of the nominal voltage (IEC 60204-1).

- If cables are grouped together with other power cables, it may be necessary to use cables of a larger size than those calculated for the standard operating conditions.
- Use the original cable entry. See section Dimension drawings. To preserve the IP protection degree of the electric cubicle and to protect its components from dust from the environment, it is mandatory to use a proper cable gland when connecting the supply cable to the Vacuum pump.
- Local regulations remain applicable if they are stricter than the values proposed below.

**Caution:**

- Always double-check the fuse size versus the calculated cable size. If required, reduce fuse size or enlarge cable size.
- Cable length should not exceed the maximum length according to IEC60204 table 10

# 9 Technical Data

### Leakage breaker (optional)

If the installation requires a leakage breaker, always use an all current sensitive leakage breaker, RCM or RCD Type B (according to IEC/EN 60755) with a sufficient trip level.

### Currents and fuses

IEC and UL/cUL approval

| Vacuum pump specification | | | | Itot | | Imax undervoltage | |
|---|---|---|---|---|---|---|---|
| | | | | Primary | Secondary | Primary | Secondary |
| Pump | Voltage | Frequency | Approval | I tot | I tot | I tot | I tot |
| | V | Hz | | A | A | A | A |
| MSV030 | 380 | 60 | IEC | 46.6 | - | 51.7 | - |
| MSV030 | 400 | 50 | IEC | 43.9 | - | 48.7 | - |
| MSV030 | 460 | 60 | IEC/CSA/UL | 38.4 | - | 42.6 | - |
| MSV030 | 200 | 50 | IEC | 87.7 | 43.9 | 97.5 | 48.7 |
| MSV030 | 230 | 60 | CSA/UL | 76.8 | 38.4 | 85.3 | 42.6 |
| MSV030 | 500 | 50 | IEC | 35.1 | 43.9 | 39.0 | 48.7 |
| MSV030 | 575 | 60 | CSA/UL | 30.7 | 38.4 | 34.1 | 42.6 |
| MSV040 | 380 | 60 | IEC | 60.2 | - | 66.9 | - |
| MSV040 | 400 | 50 | IEC | 56.8 | - | 63.1 | - |
| MSV040 | 460 | 60 | IEC/CSA/UL | 49.6 | - | 55.1 | - |
| MSV040 | 200 | 50 | IEC | 113.6 | 56.8 | 126.2 | 63.1 |
| MSV040 | 230 | 60 | CSA/UL | 99.3 | 49.6 | 110.3 | 55.1 |
| MSV040 | 500 | 50 | IEC | 45.4 | 56.8 | 50.5 | 63.1 |
| MSV040 | 575 | 60 | CSA/UL | 39.7 | 49.6 | 44.1 | 55.1 |
| MSV050 | 380 | 60 | IEC | 74.7 | - | 82.9 | - |
| MSV050 | 400 | 50 | IEC | 70.6 | - | 78.4 | - |
| MSV050 | 460 | 60 | IEC/CSA/UL | 61.6 | - | 68.4 | - |
| MSV050 | 200 | 50 | IEC | 134.1 | 67.0 | 149.0 | 74.5 |
| MSV050 | 230 | 60 | CSA/UL | 117.0 | 58.5 | 130.0 | 65.0 |
| MSV050 | 500 | 50 | IEC | 53.6 | 67.0 | 59.6 | 74.5 |
| MSV050 | 575 | 60 | CSA/UL | 46.8 | 58.5 | 52.0 | 65.0 |

I: current in the supply lines at maximum load and nominal voltage

Setting for circuit breakers

| | |
|---|---|
| Q1 | 1A |
| Q15 | 1.6A |

**Fuse calculations for IEC** are done according to 60364-4-43 electrical installations of buildings, part 4: protection for safety- section 43: protection against over current. Fuse sizes are calculated in order to protect the cable against short circuit.

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**Fuse calculations for cUL and UL:** The indicated fuse size is the maximum fuse size in order to protect the motor against short circuit. For cUL fuse HRC form II, for UL fuse class K5

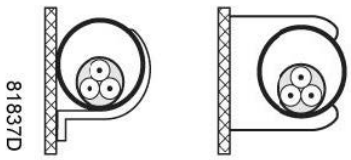
### Earthing

The earthing cable connected to the vacuum pump (PE) should be minimum according to EN 60204-1 section 828.

