

Installation, Operation and Maintenance Instructions



“Oil-sealed” Rotary Screw Vacuum Pumps Manual

Part Number 2212 0208 75.00

MSV 007, MSV 010, MSV 015, MSV 020

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
MSV007, MSV010, MSV015, MSV020**

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
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1.0 Safety Precautions

1.1 Safety Icons

Explanation

	Danger for Life
	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):
 - a. Open the power isolating switch and lock it with a personal lock

- b. 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.

1.0 Safety Precautions

1.3 Safety Precautions During Installation

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.
2. The unit is designed for indoor use. If the unit is installed outdoors, special precautions must be taken; consult BeaconMedæS.
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.

1.0 Safety Precautions

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 BeaconMedæx prior to start-up.

1.4 Safety Precautions During Operation

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
9. 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.

1.0 Safety Precautions

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.
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.

1.0 Safety Precautions

1. Never use caustic solvents which can damage materials of the air net, e.g. polycarbonate bowls.
2. Faults or wearing of seals may cause oil lubricant leaks. Avoid dispersion in soil and pollution of other materials.

	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.
	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.

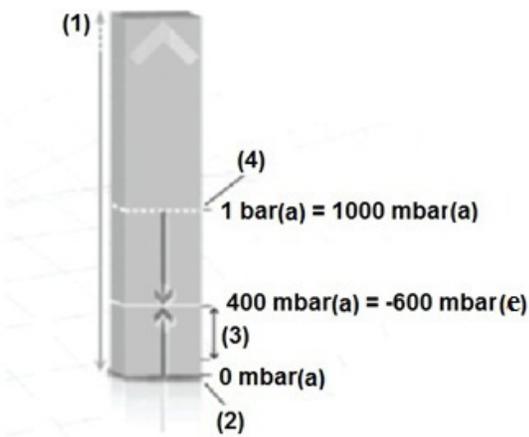
2.0 General Description

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 GHS 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 GHS 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. BeaconMedæ's vacuum pumps use volumetric flow rate to denote performance, the unit being Am³/hr.

Displacement/volumetric flow rate

For the relevant pressure range, when a GHS 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 (Am³/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.

2.0 General Description

2.2 Introduction

The MSV 007 up to MSV 020 are single-stage, oil-sealed screw vacuum pumps driven by an electric motor.

The vacuum pumps are controlled by the BeaconMedæs 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

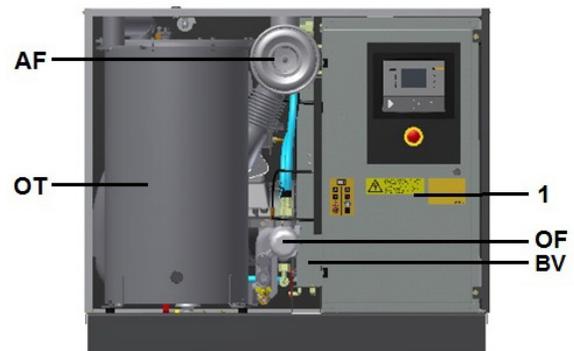


Figure 2 Open view front

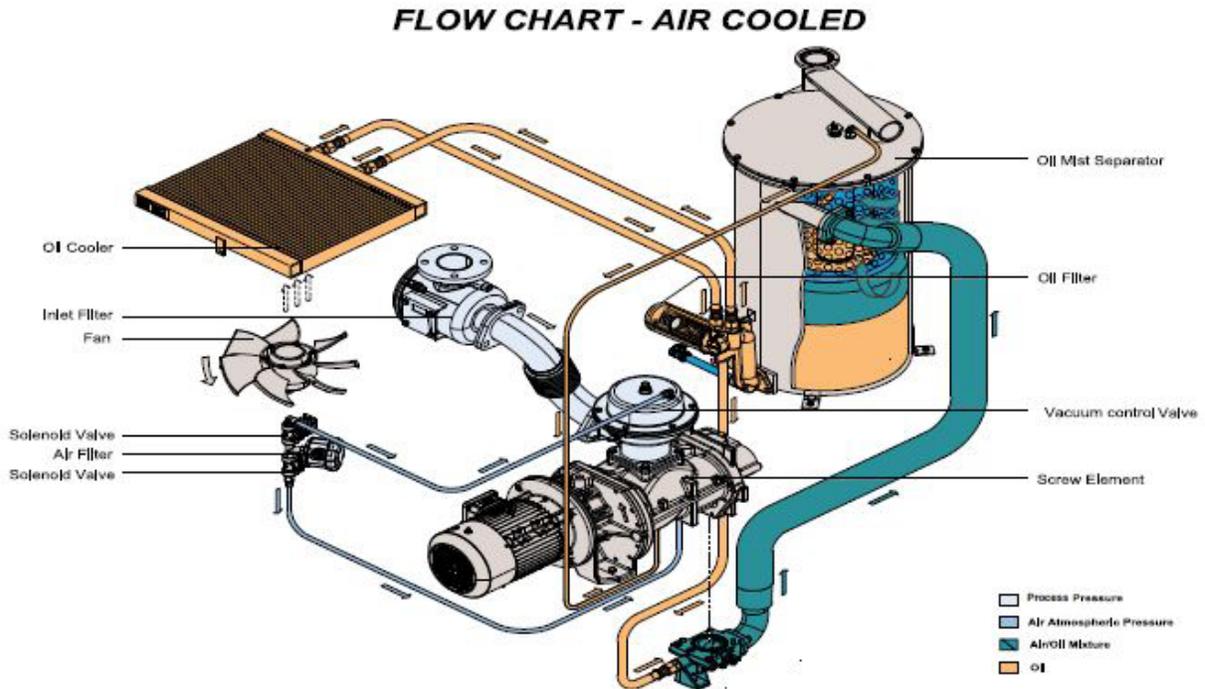


Figure 3 Open view back

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

2.0 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 83 °C (181 °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 83 °C (181 °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 (194° 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).

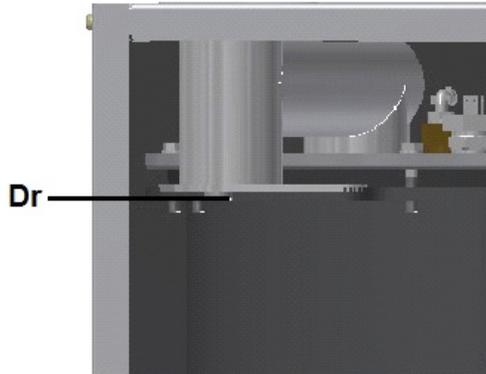
Cooling

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.

2.0 General Description

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 sealed with a threaded plug, but can be exchanged by a G1/4" connector with tube to drain the condensate. 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

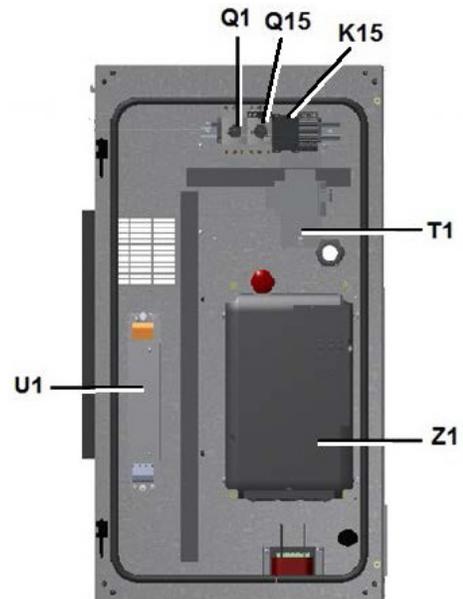


Figure 4 Electrical Cabinet

Reference	Description
T1	Transformer
Q15	Circuit breaker
Q1	Circuit breaker
K15	Contacteur
Z1	Frequency converter
U1	EMC filter

Electrical diagrams

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

3.0 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 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 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 commands 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 measurement 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 measurement 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)

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.

3.0 Elektronikon® Graphic Controller

Automatic restart after voltage failure

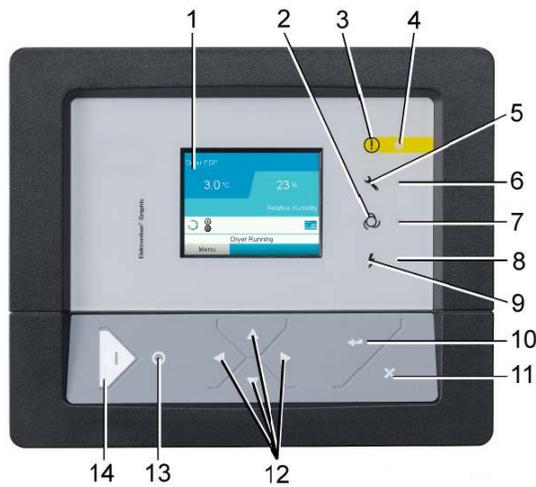
The regulator has a built-in function to automatically restart the vacuum pump if the voltage is restored after voltage failure.

For vacuum pumps leaving the factory, this function is made inactive. If desired, the function can be activated. Consult the BeaconMedæx Customer Center.

	<p>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.</p>
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3.2 Control Panel

Elektronikon Regulator



Reference		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 Elektronikon regulator is operative.

3.0 Elektronikon® Graphic Controller

3.3 Icons Used

Status Icons

Name	Icon	Description
Stopped/ Running		When the vacuum pump is stopped, the icon stands still. When the vacuum pump is running, the icon is rotating.
Vacuum pump status		Motor Stopped
		Running Purge and Intermediate states
		Running Vacuum Control
Machine control mode		Local start/stop
		Remote start/stop
		Network control
Automatic restart after voltage failure		Automatic restart after voltage failure is active
Week timer		Week timer is active
Active protection functions		Emergency stop
		Shutdown
		Warning
Service		Service required

Main Screen display		Value lines display icon
		Chart display icon
General Icons		No communication/network problem
		Not valid

3.0 Elektronikon® Graphic Controller

Input Icons

Icon	Description
	Pressure
	Temperture
	Digital input
	Special protection

System Icons

Icon	Description
	Vacuum pump element
	Fan
	Frequency converter
	Motor
	Network problem
	General alarm

Navigation Arrows

Icon	Description
	Up
	Down

Menu Icons

Icon	Description
	Inputs
	Outputs
	Alarms (warnings, shutdowns)
	Counters
	Test
	Settings
	Service
	Saved Data
	Access Key/User password
	Network
	Setpoint
	Info

3.0 Elektronikon® Graphic Controller

3.4 Main Screen

Control Panel



(1)	Scroll Keys
(2)	Enter Key
(3)	Escape Key

Function

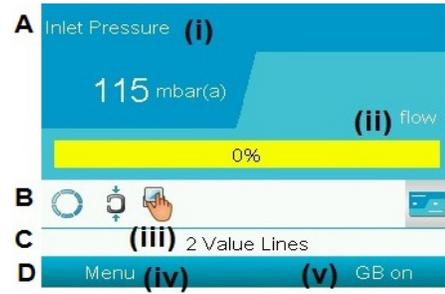
The Main screen is the screen that is shown automatically when the voltage is switched on and one of the keys is pushed. It is switched off automatically after a few minutes when no keys are pushed.

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)

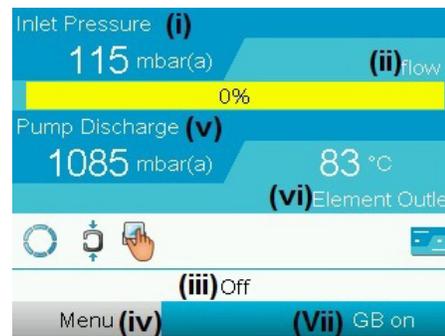
Two and Four Value Lines Screens

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



Typical Main Screen (2 value lines)

(i)	Inlet pressure
(ii)	Flow
(iii)	Vacuum control, shutdown (text varies upon vacuum pumps actual condition)
(iv)	Menu
(v)	ES (text varies upon vacuum pumps actual condition)



Typical Main Screen (4 valve lines)

(i)	Inlet pressure
(ii)	Flow
(iii)	Off, Shutdown (text varies upon vacuum pumps actual condition)
(iv)	Menu
(v)	Discharge pressure
(vi)	Element outlet
(vii)	Vacuum control, purge, preparing to go online (text varies upon vacuum pumps actual condition)

3.0 Elektronikon® Graphic Controller

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 icons:**
These icons are only shown if their corresponding function is activated (e.g. week timer, automatic restart after voltage failure, etc.)
- **Pop up icons:**
These icons pop up if an abnormal condition occurs (warnings, shutdowns, service...). To call up more information about the icons shown, select the icon concerned using the scroll keys and press the enter key.

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	Go to the menu
Modify	Modify programmable settings
Reset	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.



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.

3.0 Elektronikon® Graphic Controller

Selection of a Main Screen View

To change between 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.

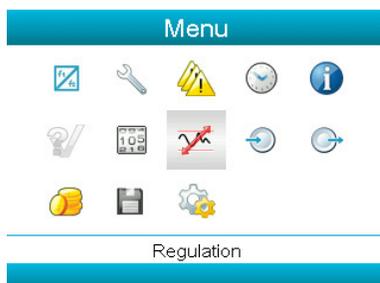
3.5 Calling Up Menus

Description

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



To go to the Menu screen, select Menu, using Scroll keys and press 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 and press the Escape key to return to the Main screen.

3.6 Inputs Menu

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.

