



Z MED

Medical Air System

MAN01-057
Rev.01
12/04/2014



BEACONMEDÆS[®]

Installation, Operation and Maintenance Manual

Z-MED Medical Air Systems W/Central Controller (ZR/ZT Systems)

This unit 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:

BeaconMedæs

1800 Overview Drive
Rock Hill, SC 29730

Tech. Services 1-888-4MEDGAS (1-888-463-3427)
Fax: (803) 817-5750

BeaconMedæs reserves the right to make changes and improvements to update products sold previously and support materials without notice or obligation.

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Safety Precautions

Pressurized air from the system may cause personnel injury or property damage if the unit is improperly operated or maintained.

Operator should have carefully read and become familiar with the contents of this manual before installing, wiring, starting, operating, adjusting and maintaining the system.

Operator is expected to use common sense safety precautions, good workmanship practices and follow any related local safety precautions.

In addition:

- **Before starting any installation or maintenance procedures, disconnect all power to the package.**
- All electrical procedures must be in compliance with all national, state and local codes and requirements.
- A certified electrician should connect all wiring.
- Refer to the electrical wiring diagram provided with the unit before starting any installation or maintenance work.
- Release all pressure from the package before removing, loosening, or servicing any covers, guards, fittings, connections, or other devices.
- Notify appropriate hospital personnel if repairs or maintenance will affect available Medical Air levels.
- Prior to using the Desiccant Dryer System, the medical facility must have a Certifier perform all installation tests as specified in NFPA 99. The medical facility is also responsible for ensuring that the Medical Air meets the minimum requirements as specified in NFPA 99.
- To prevent automatic starting, disconnect all electrical power before performing any maintenance.
- Make sure that all loose articles, packing material, and tools are clear of the package.
- Check all safety devices periodically for proper operation.
- Electrical service must be the same as specified on the control panel nameplate or damage to the equipment may occur.
- Vibration during shipment can loosen electrical terminals, fuse inserts, and mechanical connections. Tighten as necessary.

1.0 General Information

CAUTION: This manual is designed to serve as the operation and maintenance guide for your Z-MED Medical Air System. The contents of this manual should be carefully read BEFORE attempting any phase of operation or maintenance. Failure to follow the operating and maintenance procedures of the instruction manual could result in personal injury or property damage.

All information, specifications and illustrations within this manual are those in effect at the time of printing. The manufacturer reserves the right to change or make improvements without notice and without incurring any obligation to make changes or add improvements to products previously sold.

When requesting information, service, ordering of spare parts, etc., please reference all information supplied on the serial number plate located on the side panel of the Central Control System.

To facilitate maintenance, recommended spare parts for your specific Z-MED model are available. Failure to maintain recommended spare parts and filter cartridges might result in expensive and unnecessary downtime for which the manufacturer cannot be responsible. To request a quotation, or place an order for recommended or emergency spare parts, please contact **BeaconMedaes** Technical Services department at 1-888-4MEDGAS (888-463-3427).

1.1 Modular System Standard Components

System Design

The modular Z-MED Medical Air system consists of compressor modules (duplexed or multiplexed), a dryer/control module, and an air receiver module. Each module is fully compliant with NFPA 99.

Compressor Module

The compressor modules are fully enclosed with sound attenuated steel panels with full access doors for maintenance and inspection. Each compressor module includes the compressor, drive motor with starter, oil system, and a compressor control system. The compressor intake is equipped with an air intake filter and integral shutoff/unloading valve. Unloading is carried out by closing the intake valve. Loading or unloading of the unit is controlled by a pressure transducer which will actuate the loading solenoid valve. The air discharge for the compressor module has a pulsation damper, check valve and manual isolation valve. The control system will display the runtime hours, temperature readouts, pressure readouts, service indicators, safety warnings and safety shutdowns for the compressor module.

ZR Compressor Drive and Motor

The compressor is a two-stage, oil-free compressor block, consisting of separate low and high pressure rotary tooth compressor elements flanged to a common step-up gearbox. The high and low compressor elements are supplied with safety relief valves. ZR compressors have a water-cooled oil cooler, intercooler and aftercooler. The first stage air is cooled by an intercooler with moisture trap and automatic drain valve. The second stage air is cooled by an aftercooler with moisture trap with manual and automatic drain valve. The gearbox oil system includes an oil sump, pump, oil filter, bypass valve, drain connection, sight-glass and cooler.

1.0 General Information

1.1 Modular System Standard Components (continued)

ZT Compressor Drive and Motor

The compressor is a two-stage, oil-free compressor block, consisting of separate low and high pressure rotary tooth compressor elements flanged to a common step-up gearbox. The compressor elements are air cooled. The high and low compressor elements are supplied with safety relief valves. ZT compressors are provided with an air-cooled oil cooler, intercooler and aftercooler. An electric motor-driven fan generates the cooling air. The first stage air is cooled by an intercooler with moisture trap and automatic drain valve. The second stage air is cooled by an aftercooler with moisture trap with manual and automatic drain valve. The gearbox oil system includes an oil sump, pump, oil filter, bypass valve, drain connection, sight-glass and cooler.