### Cable sizing according IEC

The tables below indicate the current carrying capacities of cables for 3 commonly used installation methods, calculated according to standard 60364-5-52 - electrical installations of buildings part 5 - selection and erection equipment and section 52 - current carrying capacities in wiring systems.

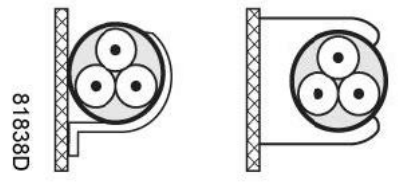
The allowed currents are valid for PVC insulated cables with three loaded copper conductors (maximum conductor temperature 70 °C).




Installation method B2 according to table B.52.1.
Multi-core cable in conduit on a wooden wall.

**Maximum allowed current in function of the ambient temperature for installation method B2**

| | Ambient Temperature | | | | |
|---|---|---|---|---|---|
| Cable Section | 30 ˚C | 40 ˚C | 45 ˚C | 50 ˚C | 55 ˚C |
| 4 mm² | < 27 A | < 23 A | < 21 A | < 19 A | < 16 A |
| 6 mm² | < 34 A | < 30 A | < 27 A | < 24 A | < 21 A |
| 10 mm² | < 46 A | < 40 A | < 36 A | < 33 A | < 28 A |
| 16 mm² | < 62 A | < 54 A | < 49 A | < 44 A | < 38 A |
| 25 mm² | < 80 A | < 70 A | < 63 A | < 57 A | < 49 A |
| 35 mm² | < 99 A | < 86 A | < 78 A | < 70 A | < 60 A |
| 50 mm² | < 118 A | < 103 A | < 93 A | < 84 A | < 72 A |
| 70 mm² | < 149 A | < 130 A | < 118 A | < 106 A | < 91 A |
| 95 mm² | < 179 A | < 156 A | < 141 A | < 127 A | < 109 A |
| 120 mm² | < 206 A | < 179 A | < 163 A | < 146 A | < 129 A |

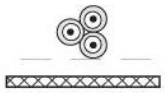



Installation method C according to table B.52.1.
Single-core or multi-core cable on a wooden wall.

# 9 Technical Data

**Maximum allowed current in function of the ambient temperature for installation method C.**

| | Ambient Temperature | | | | |
|---|---|---|---|---|---|
| Cable Section | 30 ˚C | 40 ˚C | 45 ˚C | 50 ˚C | 55 ˚C |
| 4 mm² | < 32 A | < 28 A | < 25 A | < 23 A | < 20 A |
| 6 mm² | < 41 A | < 36 A | < 32 A | < 29 A | < 25 A |
| 10 mm² | < 57 A | < 50 A | < 45 A | < 40 A | < 35 A |
| 16 mm² | < 76 A | < 66 A | < 60 A | < 54 A | < 46 A |
| 25 mm² | < 96 A | < 84 A | < 76 A | < 68 A | < 59 A |
| 35 mm² | < 119 A | < 104 A | < 94 A | < 84 A | < 73 A |
| 50 mm² | < 144 A | < 125 A | < 114 A | < 102 A | < 88 A |
| 70 mm² | < 184 A | < 160 A | < 145 A | < 131 A | < 112 A |
| 95 mm² | < 223 A | < 194 A | < 176 A | < 158 A | < 136 A |
| 120 mm² | < 259 A | < 225 A | < 205 A | < 184 A | < 158 A |

| | |
|---|---|
|  81839D | Installation method F according table B.52.1. Single-core cables, touching in free air Clearance to wall not less than one cable diameter |