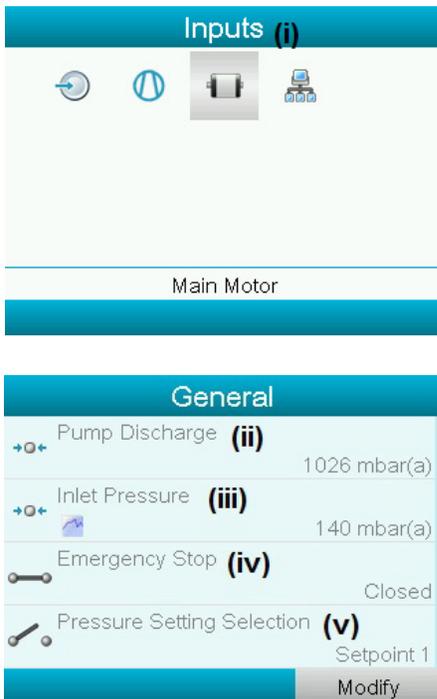
Procedure

Starting from the Main screen (see Main screen). Move the cursor to the action button Menu and press the enter key, following screen appears:



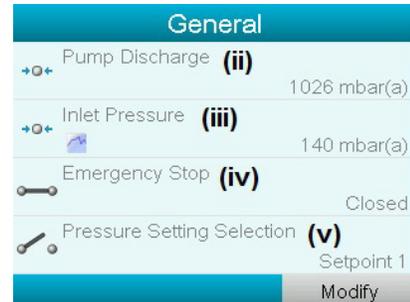
Using scroll keys, move the cursor to the inputs icon (see above, section Menu icon). Then, press the enter key, a screen similar to the one below appears:

3.0 Elektronikon® Graphic Controller



Selecting another input signal as main chart signal

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



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

(i)	Inputs
(ii)	Discharge pressure
(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.e. 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.



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



Select Yes to remove or No to quit current action.

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

3.0 Elektronikon® Graphic Controller

3.7 Outputs Menu

Menu icon, Outputs



Function

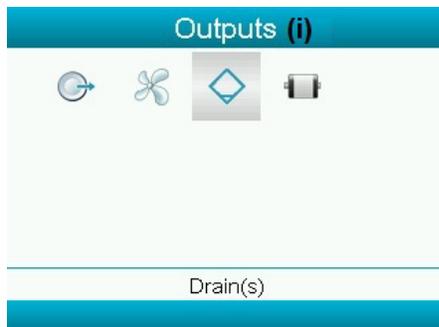
To call up information regarding the measured data and the status of inputs, such as the motor over load protection.

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:



Using scroll keys, move the cursor to the outputs icon (see above icon). Then, press the enter key, the following screen appears:



(i)	Outputs
(ii)	Modulating Valve
(iii)	Gas ballast
(iv)	Automatic Operation
(v)	General warning

The screen shows a list of all output switch 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.

3.8 Counters

Menu icon, Counters



Function

To call up:

- Running hours
- Number of motor starts
- Number of hours the regulator has been powered up
- Fan starts
- Emergency stops

3.0 Elektronikon® Graphic Controller

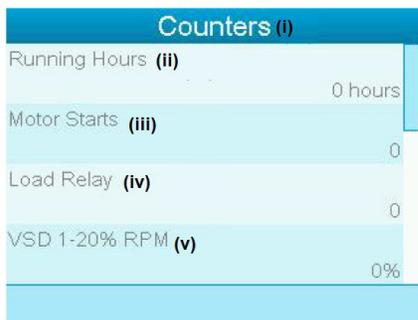
Procedure

Starting from the Main screen (see Main screen):

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



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



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

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

3.9 Control Mode Selection

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).

Procedure

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



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



There are 3 possibilities:

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

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



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.

3.10 Service Menu

Menu icon, Service



Function

- Reset the service plans which are carried out.
- Check when the next service plans are to be carried out.
- Find out which service plans were carried out in the past.
- Modify the programmed service intervals.

Procedure

Starting from the Main screen, move the cursor to the action button Menu and press the Enter key. The following screen will appear:



(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.

Overview



(i)	Overview
(ii)	Running hours
(iv)	Real Time hours
(v)	Reset

3.0 Elektronikon® Graphic Controller

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:

Service Plan (i)			
(ii) Level	(iii) Running Hours	(iv) Real Time	
A	4000	8760	
B	8000	17520	
C			
D	24000		
E	32000		
			(v) Modify

(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 Elektronikon 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:

Service Plan (i)			
(ii) Level	(iii) Running Hours	(iv) Real Time	
A	4000	8760	
B	8000	17520	
C			
D	24000		
E	32000		
			(v) Modify

Press the Enter key. The following screen appears:

Service Plan (i)			
(ii) Level	(iii) Running Hours	(iv) Real Time	
Modify Hours			
	100000		
	4000		
	0		
E	32000		
			(v) Modify

Modify the value as required using the up or down scroll keys 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.

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Next Service



(i)	Next service
(ii)	Level
(iii)	Running 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

Menu icon, Setpoint



Function

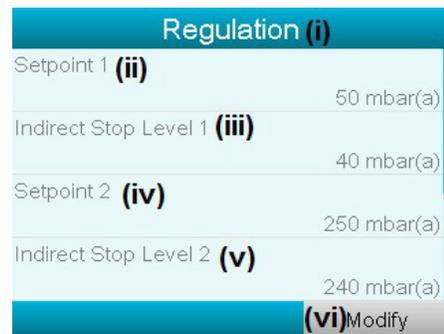
On vacuum pumps with a frequency converter driven main motor, it is possible to program two different setpoints. This menu is also used to select the active setpoint.

Procedure

Starting from the Main screen, highlight the action key Menu using the Scroll keys and press the Enter key. Following the screen that appears in the next column:

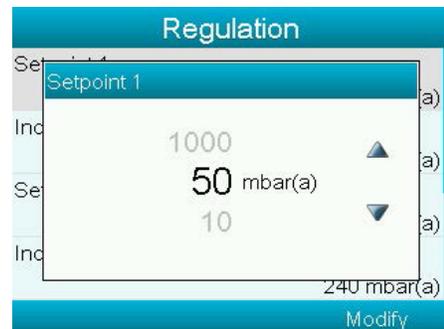


Activate the menu by pressing the enter key. A screen similar to the one below appears:



(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:



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

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

Menu icon, Event History



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). Press the enter key, the list of the last shut-down and emergency stop cases is shown.

Event History
04/04/2011 - 13:49:22
12/05/2011 - 22:12:38
13/07/2011 - 01:43:47
13/07/2011 - 01:46:25

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.

3.13 Modifying General Settings

Menu icon, Settings



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:



Using the scroll keys, move the cursor to the Settings icon (see above, section Menu icon). Press the enter key the settings screen should appear, like the following:

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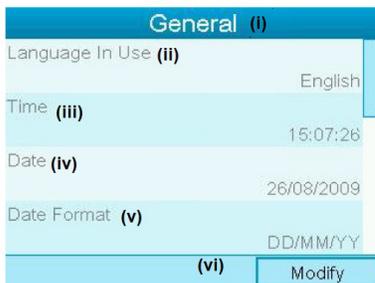


This screen shows again a number of icons. By default, the User Password icon is selected. The status bar shows the description that corresponds with the selected icon. Each icon covers one or more items, such as

- Access level
- Element
- 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.



(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 down key of the Scroll keys to select the setting to be modified and press the Enter key. A pop-up screen appears. Use the up or down 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



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3.14 Info Menu

Menu icon, Info



Function

To show the BeaconMedæs internet address.

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 Settings icon (see above, section Menu icon). Press the enter key and the BeaconMedæs internet address appears on the screen.

3.15 Week Timer Menu

Menu icon, Week Timer



Function

- Program time-based start/stop commands for the vacuum pump
- Program time-based change-over commands for the net pressure band
- Four different programmable week schemes.
- 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.

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

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 and press the Enter key.



(1)	Menu
(2)	Week Timer



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

3.0 Elektronikon® Graphic Controller

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

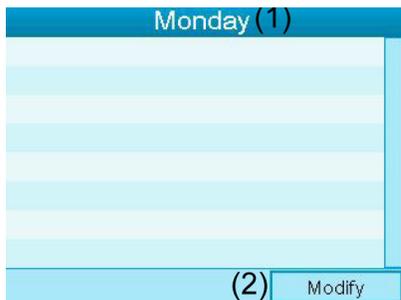
Programming week schemes

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.



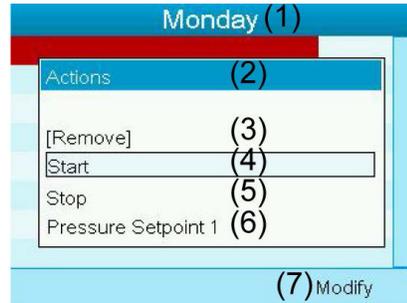
(1)	Week Action Scheme 1
(2)	Monday
(3)	Tuesday
(4)	Wednesday
(5)	Thursday
(6)	Friday
(7)	Saturday
(8)	Sunday

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



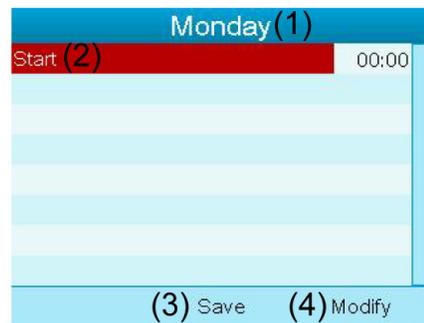
(1)	Monday
(2)	Modify

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



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

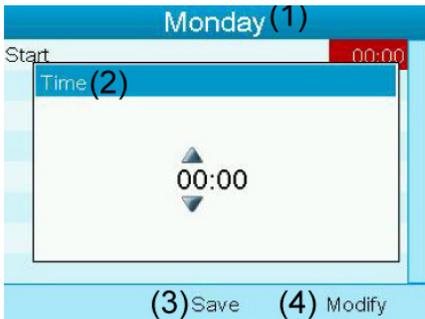
A new window opens, the action is now visible in the first day of the week.



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

A pop-up window opens. Use the up or down key of Scroll keys to modify the values of the hours. Use the left or right Scroll keys to go to the minutes.

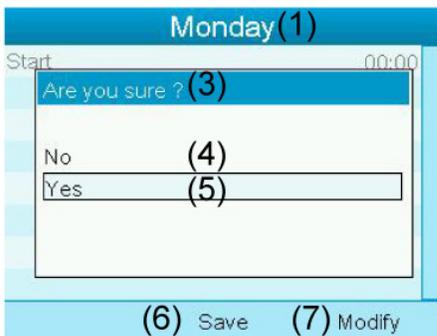
3.0 Elektronikon® Graphic Controller



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

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

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



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

Programming the week cycle

A week cycle is a sequence of 10 weeks. For each week in the cycle, one of the four programmed week schemes can be chosen. Select Week Cycle from the main Week Timer menu list.

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



Press the Escape key to leave this window.

The next action, is the day the action is planned.

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

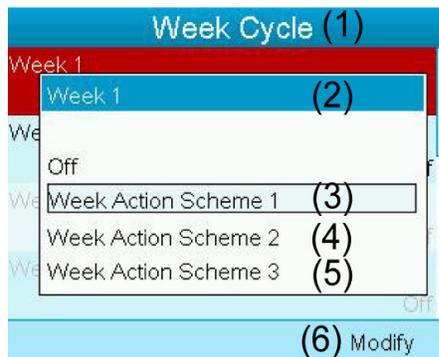
3.0 Elektronikon® Graphic Controller

A list of 10 weeks is shown.



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

Press the Enter key twice on the controller to modify the first week. A new window opens. Select the action, example: Week Action Scheme 1.



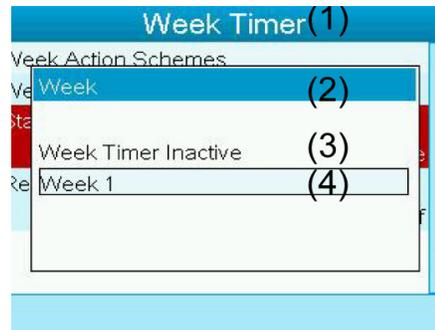
(1)	Week Cycle
(2)	Week 1
(3)	Week Action Scheme 1
(4)	Week Action Scheme 2
(5)	Week Action Scheme 3
(6)	Modify

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.



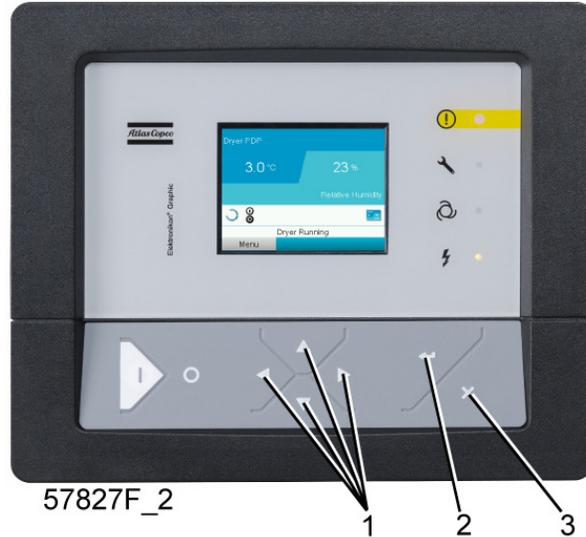
(1)	Week Timer
(2)	Week Action Schemes
(3)	Week Cycle
(4)	Status
(5)	Week Timer Inactive
(6)	Remaining Running Time

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



3.16 User password menu

Control panel



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

Menu icon, Password



“Oil-sealed” Rotary Screw Vacuum Pumps MSV007, MSV010, MSV015, MSV020

Function

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

Procedure

Starting from the Main screen (see 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.

Getting started

	<p>If the vacuum pump is equipped with a SMARTBOX, the network connection of the Elektronikon 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.</p> <p>If both the web server functionality and SMARTBOX are required, please contact your Atlas Copco Customer Center for support.</p>
--	--

Make sure you are logged in as administrator.