Intake Piping

The compressor has a factory piped intake with one "hospital type" inlet air filter with flanged connection for remote air intake. The inlet filter removes dust from the incoming air through cyclonic action and through an element. A stainless steel intake flex connector with flanges ships loose.

Discharge Piping

Each compressor module is equipped with an integral air-cooled aftercooler, complete with moisture separator and timed automatic solenoid drain valve. The compressor discharge line includes an external flex connector, internal safety relief valve and check valve. The external flex connector is braided stainless steel, type 304. For ZR watercooled systems, a water shut-off valve ships loose.

Isolation System

The compressor and motor shall be fully isolated from the main compressor module base by means of a heavy isolation system for a minimum of 95% isolation efficiency.

Dryer/Control Module

The dryer/control module shall include a central control system to control multiple compressors and a duplexed desiccant drying system with dew point hygrometer/ CO transmitters. Each dryer includes inlet filters, final line filters and regulator. All of the above shall be factory piped and wired in accordance with NFPA 99 and include valving to allow complete air receiver bypass, and air sampling port.

Dryer/Filter/Regulator System

Each desiccant dryer must be individually sized for peak calculated demand and capable of producing a -40° F (-40° C) pressure dew point. Dryer purge flow shall be minimized through an integral demand based purge saving control system. The inlet to each dryer shall include a 1 micron coalescing filter and a .01 micron high efficiency coalescing filter with automatic drains. The duplexed final line filters consist of a 1 micron particulate filter and one active carbon filter, duplexed final line regulators, single oil indicator and duplexed safety relief valves shall be factory mounted and piped. All filters shall have element change indicators.

1.0 General Information

1.1 Modular System Standard Components (continued)

Central Control System

The mounted and wired central control system shall be NEMA 12, U.L. labeled and rated for 115V single phase electrical service. The control system shall provide automatic lead/lag sequencing, visual and audible reserve unit alarm with isolated contacts for remote alarm. Automatic alternation of all compressors based on a first-on/first-off principle with provisions for simultaneous operation if required, automatic activation of reserve unit if required, visual and audible alarm indication for high discharge air temperature shutdown with isolated contacts for remote alarm shall be included.

Dew Point/ CO Transmitters

The dryer/control module shall incorporate a dew point and a CO transmitter that are mounted, pre-piped, and wired. Dew point and CO conditions will be displayed on the central control system. The dewpoint transmitter probe shall be the ceramic type sensor. The system accuracy shall be a minimum of $\pm 2^{\circ}\text{C}$ for dew point and $\pm 2\text{ PPM}$ (at 10 PPM) for carbon monoxide. Dew point alarm shall be factory set at 36°F (2°C) per NFPA 99, and the CO alarm shall be factory set at 10 PPM. Both set points shall be field adjustable. High CO and high dew point conditions shall be indicated with visual and audible alarms.

Air Receiver Module

The vertical air receiver shall be ASME Coded, National Board Certified, galvanized, rated for a minimum 150 PSIG design pressure and include a liquid level sight glass, pressure gauge, safety relief valve, manual drain valve and a automatic solenoid drain valve. “ZR” water cooled systems will include a high level condensate sensor.

2.0 Installation

2.1 Inspection Upon Receiving

The condition of the Z-MED Medical Air system should be carefully inspected upon delivery. Any indication of damage by the carrier should be noted on the delivery receipt, especially if the system will not be immediately uncrated and installed. Z-MED modules may remain in their shipping containers until ready to be installed. If any of the modules are to be stored prior to installation, they must be protected from the elements to prevent rust and deterioration.

DO NOT REMOVE the protective covers from the inlet and discharge connection ports of the modules until they are ready for connecting to the hospital's pipeline distribution system.

2.2 Handling

!!WARNING!!
USE APPROPRIATE LOAD RATED LIFTING EQUIPMENT AND OBSERVE SAFE LIFTING PROCEDURES DURING ALL MOVES.

The Z-MED modules can be moved with either a forklift or a standard pallet jack. The compressor can be moved by a forklift using the slots in the frame. Make sure that the forks protrude from the other side of the frame. The compressor 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 parallel to the bodywork by chain spreaders in order not to damage the compressor. The lifting equipment must be placed in such a way that the compressor will be lifted perpendicularly. Lift smoothly and avoid twisting. Keep all packing in place around the dew point/CO transmitters during installation to minimize damaging the transmitters. Walk along the route the unit must travel and note dimensions of doorways and low ceilings. All equipment should be positioned to ensure easy access to all four sides to perform routine maintenance and allow high visibility of indicators and gauges.