**Maximum allowed current in function of the ambient temperature for installation method F**

| | Ambient Temperature | | | | |
|---|---|---|---|---|---|
| Cable Section | 30 ˚C | 40 ˚C | 45 ˚C | 50 ˚C | 55 ˚C |
| 25 mm² | < 110 A | < 96 A | < 87 A | < 78 A | < 67 A |
| 35 mm² | < 137 A | < 119 A | < 108 A | < 97 A | < 84 A |
| 50 mm² | < 167 A | < 145 A | < 132 A | < 119 A | < 102 A |
| 70 mm² | < 216 A | < 188 A | < 171 A | < 153 A | < 132 A |
| 95 mm² | < 264 A | < 230 A | < 209 A | < 187 A | < 161 A |
| 120 mm² | < 308 A | < 268 A | < 243 A | < 219 A | < 188 A |

**Calculation method for IEC:**

- Single supply cables (3 phases + PE - configuration (1)):
- Add 10% to the total vacuum pump current (Itot from the tables)
- Install the prescribed fuse on each cable
- Parallel supply cable (2 x 3 phases + PE - configuration (2)):
- Add 10% to the total vacuum pump current (Itot from the tables) and divide by 2
- Multiply the ampacity of the cables with 0.8 (see table A.52.17 (52-E1))

# 9 Technical Data

- Install fuses of half the size of the recommended maximum fuse size on each cable.
- When using 2 x 3 phases + PE as in (3):
- Add 10% to the total vacuum pump current (Itot from the tables) and divide by ?3
- Multiply the ampacity of the cables with 0.8 (see table A.52.17 (52-E1))
- Fuse size: the recommended maximum fuse size divided by ?3 on each cable.
- Size of the PE cable:
- For supply cables up to 35 mm²: same size as supply cables
- For supply cables larger than 35 mm²: half the size of the supply wires

Always check the voltage drop over the cable (less than 5% of the nominal voltage is recommended).

Example: Itot= 89 A, maximum ambient temperature is 45 °C, recommended fuse = 100 A

- Single supply cables (3 phases + PE - configuration (1)):
- I = 89 A + 10% = 89 x 1.1 = 97.9 A
- The table for B2 and ambient temperature = 45 ° C allows a maximum current of 93 A for a 50 mm² cable. For a cable of 70 mm², the maximum allowed current is 118 A, which is sufficient. Therefore, use a 3 x 70 mm² + 35 mm² cable.
- If method C is used, 50 mm² is sufficient. (35 mm² for method F) =>cable 3 x 50 mm² + 25 mm².
- Parallel supply cable (2 x 3 phases + PE - configuration (2)):
- I = (89 A + 10%)/2 = (89 x 1.1)/2 = 49 A
- For a cable of 25 mm², B2 at 45 °C, the maximum current is 63 A x 0.8 = 50.4 A. So 2 parallel cables of 3 x 25 mm² + 25 mm² are sufficient.
- Install 50 A fuses on each cable instead of 100 A.

**Cable sizing according UL/cUL**

- Calculation method according UL 508A, table 28.1 column 5: allowable ampacities of insulated copper conductors (75 °C (167 °F)).
- Maximum allowed current in function of the wire size

| AWG or kcmil | Maximum current |
|---|---|
| 10 | < 30 A |
| 8 | < 50 A |
| 6 | < 65 A |
| 4 | < 85 A |
| 3 | < 100 A |
| 2 | < 115 A |
| 1 | < 130 A |
| 1/0 | < 150 A |
| 2/0 | < 175 A |
| 3/0 | < 200 A |

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**Calculation method for UL:**

- Single supply cables (3 phases + 1 PE - configuration (1)):
- Add 25% to the total current from the tables (see UL 508A 28.3.2: “Capacity shall have 125% of the full load current”)
- Install the prescribed maximum fuse on each cable
- Parallel supply cable (2 x 3 phases + 2 PE - configuration (2)):
- Add 25% to the total current from the tables and divide by 2
- Multiply the capacity of the cables with 0.8 (see UL 508A table 28.1 continued)
- Install fuses of half the size of the recommended maximum fuse size on each cable.
- When using 2 x 3 phase + 2 PE as in (3):
- Add 25% to the total current from the tables and divide by ?3
- Multiply the capacity of the cables with 0.8 (see UL 508A table 28.1 continued)
- Fuse size: the recommended maximum fuse size divided by ?3 on each cable.
- Size PE cable:
- For supply cables up to AWG8: same size as the supply cables
- For supply cables larger than AWG8: use maximum allowed capacity

| |
|---|
| < 100 A: use AWG8 |
| < 200 A: use AWG6 |
| < 300 A: use AWG4 |

Always check the voltage drop over the cable (less than 5 % of the nominal voltage is recommended).