“Oil-sealed” Rotary Screw Vacuum Pumps MSV007, MSV010, MSV015, MSV020

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



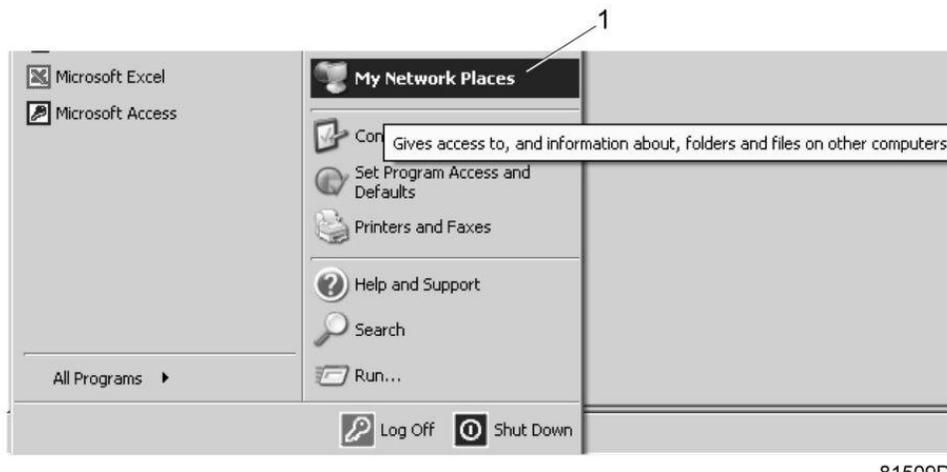
USB to LAN adapter

- 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).

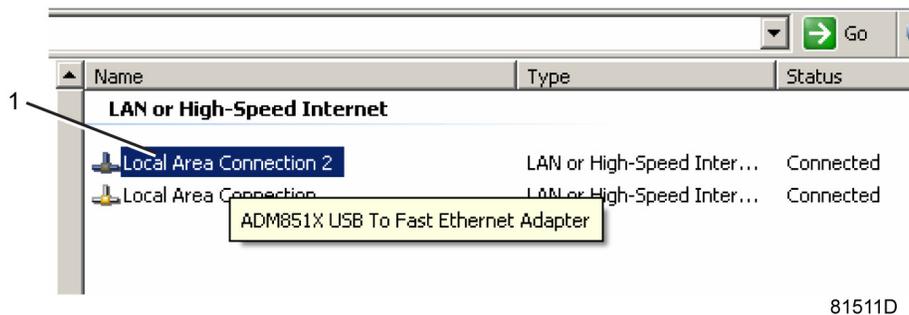


“Oil-sealed” Rotary Screw Vacuum Pumps MSV007, MSV010, MSV015, MSV020

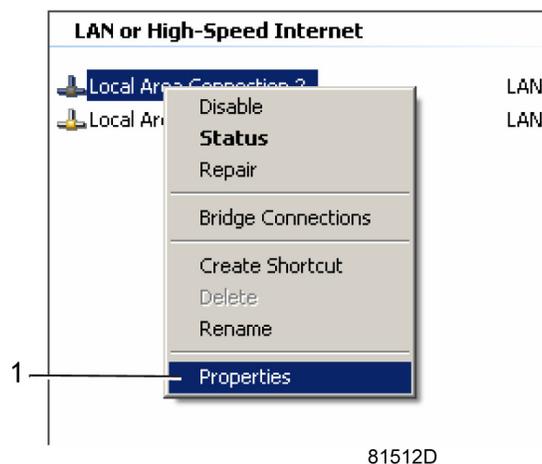
- Click on View Network connections (1).



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

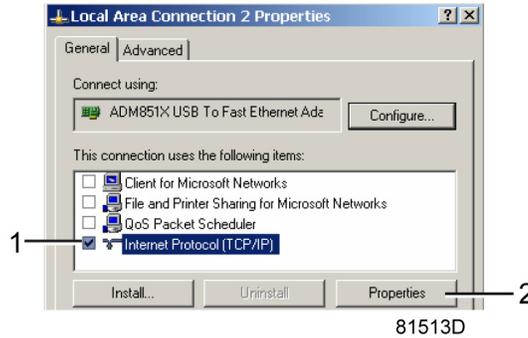


- Click with the right button and select properties (1).



"Oil-sealed" Rotary Screw Vacuum Pumps MSV007, MSV010, MSV015, MSV020

- 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 the Properties button (2) to change the settings.



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

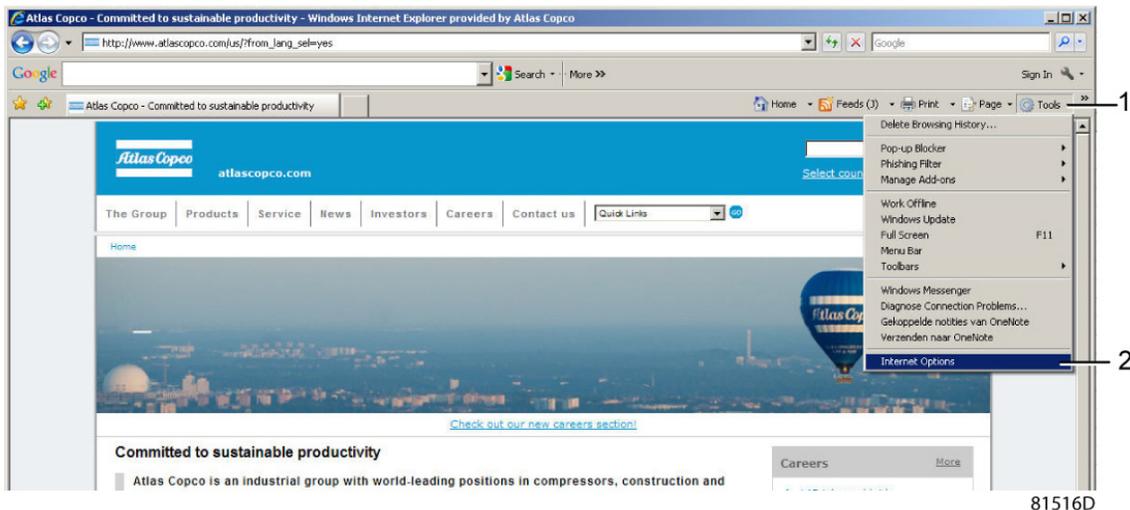
Click OK and close network connections.

Configuration of the web server

Configure the web interface

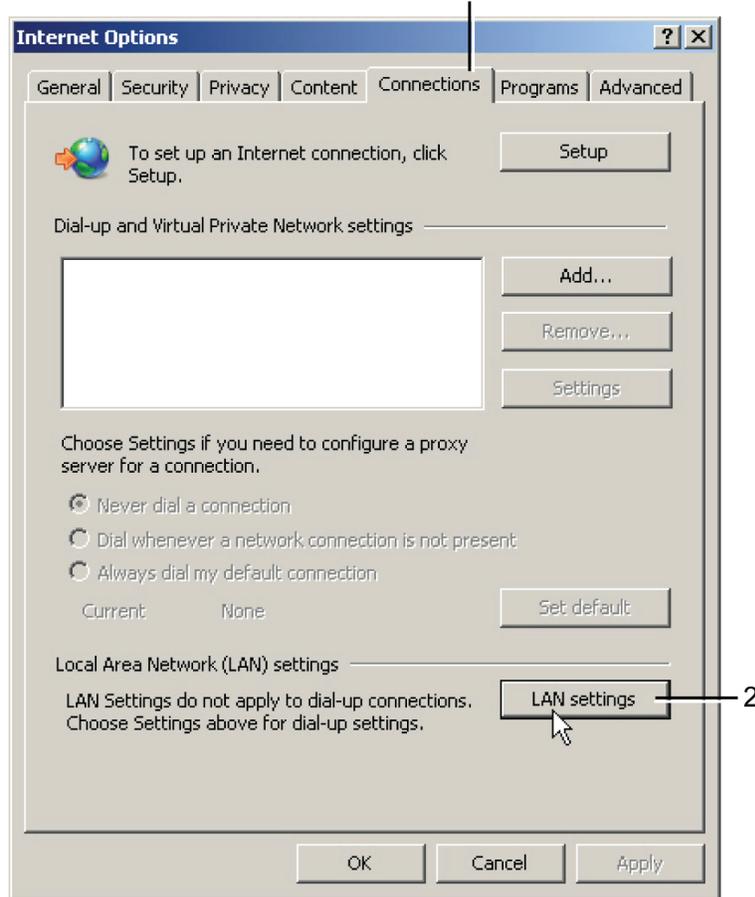
	<p>The internal web server is designed and tested for Microsoft® Internet Explorer 6, 7 and 8. Other web browsers like Opera and Firefox do not support this internal web server. When using Opera or Firefox, a redirect page opens. Click on the hyperlink to connect to the download server from Microsoft®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

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



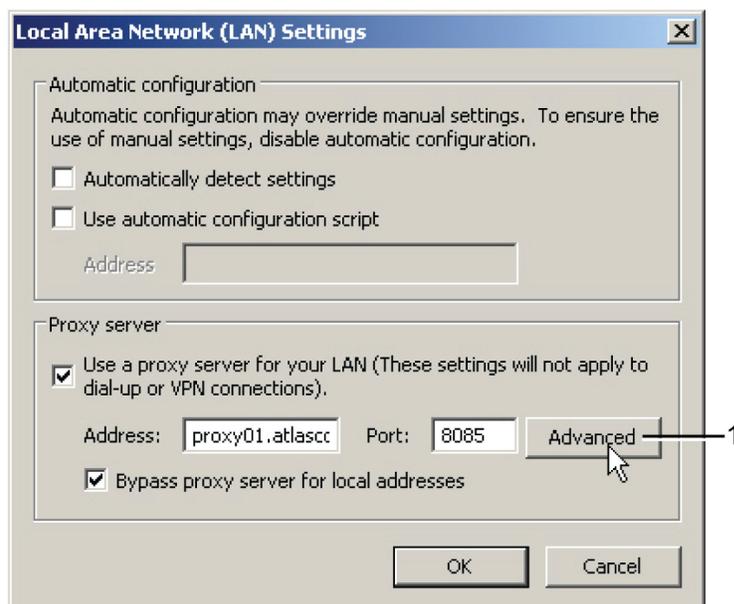
“Oil-sealed” Rotary Screw Vacuum Pumps MSV007, MSV010, MSV015, MSV020

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



81517D

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



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“Oil-sealed” Rotary Screw Vacuum Pumps MSV007, MSV010, MSV015, MSV020

- 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.

The screenshot shows the 'Proxy Settings' dialog box. It has two main sections: 'Servers' and 'Exceptions'.
In the 'Servers' section, there is a table with columns 'Type', 'Proxy address to use', and 'Port'.

Type	Proxy address to use	Port
HTTP:	proxy01.atlascopco.be	8085
Secure:	proxy01.atlascopco.be	8085
FTP:	proxy01.atlascopco.be	8085
Socks:		

Below this table is a checkbox labeled 'Use the same proxy server for all protocols' which is checked.
In the 'Exceptions' section, there is a text box with the label 'Do not use proxy server for addresses beginning with:'. The text box contains the IP addresses '192.168.100.1;192.168.100.100;192.168.100.2'. Below the text box is the instruction 'Use semicolons (;) to separate entries.'.
At the bottom of the dialog are 'OK' and 'Cancel' buttons. A red arrow points to the 'OK' button.

81519D

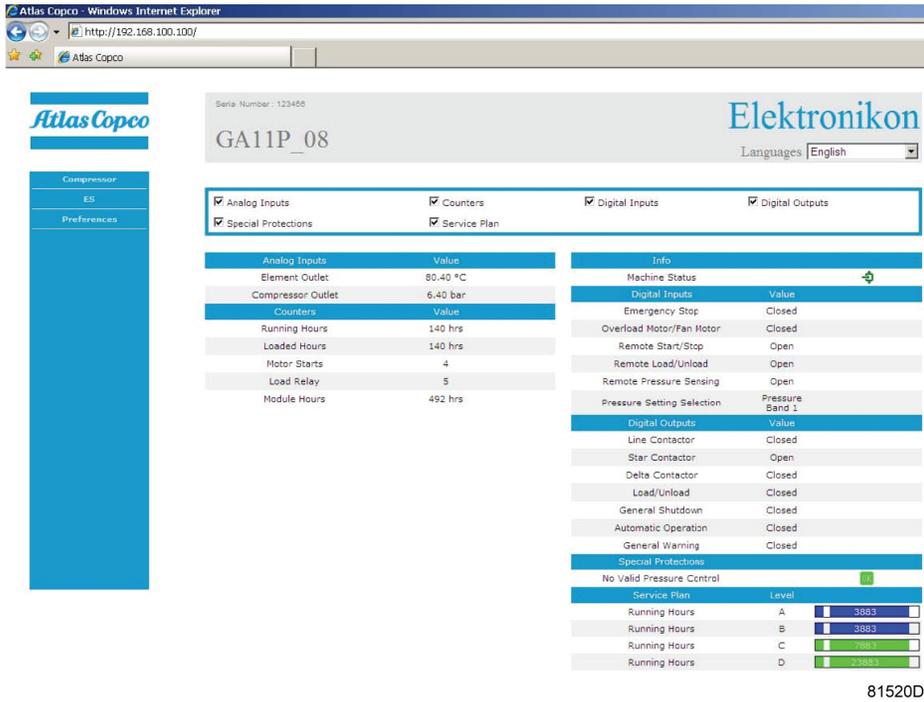
Viewing the controller data



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

“Oil-sealed” Rotary Screw Vacuum Pumps MSV007, MSV010, MSV015, MSV020

- 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.



“Oil-sealed” Rotary Screw Vacuum Pumps MSV007, MSV010, MSV015, MSV020

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.

Analog Inputs

Analog Inputs	Value
Element Outlet	131.90 °F
Compressor Outlet	110.21 psi

81523D

Counters

Lists all current counter values from controller and vacuum pump.

Counters

Counters	Value
Running Hours	29 hrs
Loaded Hours	29 hrs
Motor Starts	3
Load Relay	4
Module Hours	549 hrs

81524D

Info status

Machine status is always shown on the web interface.

Info
Machine Status

81525D

Digital inputs

Lists all Digital inputs and their status.

Digital Inputs

Digital Inputs	Value
Emergency Stop	Closed
Overload Motor/Fan Motor	Closed
Remote Start/Stop	Open
Remote Load/Unload	Open
Remote Pressure Sensing	Open
Pressure Setting Selection	Pressure Band 1

81526D

Digital outputs

Lists all Digital outputs and their status.