2.3 Location

The Z-MED system should be installed indoors in a clean, well-ventilated environment. Areas of excessive dust, dirt or other air-borne particulate should be avoided.

Secure the package to a flat, level surface capable of supporting the weight and forces of the unit. Make sure that the main bases are not bowed, twisted, or uneven. **No special foundation is required.** However, all main bases must be securely bolted using all mounting holes provided in the bases. If a raised concrete pad is used, the bases must not overhang the concrete pad. A method to drain away moisture is necessary. If a gravity drain is not available, a connection to a drain is necessary.

The area should have a minimum ambient temperature of 40°F (4.4°C) and a maximum ambient temperature of 105°F (40°C).

2.0 Installation

2.4 Space Requirements

Compressor units should be placed to ensure easy access to perform maintenance and high visibility of indicators and gauges. It is recommended that a minimum space of 48” be allowed on all sides of the compressors for maintenance. Dryer and Air Receivers require a minimum of 24” on all sides for maintenance. A vertical distance of 48” is required above all the equipment.

2.5 Piping

2.5.1 System Intake Piping

Each compressor unit is supplied with a 3” flanged inlet connection. The air intake line is typically piped to the outside of the building in accordance with NFPA 99. In this case the outside pipe must be turned down and screened to prevent contamination. To ensure that no restrictions of air flow will occur, size the intake piping according to the chart located on the Piping & Electrical Installation Drawing supplied with the system. All piping must be pre-cleaned for medical gas use. In hot, humid areas, using the building’s air-conditioned supply (per NFPA 99) may improve operation conditions of the system.

WARNING!
THE AIR INTAKE MUST BE PLACED IN AN AREA FREE FROM TOXIC OR HAZARDOUS CONTAMINATES: IT MUST BE KEPT AWAY FROM “ETO” GAS EXHAUST VENTS, VACUUM EXHAUST VENTS, AREAS CLOSE TO AUTOMOTIVE EXHAUSTS, ETC., IN ACCORDANCE WITH NFPA 99.

2.5.2 System interconnecting Piping

Refer to the Piping & Electrical Installation Drawing for interconnecting piping arrangement between the compressors, desiccant dryer and air receiver. Pipe materials and interconnecting pipe sizes are specified on this drawing. Flex lines are provided for field installation at the discharge point of each compressor units only.

2.5.3 System Discharge Piping

In all cases, the minimum discharge piping size out to the hospital should match or be greater than the dryer discharge connection.

2.0 Installation

2.6 Wiring

WARNING!
BE SURE TO DISCONNECT ALL ELECTRICAL POWER FROM THE DRYER BEFORE PERFORMING ANY ELECTRICAL PROCEDURES.

Refer to the electrical diagram provided with the unit before starting any installation or maintenance work.

Do not operate the Central Control System or Compressor units on a voltage other than the voltage specified on the control panel/equipment nameplate.

All customer wiring should be in compliance with the National Electrical Code and any other applicable state or local codes.

WARNING!
ELECTRICAL POWER FOR THE CENTRAL CONTROL SYSTEM MUST BE SUPPLIED FROM THE EQUIPMENT SYSTEM BRANCH OF THE ESSENTIAL ELECTRICAL DISTRIBUTION

2.6 Wiring

Check the control voltage, phase, and amp ratings before starting the electrical installation, and make sure the voltage supplied by the hospital is the same. The wire size should also be able to handle peak motor amp load of all operating units, refer to full load and compressor system amperes on the wiring diagram.

Check all electrical connections within the Z-MED Medical Air System that may have loosened during shipment.

Qualified electricians only should make power connections to the control panel and any interconnecting wiring.

Ensure that the emergency generation system electrical supply is consistent with the air system's requirements to allow for correct operation of the Z-MED Medical Air System at all times.

2.0 Installation

2.7 CAN Network Connection

For each compressor a connection channel is provided. Six connection channels can be selected, configured and used to connect compressors to the Central Control System. The connections between the Central Control System and compressors are through a Controller Area Network (CAN). This network allows all the compressors and controller in a system to be connected to one another using a single 3 core cable, which is daisy chained from one device to the next. The CAN network acts as a universal communication system which can be used for both control and monitoring. (See Fig 2.7)