Example of supply cable calculation: Itot= 128 A, maximum ambient temperature is 45 °C, recommended fuse = 150 A

- Single supply cables (3 phases + 1 PE - configuration (1)):
- I = 128 A + 25 % = 128 x 1.25 = 160 A
- For AWG2/0, the maximum current is 175 A, which is sufficient => use AWG2/0
- Install the prescribed maximum fuse (150 A) on each cable
- Parallel supply cable (2 x 3 phases + 2 PE - configuration (2)):
- I = (128 A + 25%)/2 = (128 x 1.25)/2 = 80 A
- For a AWG4, the maximum current is 85 A x 0.8 = 68 A, which is insufficient. For an AWG3, the maximum current is 100 x 0.8 = 80 A. So 2 parallel cables of 3 x AWG3 + 2 x AWG8 are sufficient.
- Install 80 A fuses on each cable.

# 9 Technical Data

## 9.3 Reference conditions and limitations

### Reference conditions

| | | |
|---|---|---|
| Relative humidity | % | 0 |
| Air inlet temperature | °C | 20 |
| | °F | 68 |
| Exhaust back pressure | mbar(g) | 0 |
| | psi | 0 |
| Ambient barometric pressure | mbar(a) | 1013 |
| | psi | 14.7 |

### Limitations

| | | |
|---|---|---|
| Minimum ambient temperature | ºC | 0 |
| | ºF | 32 |
| Maximum ambient temperature | ºC | 46 |
| | ºF | 115 |
| Minimum allowable inlet temperature | ºC | -10 |
| | ºF | 14 |
| Maximum allowable inlet temperature | ºC | 70 |
| | ºF | 158 |
| Maximum (absolute) inlet pressure | mbar(a) | 1050 |
| | psi | 0.73 |
| Maximum vessel pressure (mbar(g)) | mbar(a) | 1500 |
| | psi | 7.3 |

# 9 Technical Data

## 9.4 Vacuum pump data

### Reference conditions

All data specified below apply under reference conditions, see section Reference conditions and limitations.

**Common vacuum pump data**

| | Unit | |
|---|---|---|
| Number of compression stages | | 1 |
| Ultimate pressure | mbar(a) | 0.35 |
| | Torr | 0.4 |
| Maximum exhaust back pressure | mbar(g) | 100 |
| | mbar(g) | 0 |
| Temperature of the air leaving the discharge (approx.) | °C | 83 |
| | °F | 181 |

**MSV030**

| | | |
|---|---|---|
| Nominal motor power | kW | 22 |
| | HP | 29 |
| Maximum motor shaft speed | Rpm | 4500 |
| Minimum motor shaft speed | Rpm | 600 |
| Oil capacity | L | 40 |
| | US GAL | 10.5 |
| | Imp. GAL | 8.7 |
| | cu. ft. | 1.41 |
| Sound pressure level (according to ISO 2151 (2004)) | dB(A) | 78 (+/-3) |

**MSV030 (option high water handling capacity)**

| | | |
|---|---|---|
| Nominal motor power | kW | 22 |
| | HP | 29 |
| Maximum motor shaft speed | Rpm | 4500 |
| Minimum motor shaft speed | Rpm | 600 |
| Oil capacity | L | 40 |
| | US GAL | 10.5 |
| | Imp. GAL | 8.7 |
| | cu. ft. | 1.41 |
| Sound pressure level (according to ISO 2151 (2004)) | dB(A) | 78 (+/-3) |