"Oil-sealed" Rotary Screw Vacuum Pumps MSV007, MSV010, MSV015, MSV020

Digital Outputs

Digital Outputs	Value
Line Contactor	Closed
Star Contactor	Open
Delta Contactor	Closed
Load/Unload	Closed
General Shutdown	Closed
Automatic Operation	Closed
General Warning	Closed

81527D

Special protections

Lists all special protections of the vacuum pump.

Special Protections

Special Protections
No Valid Pressure Control

81528D

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.

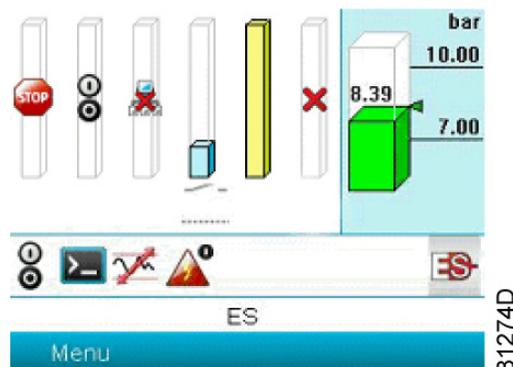
Service Plan

Service Plan	Level	Running Hours
Running Hours	A	3971
Running Hours	B	3971
Running Hours	C	7971
Running Hours	D	23971

81529D

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.



A possible ESi screen

"Oil-sealed" Rotary Screw Vacuum Pumps MSV007, MSV010, MSV015, MSV020

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	10	15
Integration time	sec	0,5	5	10

Parameters

		Minimum setting	Factory setting	Maximum setting
Run time at minimum pressure	sec	0	30	300
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
Manual purge time	min	0	30	120
Minimum stop time	sec	5	5	30
Power recovery time	sec	10	10	3600
Restart delay	sec	0	0	1200
Communication time-out	sec	10	30	60
Fan motor starts per day (air-cooled vacuum pumps)		1	240	240

Protections

		Minimum setting	Factory setting	Maximum setting
Vacuum pump element outlet temperature (shut-down warning level)	°C	50	110	119
Vacuum pump element outlet temperature (shut-down warning level)	°F	122	230	246
Vacuum pump element outlet temperature (shut-down level)	°C	111	120	120
Vacuum pump element outlet temperature (shut-down level)	°F	232	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.

“Oil-sealed” Rotary Screw Vacuum Pumps MSV007, MSV010, MSV015, MSV020

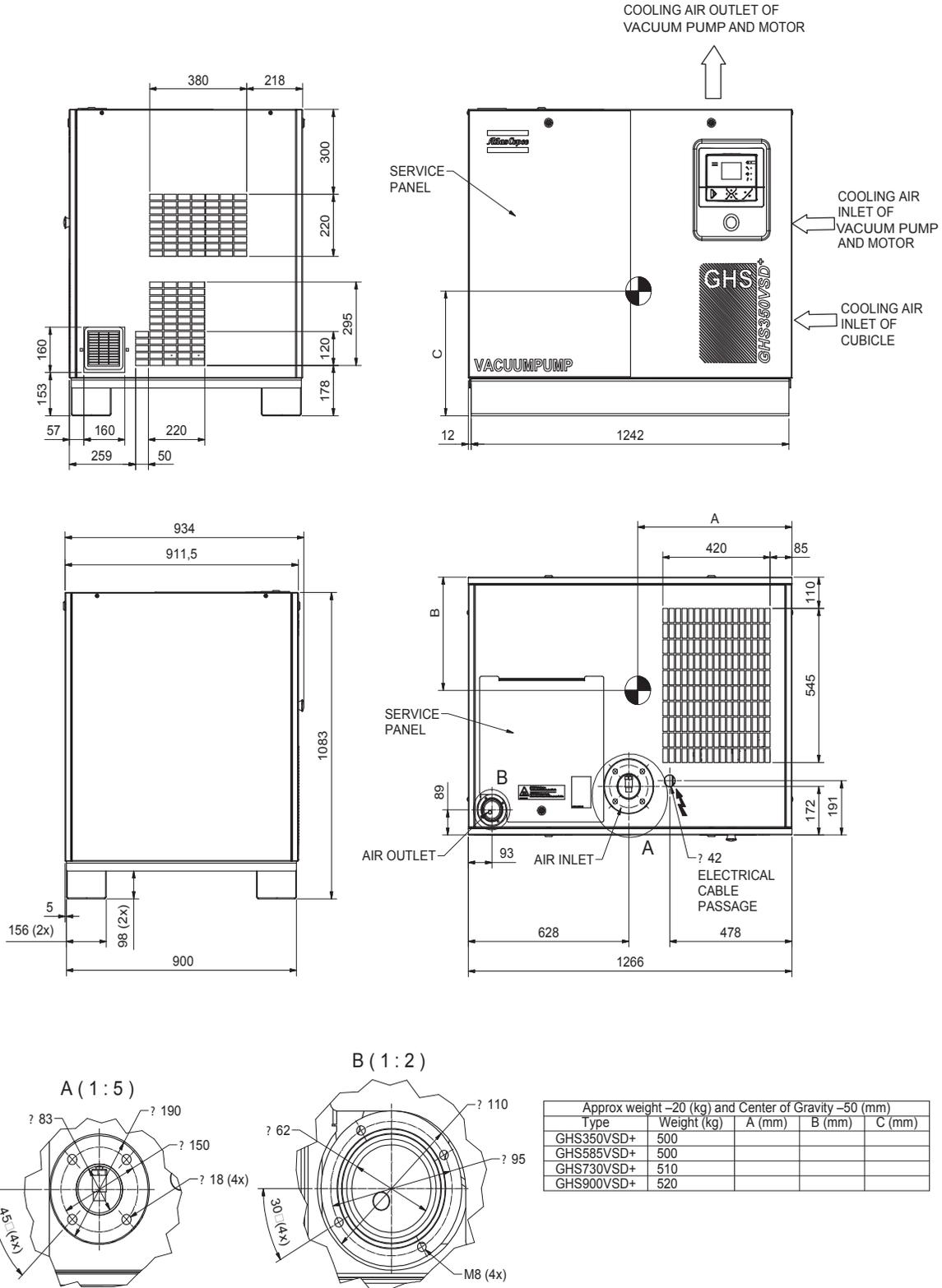
Consult BeaconMedaes if a timer setting needs to be changed. The intervals must not exceed the nominal intervals and must coincide logically. See section Modifying general settings.

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. 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. Altering these settings may damage the Vacuum pump. Consult BeaconMedaes.

4.0 Elektronikon® Graphic Controller

4.1 Dimension drawings



4.0 Elektronikon® Graphic Controller

Center of gravity and weight

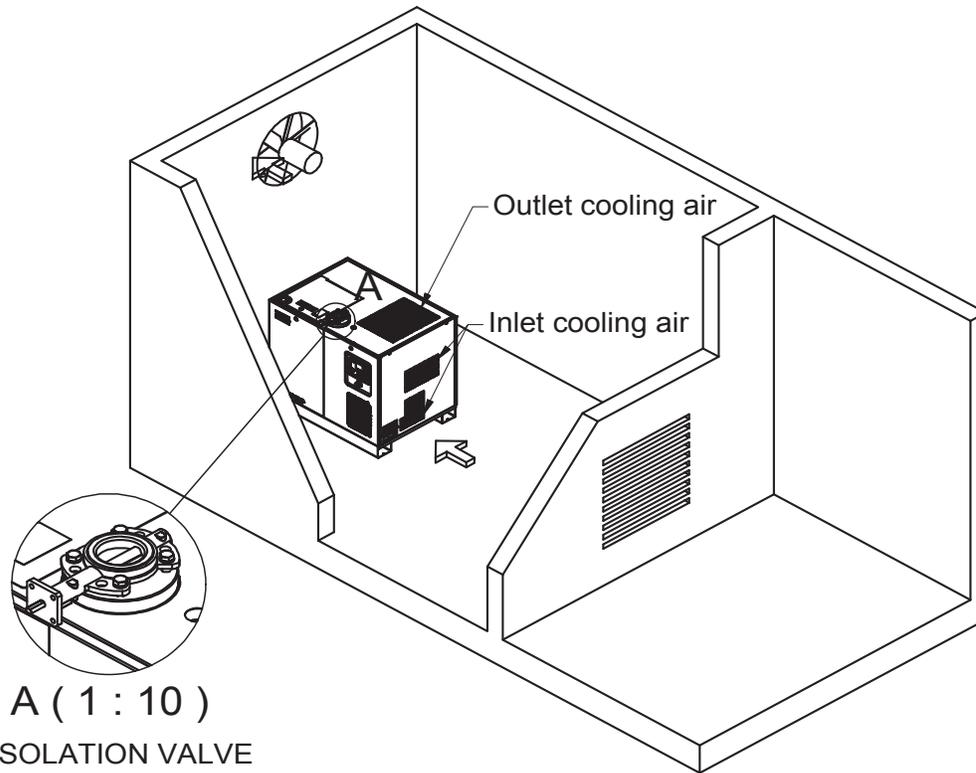
Type	L (mm)	L (inches)	W (mm)	W (inches)	H (mm)	H (inches)	Weight (Kg)	Weight (lbs)
MSV 007	642	25	498	20	400	16	500	1102
MSV 010	642	25	498	20	400	16	500	1102
MSV 015	642	25	498	20	400	16	510	1124
MSV 020	642	25	498	20	400	16	520	1146

Dimensions +/- 10 mm or 0.3 inches

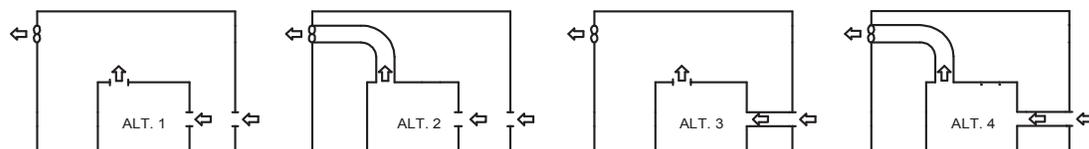
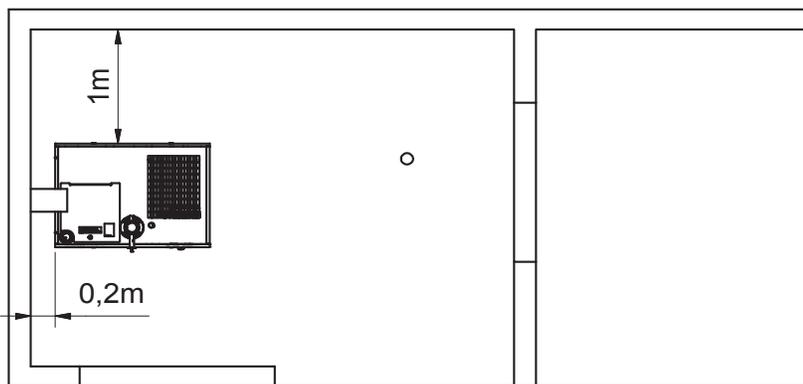
Weights (oil included) +/- 20 kg or 44 lbs

4.0 Elektronikon® Graphic Controller

4.2 Installation proposal



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



4.0 Elektronikon® Graphic Controller

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 :

$$Q_v = 1.06 N / T$$

Where,

Q_v = Required cooling air flow (m³/s)

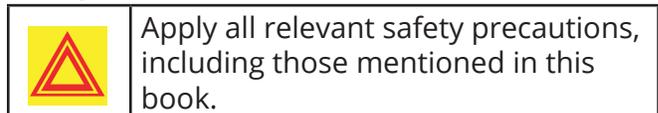
N = Nominal motor power of vacuum pump (kW)

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



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 BeaconMedæs.

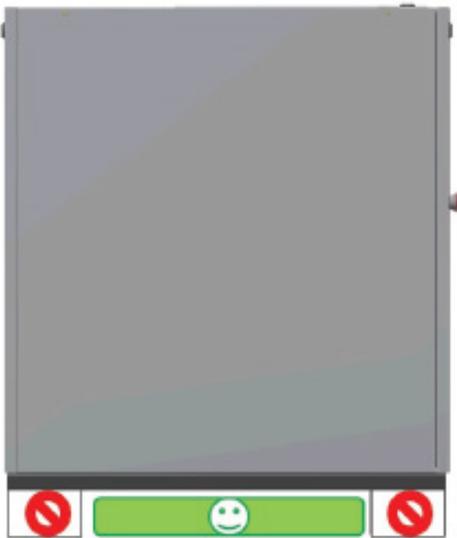
4.0 Elektronikon® Graphic Controller

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 BeaconMedæs.