# 9 Technical Data

**MSV030 (option high water handling capacity)**

| | | |
|---|---|---|
| Nominal motor power | kW | 30 |
| | HP | 40 |
| Maximum motor shaft speed | Rpm | 5600 |
| Minimum motor shaft speed | Rpm | 3700 |
| Oil capacity | L | 40 |
| | US GAL | 10.5 |
| | Imp. GAL | 8.7 |
| | cu. ft. | 1.41 |
| Sound pressure level (according to ISO 2151 (2004)) | dB(A) | 78 (+/-3) |

**MSV030 (option Turbo, high water handling capacity)**

| | | |
|---|---|---|
| Nominal motor power | kW | 30 |
| | HP | 40 |
| Maximum motor shaft speed | Rpm | 5600 |
| Minimum motor shaft speed | Rpm | 3700 |
| Oil capacity | L | 40 |
| | US GAL | 10.5 |
| | Imp. GAL | 8.7 |
| | cu. ft. | 1.41 |
| Sound pressure level (according to ISO 2151 (2004)) | dB(A) | 78 (+/-3) |

**MSV040**

| | | |
|---|---|---|
| Nominal motor power | kW | 30 |
| | HP | 40 |
| Maximum motor shaft speed | Rpm | 5600 |
| Minimum motor shaft speed | Rpm | 3700 |
| Oil capacity | L | 40 |
| | US GAL | 10.5 |
| | Imp. GAL | 8.7 |
| | cu. ft. | 1.41 |
| Sound pressure level (according to ISO 2151 (2004)) | dB(A) | 78 (+/-3) |

# 9 Technical Data

**MSV040 (option high water handling capacity)**

| | | |
|---|---|---|
| Nominal motor power | kW | 30 |
| | HP | 40 |
| Maximum motor shaft speed | Rpm | 5600 |
| Minimum motor shaft speed | Rpm | 3700 |
| Oil capacity | L | 40 |
| | US GAL | 10.5 |
| | Imp. GAL | 8.7 |
| | cu. ft. | 1.41 |
| Sound pressure level (according to ISO 2151 (2004)) | dB(A) | 78 (+/-3) |

**MSV040 (optional Turbo)**

| | | |
|---|---|---|
| Nominal motor power | kW | 37 |
| | HP | 50 |
| Maximum motor shaft speed | Rpm | 6200 |
| Minimum motor shaft speed | Rpm | 4300 |
| Oil capacity | L | 40 |
| | US GAL | 10.5 |
| | Imp. GAL | 8.7 |
| | cu. ft. | 1.41 |
| Sound pressure level (according to ISO 2151 (2004)) | dB(A) | 78 (+/-3) |

**MSV040 (option Turbo, high water handling capacity)**

| | | |
|---|---|---|
| Nominal motor power | kW | 37 |
| | HP | 50 |
| Maximum motor shaft speed | Rpm | 6200 |
| Minimum motor shaft speed | Rpm | 4300 |
| Oil capacity | L | 40 |
| | US GAL | 10.5 |
| | Imp. GAL | 8.7 |
| | cu. ft. | 1.41 |
| Sound pressure level (according to ISO 2151 (2004)) | dB(A) | 78 (+/-3) |

# 9 Technical Data

**MSV050**

| | | |
|---|---|---|
| Nominal motor power | kW | 37 |
| | HP | 50 |
| Maximum motor shaft speed | Rpm | 6200 |
| Minimum motor shaft speed | Rpm | 600 |
| Oil capacity | L | 40 |
| | US GAL | 10.5 |
| | Imp. GAL | 8.7 |
| | cu. ft. | 1.41 |
| Sound pressure level (according to ISO 2151 (2004)) | dB(A) | 78 (+/-3) |

**MSV050 (option high water handling capacity)**

| | | |
|---|---|---|
| Nominal motor power | kW | 37 |
| | HP | 50 |
| Maximum motor shaft speed | Rpm | 6200 |
| Minimum motor shaft speed | Rpm | 600 |
| Oil capacity | L | 40 |
| | US GAL | 10.5 |
| | Imp. GAL | 8.7 |
| | cu. ft. | 1.41 |
| Sound pressure level (according to ISO 2151 (2004)) | dB(A) | 78 (+/-3) |