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

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.
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4.0 Elektronikon® Graphic Controller

4.3 Electrical connections

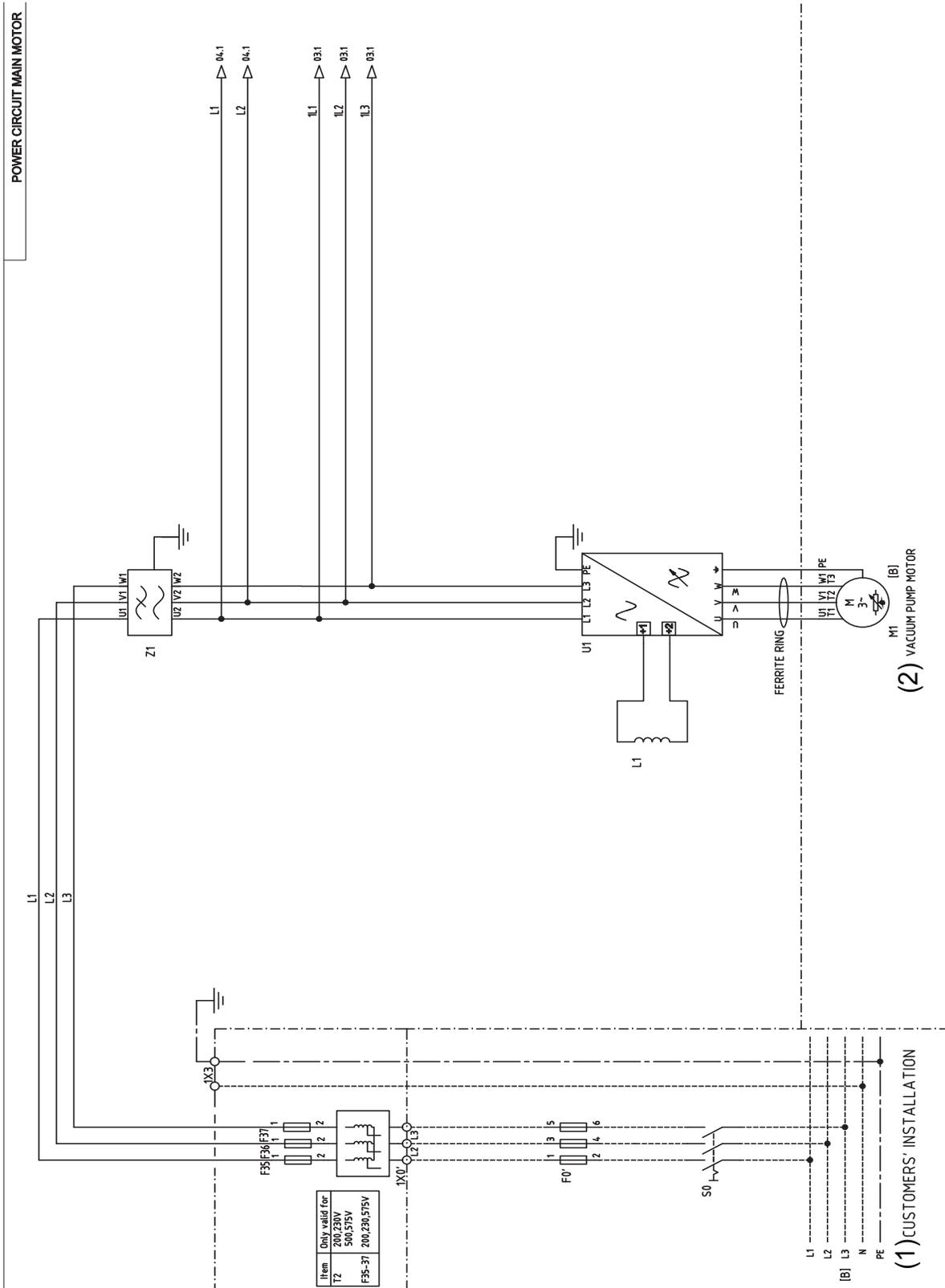
	<p>Working with machinery controlled by a frequency converter requires special safety precautions. These safety precautions depend on the kind of network used (TN, TT, IT system). Consult BeaconMedæs.</p>
---	--

	<p>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.</p> <p>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 BeaconMedæs.</p>
---	---

Electrical connections for MSV 007 up to MSV 020

4.0 Elektronik® Graphic Controller

Service diagram



4.0 Elektronikon® Graphic Controller

Reference	Designation
1	Customer’s installation
2	Vacuum pump motor

Note

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 modes

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 BeaconMedæs. 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 BeaconMedæs.

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)

4.0 Elektronikon® Graphic Controller

Maximum contact load: 10 A / 250 V AC.

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

4.4 Picrographs

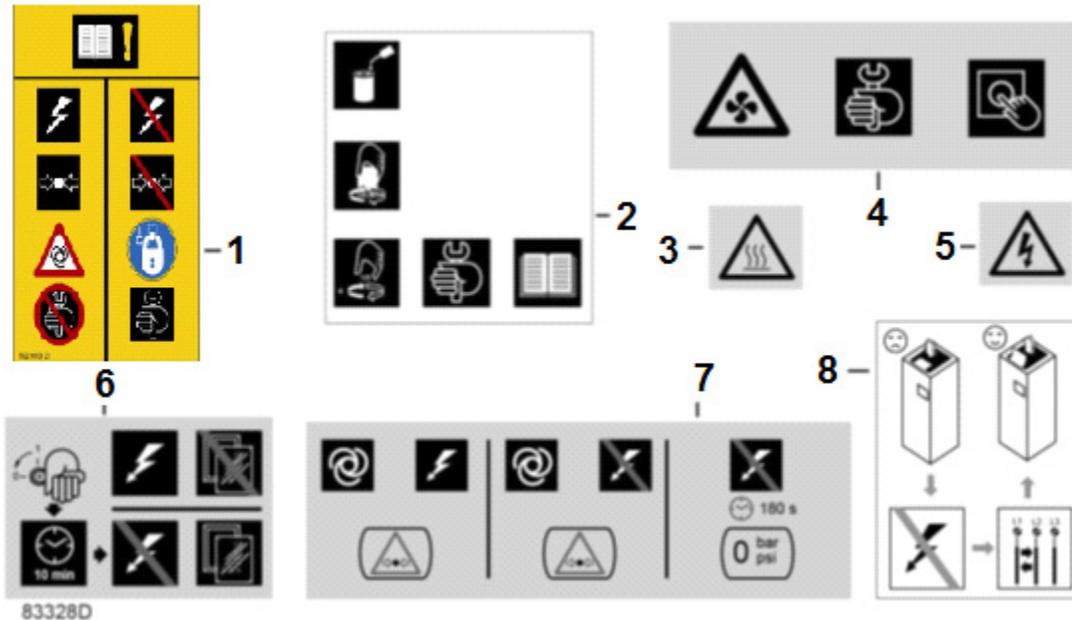


Figure 6 Pictographs

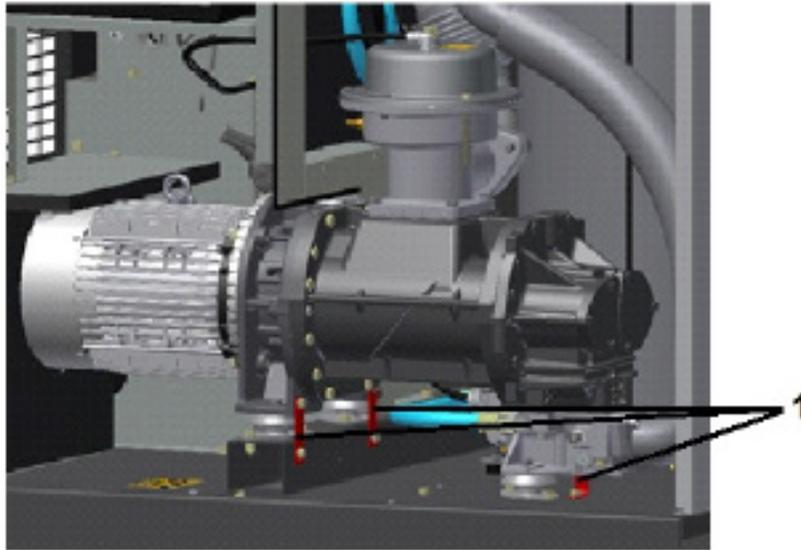
Reference	Designation
1	Switch off the voltage and depressurize the vacuum pump before starting maintenance or Repairs
2	Lightly oil the gasket of the oil filter, screw it on and tighten by hand (approx. half a turn)
3	Warning, hot surface
4	Stop the vacuum pump before cleaning the coolers
5	Warning, voltage
6	Switch off the voltage and wait at least 10 minutes before maintenance
7	Vacuum pump remains pressurized for 180 seconds after switching off the voltage
8	If the rotation direction is wrong, open the isolating switch in the voltage supply line and reverse two incoming electric lines

5.0 Operating instructions

5.1 Initial start-up



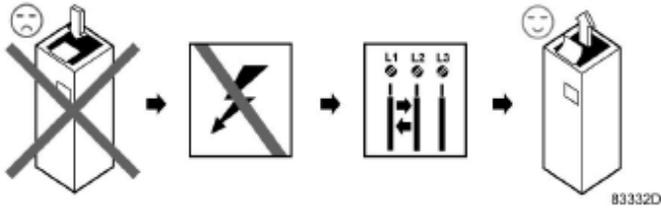
The operator must apply all relevant Safety precautions. Also consult section Problem solving.



- Remove the 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.
- 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).

5.0 Operating instructions

- 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 BeaconMedæs).
 - 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).

5.2 Starting

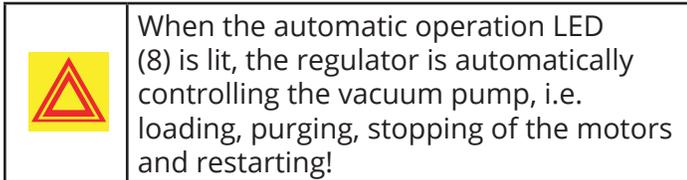
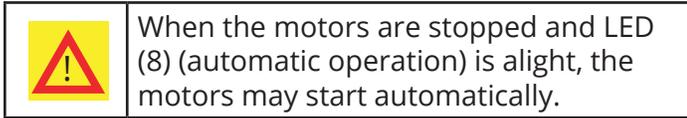


Figure 7 Control panel Elektronikon® Graphic

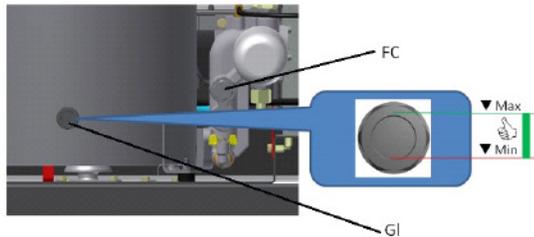
Step	Action
1	Switch on the voltage. Check that voltage on LED (6) lights up.
2	Press start button (1) on the control panel. The vacuum pump starts running and the automatic operation LED (8) lights up.
3	Open the inlet isolation valve (IV).

5.0 Operating instructions

5.3 During operation



Regularly check the oil level during operation.



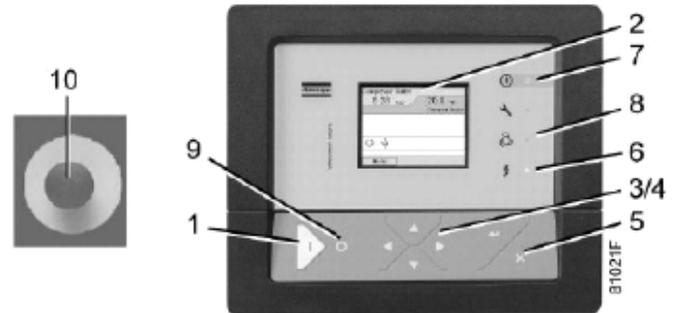
A few minutes after stopping, the oil level should reach the top of the oil sight glass (GI).

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).

On vacuum pump with an Elektronikon® Graphic controller, 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.

5.0 Operating instructions

5.4 Taking out of operation

- Disconnect the vacuum pump from the mains.
- Shut off and vent the part of the system which is connected to the vacuum pump by opening the plug located on the lid of the air inlet filter. Isolate the vacuum pump from the vacuum system.
- Drain the oil.

5.5 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.

6.0 Maintenance

6.1 Preventive maintenance schedule

Control panel

Warning

	<p>Before carrying out any maintenance, repair work or adjustments, proceed as follows:</p> <ul style="list-style-type: none"> • 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. <p>For detailed instructions, see section Problem solving. The operator must apply all relevant Safety precautions.</p>
---	---

Regularly check the oil level during operation.

Warranty - Product Liability

Use only authorised parts. Any damage or malfunction caused by the use of unauthorised 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

BeaconMedæs offers several types of service contracts, relieving you of all preventive maintenance work.

Consult your BeaconMedæs Customer Center.

General

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

Intervals

The local BeaconMedæs 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.
Monthly (1)	Remove the air filter elements and inspect. Replace damaged or heavily contaminated elements. Check for possible air and oil leakages.
Monthly (3)	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 BeaconMedæs Customer Center.

"Oil-sealed" Rotary Screw Vacuum Pumps MSV007, MSV010, MSV015, MSV020

6.0 Maintenance

Preventive Maintenance schedule programmed in the Elektronikon® for normal applications

Current instruction book situation	Type of application		
	Normal	Medium	Harsh
Action			
Check oil level and condition	Daily	Daily	Daily
Check readings on display			
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	3-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 scavenge line and blow out the restriction nozzle			
Replace the oil separator 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	8000 hrs (2)	6000 hrs (2)	4000 hrs (2)
Replace the filter element of electric cabinet			
Replace the thermostatic valve			
Test pressure switch	24000 hrs	24000 hrs	24000 hrs
Replace membrane of vacuum control valve (3)			
Motor overhaul			

"Oil-sealed" Rotary Screw Vacuum Pumps MSV007, MSV010, MSV015, MSV020

6.0 Maintenance

Current instruction book situation	Type of application		
	(1)	(2)	(3)
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

(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 BeaconMedæs if in doubt.

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

BeaconMedæs 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

BeaconMedæs 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*

6.0 Maintenance

Important

	<ul style="list-style-type: none">• Always consult BeaconMedæs 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 BeaconMedæs Customer Center.• Any leakage should be attended to immediately. Damaged hoses or flexible joints must be replaced.
---	---

6.2 Oil specifications

It is strongly recommended to use genuine BeaconMedæs 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.

	<p>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.</p>
---	--

BeaconMedæs vacuum mineral fluid

BeaconMedæs'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 BeaconMedæs'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).

BeaconMedæs vacuum synthetic fluid

BeaconMedæs'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).

BeaconMedæs vacuum foodgrade Fluid

Special oil, delivered as an option.

BeaconMedæs'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).

6.0 Maintenance

6.3 Drive motor

Bearing maintenance Attention

Attention



Never mix greases of different brands or types.

Recommended grease:

Use 2901 0338.3 Amber Quantity:

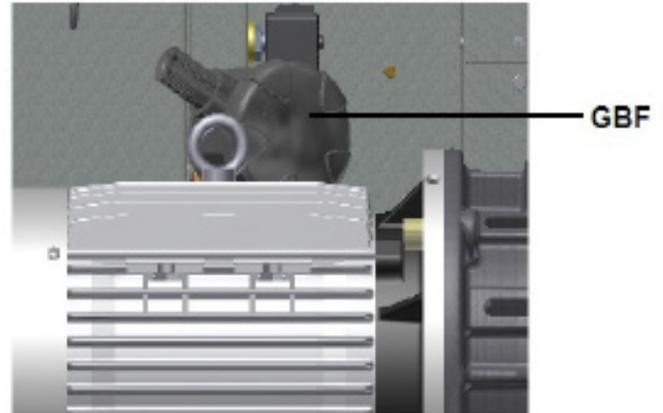
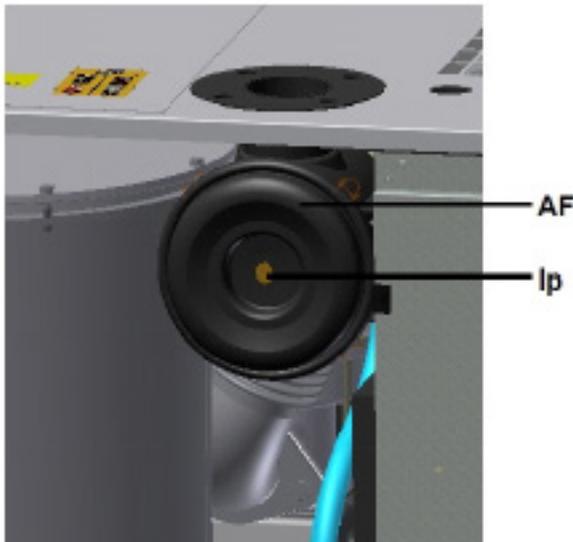
MSV 007	6.9 g (0.24 oz)
MSV 010	per bearing
MSV 015	7.2 g (0.25 oz)
MSV 020	per bearing



Do not use more grease than prescribed!

6.4 Air Filter

Bearing maintenance Attention



Procedure

1. Stop the vacuum pump. Switch off the voltage.
2. Vent the vacuum pump by opening the plug (Ip) on the lid 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.

6.0 Maintenance

6.5 Oil and oil filter change

Warning

	<p>The operator must apply all relevant Safety precautions.</p> <p>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.</p> <p>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.</p>
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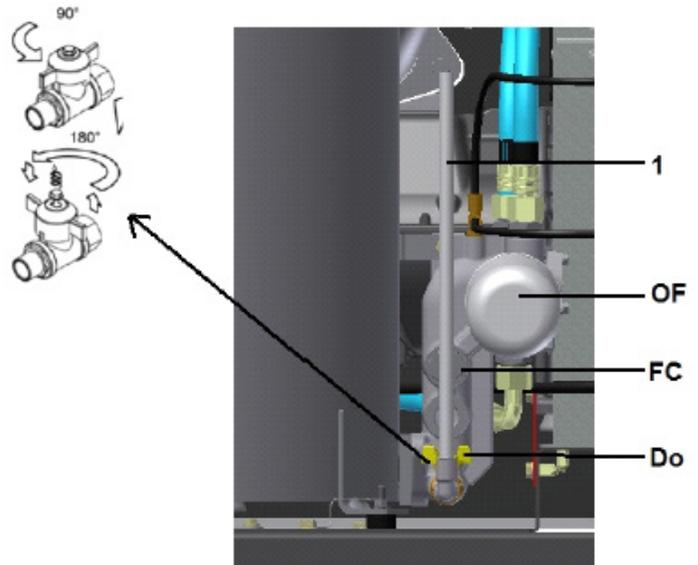
Procedure

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.

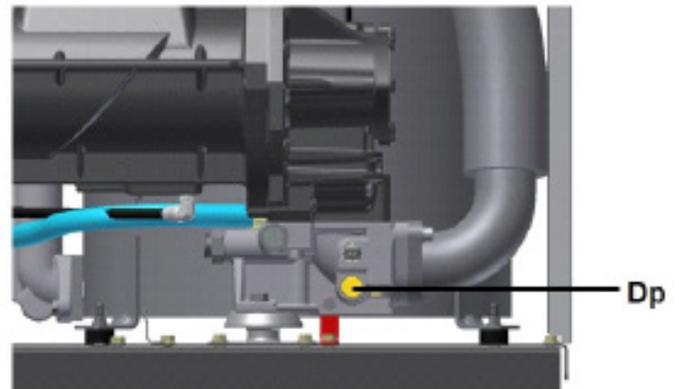


3. Open the oil drain valve (Do).

- Hold the oil drain hose (1) downward to drain the oil.



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 valve (Do).
6. Clean the seat on the manifold. Lubricate the gasket of the new oil filter and screw it into place. Tighten firmly by hand.

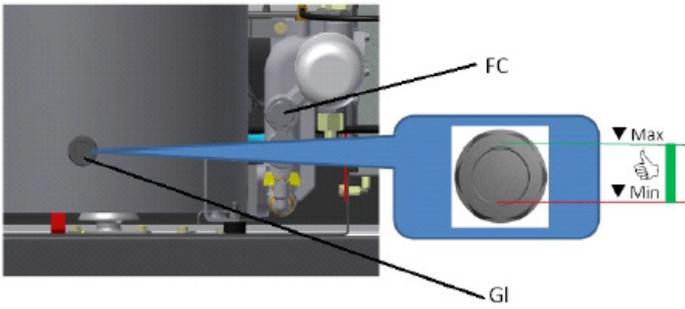


- Unscrew the plug (Dp) in the outlet element housing and drain the oil. Collect the oil in a collector and deliver it to the local collection service. Refit the vent plugs after draining.

6.0 Maintenance

7. Remove filler plug (FC).

- Fill the oil separator 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 air inlet 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 air receiver (AR) 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.

6.6 Coolers

General

Keep the coolers clean to maintain their efficiency.

Procedure

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



Remove dirt from the coolers with a fibre 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 BeaconMedæs.



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.

6.0 Maintenance

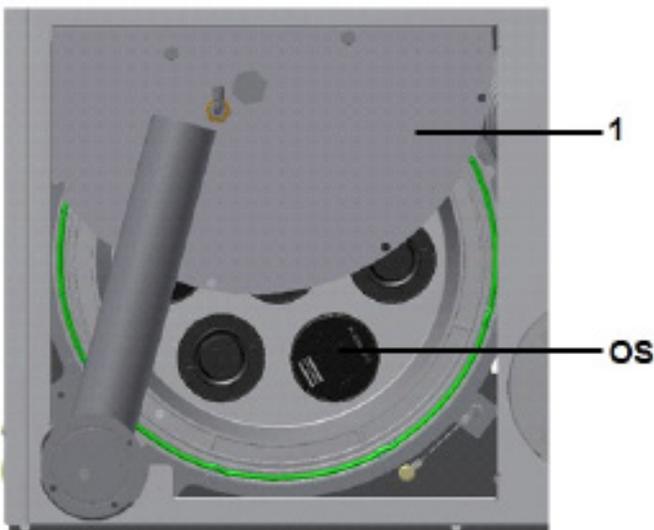
6.7 Oil separator change

Warning

	The operator must apply all relevant Safety precautions.
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Procedure

- Stop the vacuum pump, close the air inlet valve and switch off the voltage.
- Wait a few moments for the vacuum pump to vent the vessel.
- Open the service panel in the roof.
- Unscrew the bolts of the cover (1) of the oil separator tank.



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

- Slide the cover (1) of the oil separator tank back in position. Caution not to squeeze the O-ring.
- Tighten bolts.

6.8 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.
---	--

6.0 Maintenance

6.9 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 BeaconMedæs 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.

6.10 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.

6.11 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.

7.0 Problem Solving

Warning

	<p>Before carrying out any maintenance, repair work or adjustment, stop vacuum pump, close the air inlet valve and wait 3 minutes.</p> <p>Press the emergency stop button and switch off the voltage.</p> <p>Vent the vacuum pump by opening the plug on the cover of the air inlet filter.</p> <p>For location of components, see sections:</p> <ul style="list-style-type: none"> • Introduction • Operation instructions • Maintenance <p>Open and lock the isolating switch.</p> <p>Lock the air inlet valve during maintenance or repair. The operator must apply all relevant Safety precautions.</p>
---	--

Before electrical maintenance

	<p>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.</p>
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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 BeaconMedæs

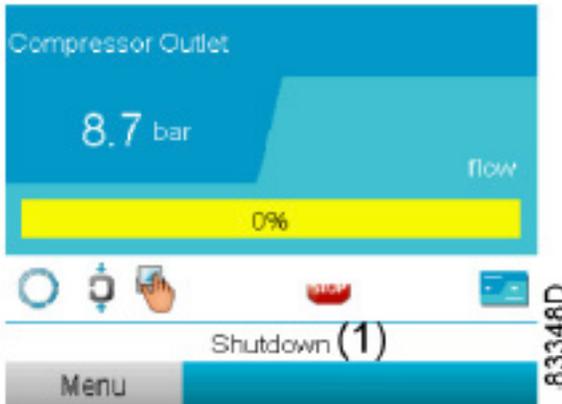
7.0 Problem Solving

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 BeaconMedæs
	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 BeaconMedæs	

7.0 Problem Solving

Converter fault codes

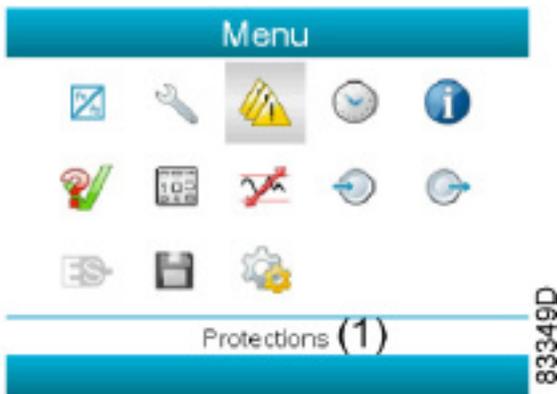
If a problem is detected by the converter, a specific code (Main motor converter alarm) will appear on the Elektronikon® display, together with a fault code. Below table lists the most important error codes. If another code appears, please contact BeaconMedæs.



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.

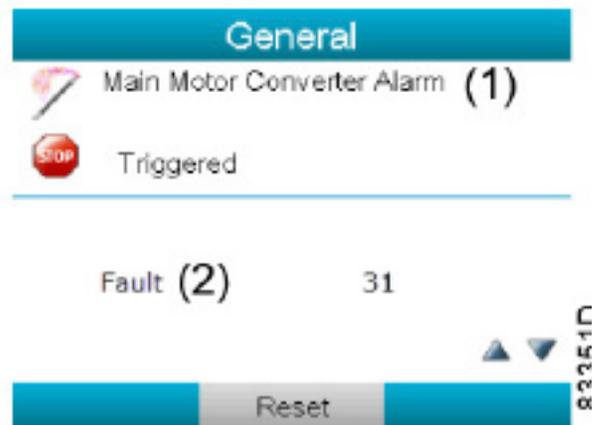


(1) Protections



(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

7.0 Problem Solving

Fault code	Fault	Remedy
2 (or 60000)	DC Bus Undervoltage (Uv1)	Check supply voltage Check input wiring Check EMC filter
3 (or 60000)	Control Power Supply Voltage Fault (Uv2)	Check supply voltage Check input wiring Check EMC filter
4 (or 60000)	Undervoltage 3 (Uv3)	Check supply voltage Check input wiring Check EMC filter
5	Output Short-Circuit or IGBT Fault (SC)	Check wiring to motor Check for short-circuits Check inlet valve Check back pressure oil separator vessel Check oil injection
6	Ground Fault (GF)	Check wiring to motor Check for short-circuits Check inlet valve Check back pressure oil separator vessel Check oil injection
7	Overcurrent (oC)	Check wiring to motor Check for short-circuits Check inlet valve Check back pressure oil separator vessel Check oil injection
8	Drive Overheat Warning (ov)	Check ambient temperatures Check cooling unit/inverter Check heatsink inverter
9	Heatsink Overheat (oH)	Check ambient temperatures Check cooling unit/inverter Check heatsink inverter
10	Overheat 1 (oH1)	Check ambient temperatures Check cooling unit/inverter Check heatsink inverter
11	Motor Overload (oL1)	Check inlet valve Check back pressure oil separator vessel Check drive train Check oil injection
12	Drive Overload (oL2)	Check inlet valve Check back pressure oil separator vessel Check drive train Check oil injection

7.0 Problem Solving

Fault code	Fault	Remedy
13	Overtorque Detection 1 (oL3)	Check inlet valve Check back pressure oil separator vessel Check drive train Check oil injection
14	Overtorque Detection 2 (oL4)	Check inlet valve Check back pressure oil separator vessel Check drive train Check oil injection
15	Dynamic Braking Transistor (rr)	Contact BeaconMedæs
16	Braking Resistor Overheat (rH)	Contact BeaconMedæs
17	External Fault at Input Terminal S3 (EF3)	Check control wiring
18	External Fault at Input Terminal S4 (EF4)	Check control wiring
19	External Fault at Input Terminal S5 (EF5)	Check control wiring
20	External Fault at Input Terminal S6 (EF6)	Check control wiring
21	External Fault at Input Terminal S7 (EF7)	Check control wiring
22	External Fault at Input Terminal S8 (EF8)	Check control wiring
23	Internal Fan Fault (FAn)	Check cooling inverter
24	Overspeed (oS)	Contact BeaconMedæs
25	Speed Deviation (dEv)	Contact BeaconMedæs
26	PG Disconnect (PGo)	Contact BeaconMedæs
27	Input Phase Loss (PF)	Check supply voltage Check input wiring Check EMC filter
28	Output Phase Loss (LF)	Check wiring to motor
29	Motor Overheat (PTC input) (oH3)	Check wiring to motor Check ambient temperatures Check cooling unit Check inlet valve Check back pressure oil separator vessel
30	Digital Operator Connection (oPr)	Contact BeaconMedæs
31	EEPROM Write Error (Err)	Contact BeaconMedæs
32	Motor Overheat (PTC input) (oH4)	Check wiring to motor Check ambient temperatures Check cooling unit Check inlet valve Check back pressure oil separator vessel
33	MEMOBUS/Modbus Communication Error (CE)	Check communication wiring
34	Option Communication Error (bUS)	Contact BeaconMedæs
37	Control Fault (CF)	Contact BeaconMedæs
38	Zero-Servo Fault (SvE)	Contact BeaconMedæs
Fault code	Fault	Remedy