# 9 Technical Data

## 9.5 Technical data Elektronikon® controller

### General

| | |
|---|---|
| Supply voltage | 24V AC/16 VA 50/60Hz (+40%/-30%)<br>24V DC/0.7 A |
| Type of protection | IP54 (front)<br>IP21 (back) |
| Ambient and temperature condition | IEC60068-2 |
| Operating temperature range<br>Storage temperature range | -10°C.....+60°C (14°F.....140°F)<br>-30°C.....+70°C (-22°F.....158°F) |
| Permissible humidity | Relative humidity 90%<br>No condensation |
| Noise emission | IEC61000-6-3 |
| Noise immunity | IEC61000-6-2 |
| Mounting | Cabinet door |

### Digital outputs

| | |
|---|---|
| Number of outputs | 9 (Elektronikon® Graphic controller - p.n. 1900 5200 10.....1900 5200 19) |
| Type | Relay (voltage free contacts) |
| Related voltage AC | 250 V AC/10 A Max. |
| Related voltage AC | 30 V DC/10 A Max. |

### Digital intputs

| | |
|---|---|
| Number of inputs | 10 (Elektronikon® Graphic controller - p.n. 1900 5200 10.....1900 5200 19) |
| Supply by controller | 24 V DC |
| Supply protection | Short circuit protected to ground |
| Input protection | Not isolated |

### Analog inputs

| | |
|---|---|
| Number of pressure inputs | 2 (Elektronikon® Graphic controller - p.n. 1900 5200 10.....1900 5200 19) |
| Number of temperature inputs | 5 (Elektronikon® Graphic controller - p.n. 1900 5200 10.....1900 5200 19) |

# 10 Instructions for Use

**Air/oil separator vessel**

- This vessel can contain pressurised air; this can be potentially dangerous if the equipment is misused.
- This vessel must only be used as a air/oil separator and must be operated below 0.5bar(g).
- No alterations must be made to this vessel by welding, drilling or any other mechanical methods without the written permission of the manufacturer.
- Use only oil as specified by the manufacturer.
- This vessel has been designed and built to guarantee an operational lifetime in excess of 20 years.
- The vessel needs a yearly visual inspection.

# 11 Guidelines for Inspection

**Guidelines**

- On the Declaration of Conformity / Declaration by the Manufacturer, the harmonised and/or other standards that have been used for the design are shown and/or referred to.
- The Declaration of Conformity / Declaration by the Manufacturer is part of the documentation that is supplied with this vacuum pump.
- Local legal requirements and/or use outside the limits and/or conditions as specified by the manufacturer may require other inspection periods as mentioned below.

# 12 Declaration of Conformity

1

## EC DECLARATION OF CONFORMITY

2 We, BeaconMedæs, declare under our sole responsibility, that the product
3 Machine name *vacuum pump*
4 Machine type
5 Serial number

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

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

7

| Directive on the approximation of laws of the Member States relating to | | Harmonized and/or Technical Standards used | Att' mnt |
|---|---|---|---|
| b Machinery Safety | 2006/42/EC | EN ISO 12100<br>EN 1012 - 2 | |
| d Electromagnetic compatibility | 2004/108/EC | EN 61000-6-2<br>EN 61000-6-4 | |
| e Low voltage equipment | 2006/95/EC | EN 60034<br>EN 60204-1<br>EN 60439 | |
| l Ecodesign, energy-using products<br>Ecodesign, energy-related products | 2005/32/EC<br>2009/125/EC | | X |

8. a The harmonized and the technical standards used are identified in the attachment hereafter

8. b BeaconMedæs is authorized to compile the technical file

9
10
11
12

| | Conformity of the specification to the directives | Conformity of the products to the specification and by implication to the directives |
|---|---|---|
| 13 Issued by | Engineering<br>Manufacturing | |
| 14 Name | | |
| 15 Signature | | |
| 16 Date | | |

Typical example of a Declaration of Conformity document

(1): Contact address:
BeaconMedaes, Telford Crescent, Staveley, Derbyshire S43 3PF United Kingdom

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

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


*Part of the Atlas Copco Group*

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(888) 4-MEDGAS (888) 463-3427
HTM/ISO Standard:
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Telephone: + 44(0)1246.474.242
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