7.0 Problem Solving

39	Option External Fault (EF0)	Contact BeaconMedæs
40	PID Feedback Loss (FbL)	Contact BeaconMedæs
41	Undertorque Detection 1 (UL3)	Contact BeaconMedæs
42	Undertorque Detection 2 (UL4)	Contact BeaconMedæs
43	High Slip Braking Overload (oL7)	Contact BeaconMedæs
48	Hardware Fault (including oFx)	Contact BeaconMedæs
50	Z Pulse Fault (dv1)	Contact BeaconMedæs
51	Z Pulse Noise Fault Detection (dv2)	Contact BeaconMedæs
52	Inversion Detection (dv3)	Contact BeaconMedæs
53	Inversion Prevention Detection (dv4)	Contact BeaconMedæs
54	Output Current Imbalance (LF2)	Check wiring to motor
55	Pullout Detection (Sto)	Contact BeaconMedæs
56	PG Hardware Fault (PGoH)	Contact BeaconMedæs
57	MECHATROLINK Watchdog Timer Error (E5)	Contact BeaconMedæs
59	Too Many Speed Search Restarts (SEr)	Contact BeaconMedæs
65	PID Feedback Loss (FbH)	Contact BeaconMedæs
66	External Fault 1, Input Terminal S1 (EF1)	Contact BeaconMedæs
67	External Fault 2, Input Terminal S2 (EF2)	Contact BeaconMedæs
68	Mechanical Weakening Detection 1 (oL5)	Contact BeaconMedæs
69	Mechanical Weakening Detection 2 (UL5)	Contact BeaconMedæs
70	Current Offset Fault (CoF)	Contact BeaconMedæs
71	PLC Detection Error 1 (PE1)	Contact BeaconMedæs
72	PLC Detection Error 2 (PE2)	Contact BeaconMedæs
73	DriveWorksEZ Fault (dWFL)	Contact BeaconMedæs
74	EEPROM Memory DriveWorksEZ Data Er (dWF1)	Contact BeaconMedæs
77	Output Voltage Detection Fault (voF)	Contact BeaconMedæs
78	Braking Resistor Transistor Fault (rF)	Contact BeaconMedæs
79	Braking Transistor Overload Fault (boL)	Contact BeaconMedæs
80	Motor Overheat (NTC Input) (oH5)	Contact BeaconMedæs
81	LSo Fault (LSo)	Contact BeaconMedæs
82	Node Setup Fault (nSE)	Contact BeaconMedæs
83	Thermistor Disconnect (THo)	Contact BeaconMedæs
91	Initial Polarity Estimation Timeout (dv7)	Contact BeaconMedæs
95	Power Unit Output Phase Loss 3 (LF3)	Contact BeaconMedæs
96	Current Unbalance (UnbC)	Check wiring to motor
97	Power Supply Module Undervoltage (Uv4)	Contact BeaconMedæs
131	A/D Conversion Error (CPF02)	Contact BeaconMedæs
132	PWM Data Fault (CPF03)	Contact BeaconMedæs

7.0 Problem Solving

Fault code	Fault	Remedy
135	EEPROM Memory Data Error (CPF06)	Contact BeaconMedæs
136	Terminal Board Connection Error (CPF07)	Contact BeaconMedæs
137	EEPROM Serial Communication Fault (CPF08)	Contact BeaconMedæs
140	RAM Fault (CPF11)	Contact BeaconMedæs
141	Flash Memory Circuit Exception (CPF12)	Contact BeaconMedæs
142	Watchdog Circuit Exception (CPF13)	Contact BeaconMedæs
143	Control Circuit Fault (CPF14)	Contact BeaconMedæs
145	Clock Fault (CPF16)	Contact BeaconMedæs
146	Timing Fault (CPF17)	Contact BeaconMedæs
147	Control Circuit Fault (CPF18)	Contact BeaconMedæs
148	Control Circuit Fault (CPF19)	Contact BeaconMedæs
149	Hardware Fault at Power Up (CPF20)	Contact BeaconMedæs
150	Hardware Fault at Communication Start Up (CPF21)	Contact BeaconMedæs
151	A/D Conversion Fault (CPF22)	Contact BeaconMedæs
152	PWM Feedback Fault (CPF23)	Contact BeaconMedæs
153	Drive Unit Signal Fault (CPF24)	Contact BeaconMedæs
154	Terminal Board is Not Properly Connected. (CPF25)	Contact BeaconMedæs
155	ASIC BB Circuit Error (CPF26)	Contact BeaconMedæs
156	ASIC PWM Setting Register Error (CPF27)	Contact BeaconMedæs
157	ASIC PWM Pattern Error (CPF28)	Contact BeaconMedæs
158	ASIC On-delay Error (CPF29)	Contact BeaconMedæs
159	ASIC BBON Error (CPF30)	Contact BeaconMedæs
160	ASIC Code Error (CPF31)	Contact BeaconMedæs
161	ASIC Start-up Error (CPF32)	Contact BeaconMedæs
162	Watch-dog Error (CPF33)	Contact BeaconMedæs
163	ASIC Power/Clock Error (CPF34)	Contact BeaconMedæs
164	External A/D Converter Error (CPF35)	Contact BeaconMedæs
169	Control Circuit Error (CPF40)	Contact BeaconMedæs
170	Control Circuit Error (CPF41)	Contact BeaconMedæs
171	Control Circuit Error (CPF42)	Contact BeaconMedæs
172	Control Circuit Error (CPF43)	Contact BeaconMedæs
173	Control Circuit Error (CPF44)	Contact BeaconMedæs
174	Control Circuit Error (CPF45)	Contact BeaconMedæs
257	Option Compatibility Error (oFA00)	Contact BeaconMedæs
258	Option Not Properly Connected (oFA01)	Contact BeaconMedæs
259	Same Type of Option Card Already Connected (oFA02)	Contact BeaconMedæs

7.0 Problem Solving

Fault code	Fault	Remedy
262	A/D Conversion Error (oFA05)	
263	Option Response Error (oFA06)	Contact BeaconMedæs
273	Option RAM Fault (oFA10)	Contact BeaconMedæs
274	Option Operation Mode Fault (SLMOD) (oFA11)	Contact BeaconMedæs
275	Drive Receive CRC Error (oFA12)	Contact BeaconMedæs
276	Drive Receive Frame Error (oFA13)	Contact BeaconMedæs
277	Drive Receive Abort Error (oFA14)	Contact BeaconMedæs
278	Option Receive CRC Error (oFA15)	Contact BeaconMedæs
279	Option Receive Frame Error (oFA16)	Contact BeaconMedæs
280	Option Receive Abort Error (oFA17)	Contact BeaconMedæs
305	Comm. ID Error (oFA30)	Contact BeaconMedæs
306	Model Code Error (oFA31)	Contact BeaconMedæs
307	Sumcheck Error (oFA32)	Contact BeaconMedæs
308	Comm. Option Timeout Waiting for Response (oFA33)	Contact BeaconMedæs
309	MEMOBUS Timeout (oFA34)	Contact BeaconMedæs
310	Drive Timeout Waiting for Response (oFA35)	Contact BeaconMedæs
311	CI Check Error (oFA36)	Contact BeaconMedæs
312	Drive Timeout Waiting for Response (oFA37)	Contact BeaconMedæs
313	Control Command Selection Error (oFA38)	Contact BeaconMedæs
314	Drive Timeout Waiting for Response (oFA39)	Contact BeaconMedæs
315	Control Response Selection 1 Error (oFA40)	Contact BeaconMedæs
316	Drive Timeout Waiting for Response (oFA41)	Contact BeaconMedæs
317	Control Response Selection 2 Error (oFA42)	Contact BeaconMedæs
318	Control Response Selection Error (oFA43)	Contact BeaconMedæs
513	Option Compatibility Error (oFB00)	Contact BeaconMedæs
514	Option Connection Error (oFb01)	Contact BeaconMedæs
515	Same Type of Option Card Already Connected (oFb02)	Contact BeaconMedæs
518	A/D Conversion Error (oFb05)	Contact BeaconMedæs
519	Option Response Error (oFb06)	Contact BeaconMedæs
529	Option RAM Fault (oFb10)	Contact BeaconMedæs
530	Option Operation Mode Fault (SLMOD) (oFb11)	Contact BeaconMedæs
531	Drive Receive CRC Error (oFb12)	Contact BeaconMedæs
532	Drive Receive Frame Error (oFb13)	Contact BeaconMedæs
533	Drive Receive Abort Error (oFb14)	Contact BeaconMedæs
534	Option Receive CRC Error (oFb15)	Contact BeaconMedæs

7.0 Problem Solving

535	Option Receive Frame Error (oFb16)	Contact BeaconMedæs
536	Option Receive Abort Error (oFb17)	Contact BeaconMedæs
Fault code	Fault	Remedy
561	Comm. ID Error (oFb30)	Contact BeaconMedæs
562	Model Code Error (oFb31)	Contact BeaconMedæs
563	Sumcheck Error (oFb32)	Contact BeaconMedæs
564	Comm. option Timeout Waiting for Response (oFb33)	Contact BeaconMedæs
565	MEMOBUS Timeout (oFb34)	Contact BeaconMedæs
566	Drive Timeout Waiting for Response (oFb35)	Contact BeaconMedæs
567	CI Check Error (oFb36)	Contact BeaconMedæs
568	Drive Timeout Waiting for Response (oFb37)	Contact BeaconMedæs
569	Control Command Selection Error (oFb38)	Contact BeaconMedæs
570	Drive Timeout Waiting for Response (oFb39)	Contact BeaconMedæs
571	Control Response Selection 1 Error (oFb40)	Contact BeaconMedæs
572	Drive Timeout Waiting for Response (oFb41)	Contact BeaconMedæs
573	Control Response Selection 2 Error (oFb42)	Contact BeaconMedæs
574	Control Response Selection Error (oFb43)	Contact BeaconMedæs
769	Option Compatibility Error (oFC00)	Contact BeaconMedæs
771	Option Not Properly Connected (oFC01)	Contact BeaconMedæs
772	Same Type of Option Card Already Connected (oFC02)	Contact BeaconMedæs
774	A/D Conversion Error (oFC05)	Contact BeaconMedæs
775	Option Response Error (oFC06)	Contact BeaconMedæs
785	Option RAM Fault (oFC10)	Contact BeaconMedæs
786	Option Operation Mode Fault (SLMOD) (oFC11)	Contact BeaconMedæs
787	Drive Receive CRC Error (oFC12)	Contact BeaconMedæs
788	Drive Receive Frame Error (oFC13)	Contact BeaconMedæs
789	Drive Receive Abort Error (oFC14)	Contact BeaconMedæs
790	Option Receive CRC Error (oFC15)	Contact BeaconMedæs
791	Option Receive Frame Error (oFC16)	Contact BeaconMedæs
792	Option Receive Abort Error (oFC17)	Contact BeaconMedæs
849	Encoder Option AD Conversion Error (oFC50)	Contact BeaconMedæs
850	Encoder Option Analog Circuit Error (oFC51)	Contact BeaconMedæs
851	Encoder Communication Timeout (oFC52)	Contact BeaconMedæs
852	Encoder Communication Data Error (oFC53)	Contact BeaconMedæs
853	Encoder Error (oFC54)	Contact BeaconMedæs
854	Resolver Error (oFC55)	Contact BeaconMedæs

8.0 Technical data

8.1 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. 83°C (181°F) (ambient temperature 20 °C + 63°C)
Discharge pressure	Approx. 1020mbar(a)

8.2 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

"Oil-sealed" Rotary Screw Vacuum Pumps MSV007, MSV010, MSV015, MSV020

8.0 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	Freq.	Secondary voltage autotransformer	Approval	Itot	Itot	Itot	Itot
	V	Hz			A	A	A	A
MSV 007 - 010	380	60		IEC	18,4		20,4	
MSV 007 - 010	400	50		IEC	17,4		19,4	
MSV 007 - 010	460	60		IEC/ CSA/ UL	15,2		16,9	
MSV 007 - 010	200	50	400	IEC	34,9	17,4	38,8	19,4
MSV 007 - 010	230	60	460	CSA/UL	30,3	15,2	33,7	16,9
MSV 007 - 010	500	50	400	IEC	14,0	17,4	15,5	19,4
MSV 007 - 010	575	60	460	CSA/UL	12,1	15,2	13,5	16,9
MSV 015	380	60		IEC	25,2		28,0	
MSV 015	400	50		IEC	23,9		26,6	
MSV 015	460	60		IEC/ CSA/ UL	20,8		23,1	
MSV 015	200	50	400	IEC	47,8	23,9	53,2	26,6
MSV 015	230	60	460	CSA/UL	41,6	20,8	46,2	23,1
MSV 015	500	50	400	IEC	19,1	23,9	21,3	26,6
MSV 015	575	60	460	CSA/UL	16,6	20,8	18,5	23,1
MSV 020	380	60		IEC	35,8		39,8	
MSV 020	400	50		IEC	34,0		37,8	
MSV 020	460	60		IEC/ CSA/ UL	29,6		32,9	
MSV 020	200	50	400	IEC	64,7	32,3	71,8	35,9
MSV 020	230	60	460	CSA/UL	56,2	28,1	62,5	31,2
MSV 020	500	50	400	IEC	25,9	32,3	28,7	35,9
MSV 020	575	60	460	CSA/UL	22,5	28,1	25,0	31,2

"Oil-sealed" Rotary Screw Vacuum Pumps MSV007, MSV010, MSV015, MSV020

8.0 Technical data

Pump	Voltage	Freq.	Max. fuse pack		Supply cables	
			IEC class gL/gC	UL class K5 CSA HRC from ii	Wire ends	Recommended cable size
			A	A		mm ² (P/FF)
MSV 007 - 010	380	60	20	20	end sockets	4
MSV 007 - 010	400	50	20	20	end sockets	4
MSV 007 - 010	460	60	20	20	end sockets	4
MSV 007 - 010	200	50	40	40	end sockets	16
MSV 007 - 010	230	60	35	35	end sockets	10
MSV 007 - 010	500	50	15	15	end sockets	2,5
MSV 007 - 010	575	60	15	15	end sockets	2,5
MSV 015	380	60	32	30	end sockets	6
MSV 015	400	50	32	30	end sockets	6
MSV 015	460	60	25	25	end sockets	6
MSV 015	200	50	63	60	end sockets	25
MSV 015	230	60	50	50	end sockets	16
MSV 015	500	50	25	25	end sockets	4
MSV 015	575	60	20	20	end sockets	4
MSV 020	380	60	40	40	end sockets	10
MSV 020	400	50	40	40	end sockets	10
MSV 020	460	60	35	35	end sockets	10
MSV 020	200	50	80	80	end sockets	35
MSV 020	230	60	80	70	end sockets	25
MSV 020	500	50	32	30	end sockets	10
MSV 020	575	60	32	30	end sockets	6

I: current in the supply lines at maximum load and nominal voltage
Setting for circuit breakers

Q1	1A
Q15	0.6A

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.

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.

8.0 Technical data

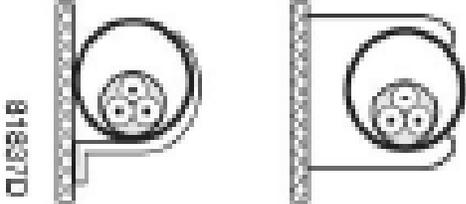
Earthing

The earthing cable connected to the vacuum pump (PE) should be minimum 10 mm² (according to EN 60204-1 section 828).

Cable sizing according IEC

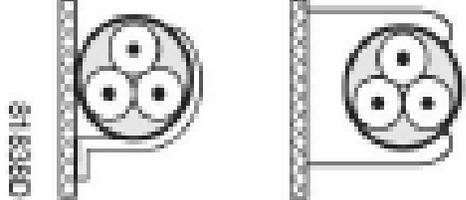
The tables below indicate the current carrying capacities of cables for 3 commonly used installation methods, calculated according to standard 60364-5-52 - electrical installations of buildings part 5 - selection and erection equipment and section 52 - current carrying capacities in wiring systems.

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

	<p>Installation method B2 according to table B.52.1. Multi-core cable in conduit on a wooden wall.</p>
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Maximum allowed current in function of the ambient temperature for installation method B2

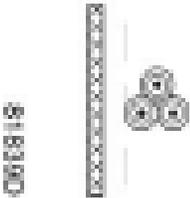
Cable section	Ambient temperature				
	30°C	40 °C	45 °C	50 °C	55 °C
4 mm ²	< 27 A	< 23 A	< 21 A	< 19 A	< 16 A
6 mm ²	< 34 A	< 30 A	< 27 A	< 24 A	< 21 A
10 mm ²	< 46 A	< 40 A	< 36 A	< 33 A	< 28 A
16 mm ²	< 62 A	< 54 A	< 49 A	< 44 A	< 38 A
25 mm ²	< 80 A	< 70 A	< 63 A	< 57 A	< 49 A
35 mm ²	< 99 A	< 86 A	< 78 A	< 70 A	< 60 A
50 mm ²	< 118 A	< 103 A	< 93 A	< 84 A	< 72 A
70 mm ²	< 149 A	< 130 A	< 118 A	< 106 A	< 91 A
95 mm ²	< 179 A	< 156 A	< 141 A	< 127 A	< 109 A
120 mm ²	< 206 A	< 179 A	< 163 A	< 146 A	< 126 A

	<p>Installation method C according to table B.52.1. Single-core or multi-core cable on a wooden wall.</p>
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8.0 Technical data

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

Cable section	Ambient temperature				
	30°C	40 °C	45 °C	50 °C	55 °C
4 mm ²	< 32 A	< 28 A	< 25 A	< 23 A	< 20 A
6 mm ²	< 41 A	< 36 A	< 32 A	< 29 A	< 25 A
10 mm ²	< 57 A	< 50 A	< 45 A	< 40 A	< 35 A
16 mm ²	< 76 A	< 66 A	< 60 A	< 54 A	< 46 A
25 mm ²	< 96 A	< 84 A	< 76 A	< 68 A	< 59 A
35 mm ²	< 119 A	< 104 A	< 94 A	< 84 A	< 73 A
50 mm ²	< 144 A	< 125 A	< 114 A	< 102 A	< 88 A
70 mm ²	< 184 A	< 160 A	< 145 A	< 131 A	< 112 A
95 mm ²	< 223 A	< 194 A	< 176 A	< 158 A	< 136 A
120 mm ²	< 259 A	< 225 A	< 205 A	< 184 A	< 158 A

	<p>Installation method F according table B.52.1. Single-core cables, touching in free air Clearance to wall not less than one cable diameter.</p>
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Maximum allowed current in function of the ambient temperature for installation method F.

Cable section	Ambient temperature				
	30°C	40 °C	45 °C	50 °C	55 °C
25 mm ²	< 110 A	< 96 A	< 87 A	< 78 A	< 67 A
35 mm ²	< 137 A	< 119 A	< 108 A	< 97 A	< 84 A
50 mm ²	< 167 A	< 145 A	< 132 A	< 119 A	< 102 A
70 mm ²	< 216 A	< 188 A	< 171 A	< 153 A	< 132 A
95 mm ²	< 264 A	< 230 A	< 209 A	< 187 A	< 161 A
120 mm ²	< 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 (I_{tot} from the tables)
 - Install the prescribed fuse on each cable

8.0 Technical data

- Parallel supply cable (2 x 3 phases + PE - configuration (2)):
 - Add 10% to the total vacuum pump current (I_{tot} from the tables) and divide by 2
 - Multiply the ampacity of the cables with 0.8 (see table A.52.17 (52-E1))
 - Install fuses of half the size of the recommended maximum fuse size on each cable.
 - Install fuses of half the size of the recommended maximum fuse size on each cable.
- Add 10% to the total vacuum pump current (I_{tot} 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: $I_{tot} = 89$ A, maximum ambient temperature is 45 °C, recommended fuse = 100 A

- Single supply cables (3 phases + PE - configuration (1)):

- $I = 89 \text{ A} + 10\% = 89 \times 1.1 = 97.9 \text{ A}$
- 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)):

- $I = (89 \text{ A} + 10\%)/2 = (89 \times 1.1)/2 = 49 \text{ A}$
- 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 of kcmil	Maximum current
10	< 30 A
8	< 50 A
6	< 65 A
4	< 85 A
3	< 100 A
2	< 115A
1	< 130 A
1/0	< 150 A
2/0	< 175 A
3/0	< 200 A

8.0 Technical data

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: $I_{tot} = 128$ A, maximum ambient temperature is 45 °C, recommended fuse = 150 A

- Single supply cables (3 phases + 1 PE - configuration (1)):
 - $I = 128 \text{ A} + 25 \% = 128 \times 1.25 = 160 \text{ A}$
 - 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)):
 - $I = (128 \text{ A} + 25\%)/2 = (128 \times 1.25)/2 = 80 \text{ A}$
 - For a AWG4, the maximum current is $85 \text{ A} \times 0.8 = 68 \text{ A}$, which is insufficient. For an AWG3, the maximum current is $100 \times 0.8 = 80 \text{ A}$. So 2 parallel cables of 3 x AWG3 + 2 x AWG8 are sufficient.
 - Install 80 A fuses on each cable.

8.0 Technical data

8.3 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	°C	0
	°F	32
Maximum ambient temperature	°C	46
	°F	115
Minimum allowable inlet temperature	°C	-10
	°F	14
Maximum allowable inlet temperature	°C	70
	°F	158
Maximum inlet pressure	mbar(a)	1050
	Psi	0.73
Maximum vessel pressure	mbar(a)	1500
	Psi	7.3

8.0 Technical data

8.4 Vacuum pump data

Reference conditions

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

GHS 350 VSD+

Maximum inlet pressure for water vapor	mbar(a)	43
	Torr	32
Maximum water vapor pumping rate	kg/h	12.8
	lb/h	28.2
Nominal motor power	kW	5.5
	HP	7.5
Maximum motor shaft speed	Rpm	3500
	Rpm	600
Oil capacity	L	16
	US GAL	4.2
	Imp. GAL	3.5
	cu. ft.	0.57
Sound pressure level (according to ISO 2151 (2004))	dB(A)	65 (+/-3)

“Oil-sealed” Rotary Screw Vacuum Pumps MSV007, MSV010, MSV015, MSV020

8.0 Technical data

MSV 007 (option high water handling capacity)

Maximum inlet pressure for water vapor	mbar(a)	648
	Torr	486
Maximum water vapor pumping rate	kg/h	192
	lb/h	423
Nominal motor power	kW	5.5
	HP	7.5
Maximum motor shaft speed	Rpm	3500
	Rpm	600
Oil capacity	L	16
	US GAL	4.2
	Imp. GAL	3.5
	cu. ft.	0.57
Sound pressure level (according to ISO 2151 (2004))		65

MSV 010

Maximum inlet pressure for water vapor	mbar(a)	35
	Torr	26
Maximum water vapor pumping rate	kg/h	12.8
	lb/h	28.2
Nominal motor power	kW	7.5
	HP	10
Maximum motor shaft speed	Rpm	4500
Minimum motor shaft speed	Rpm	600
Oil capacity	L	16
	US GAL	4.2
	Imp. GAL	3.5
	cu. ft.	0.57
Sound pressure level (according to ISO 2151 (2004))		68

“Oil-sealed” Rotary Screw Vacuum Pumps MSV007, MSV010, MSV015, MSV020

8.0 Technical data

MSV 015 (option high water handling capacity)

Maximum inlet pressure for water vapor	mbar(a)	520
	Torr	390
Maximum water vapor pumping rate	kg/h	192
	lb/h	423
Nominal motor power	kW	7.5
	HP	10
Maximum motor shaft speed	Rpm	4500
Minimum motor shaft speed	Rpm	600
Oil capacity	L	16
	US GAL	4.2
	Imp. GAL	3.5
	cu. ft.	0.57
Sound pressure level (according to ISO 2151 (2004))		68

MSV 020

Maximum inlet pressure for water vapor	mbar(a)	27
	Torr	20
Maximum water vapor pumping rate	kg/h	12.8
	lb/h	28.2
Nominal motor power	kW	11
	HP	15
Maximum motor shaft speed	Rpm	6000
Minimum motor shaft speed	Rpm	600
Oil capacity	L	16
	US GAL	4.2
	Imp. GAL	3.5
	cu. ft.	0.57
Sound pressure level (according to ISO 2151 (2004))		73

“Oil-sealed” Rotary Screw Vacuum Pumps MSV007, MSV010, MSV015, MSV020

8.0 Technical data

MSV 015 (option high water handling capacity)

Maximum inlet pressure for water vapor	mbar(a)	399
	Torr	299
Maximum water vapor pumping rate	kg/h	192
	lb/h	423
Nominal motor power	kW	11
	HP	15
Maximum motor shaft speed	Rpm	6000
Minimum motor shaft speed	Rpm	600
Oil capacity	L	16
	US GAL	4.2
	Imp. GAL	3.5
	cu. ft.	0.57
Sound pressure level (according to ISO 2151 (2004))		73

MSV 020

Maximum inlet pressure for water vapor	mbar(a)	24
	Torr	18
Maximum water vapor pumping rate	kg/h	12.8
	lb/h	28.2
Nominal motor power	kW	15
	HP	20
Maximum motor shaft speed	Rpm	7000
Minimum motor shaft speed	Rpm	600
Oil capacity	L	16
	US GAL	4.2
	Imp. GAL	3.5
	cu. ft.	0.57
Sound pressure level (according to ISO 2151 (2004))		76

8.0 Technical data

MSV 020 (option high water handling capacity)

Maximum inlet pressure for water vapor	mbar(a)	353
	Torr	264
Maximum water vapor pumping rate	kg/h	192
	lb/h	423
Nominal motor power	kW	15
	HP	20
Maximum motor shaft speed	Rpm	7000
Minimum motor shaft speed	Rpm	600
Oil capacity	L	16
	US GAL	4.2
	Imp. GAL	3.5
	cu. ft.	0.57
Sound pressure level (according to ISO 2151 (2004))		76

8.0 Technical data

8.5 Technical data Elektronikon® controller

General

Supply voltage	24V AC/16 VA 50/60Hz (+40%/-30%) 24V DC/0.7 A
Type of protection	IP54 (front)
	IP21 (back)
Ambient and temperature condition	IEC60068-2
Operating temperature range	10°C.....+60°C (14°F.....140°F)
Storage temperature range	30°C.....+70°C (-22°F.....158°F)
Permissible humidity	Relative humidity 90% 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.
	30 V DC/10 A Max.

Digital outputs

Number of outputs	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)

9.0 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.

10.0 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.

11.0 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 EN 1012 - 2	
d	Electromagnetic compatibility 2004/108/EC	EN 61000-6-2 EN 61000-6-4	
e	Low voltage equipment 2006/95/EC	EN 60034 EN 60204-1 EN 60439	
i	Ecodesign, energy-using products Ecodesign, energy-related products 2005/32/EC 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 Conformity of the specification
 11 to the directives

12

Conformity of the products to
 the specification and by implication
 to the directives

13 Issued by

Engineering
 Manufacturing

14 Name

15 Signature

16 Date

11.0 Declaration of conformity

Typical example of a Declaration of Conformity document

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

Telephone: + 44(0) 1246 474242

www.beaconmedaes.com

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

NFPA Standard:

1059 Paragon Way, Rock Hill, SC 29730

(888) 4-MEDGAS (888) 463-3427

HTM/ISO Standard:

Telford Crescent, Staveley, Derbyshire, S43 3 PF

Telephone: + 44(0)1246.474.242

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