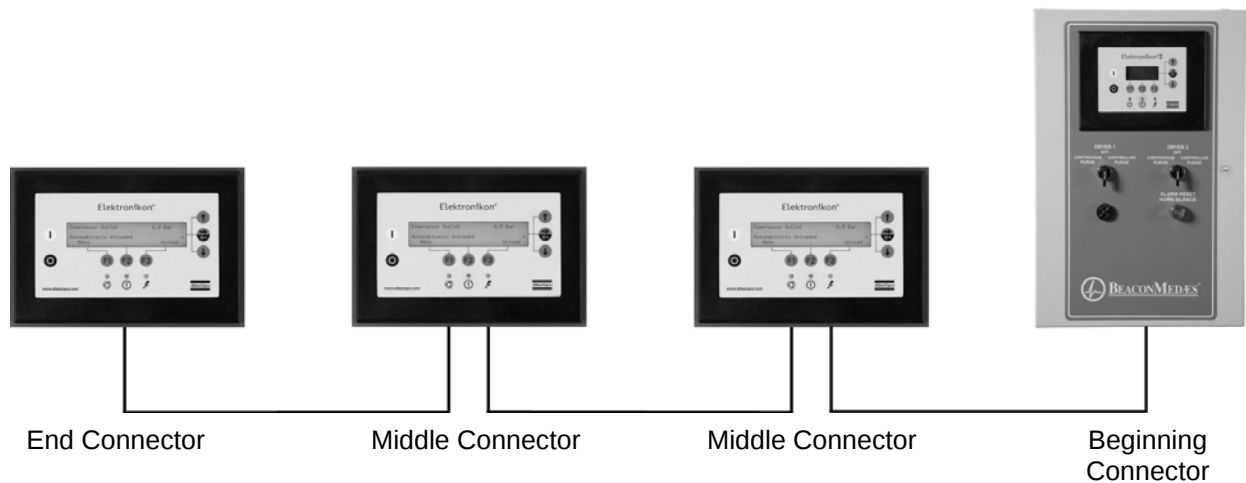


FIG. 2.7 CAN Network Connection Method

2.7.1 CAN Connections

For connections that are connected over CAN, appropriate Node ID addresses must be used. Only the LAN addresses 1 up to 6 can be used. On each compressor, the correct Node ID must be set depending on the connection channel.

Connection channel 1	Node ID1
Connection channel 2	NodeID2
Connection channel 6	Node ID 6
Central Controller	Node ID 30

2.0 Installation

2.8. CAN Cable Connectors

Two types of connectors are used; normal node and service node (See FIG 2.8. Can Connectors). A service node can be used on the device where a computer can be connected. It allows the connection of another device without disconnecting any other device. There can be as many service points as needed, but only one can be connected to a PC at any time. The recommended location for the service node is in the central controller cabinet.



FIG. 2.8. CAN Connectors



FIG 2.8a. Service CAN Connector

2.0 Installation

2.8. CAN Cable Connectors (continued)

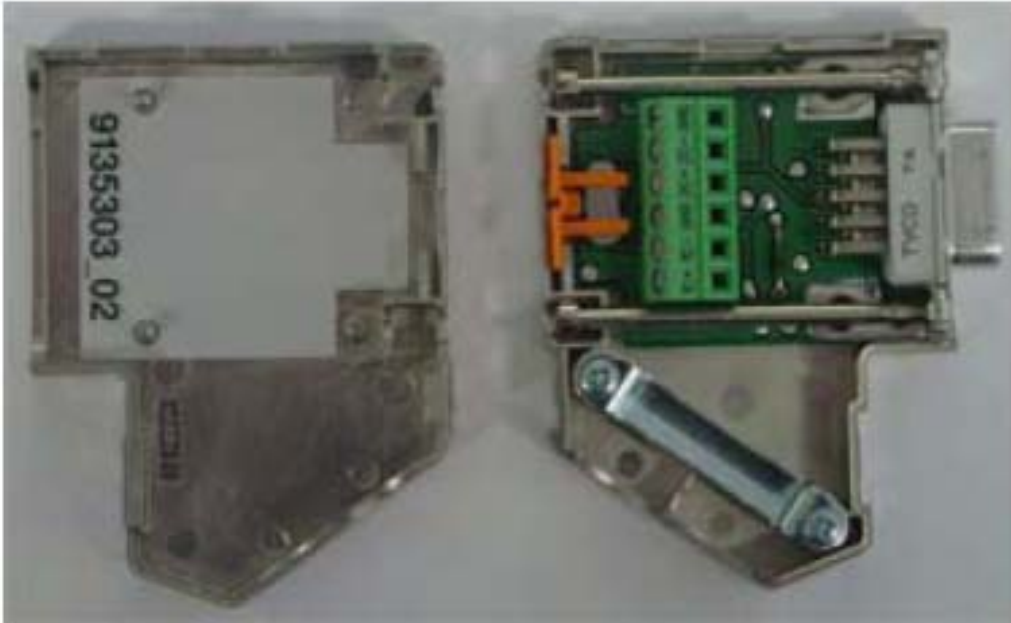


FIG. 2.8b. Normal CAN Connector

A.2.8.1. Cable

The CAN cable (1 pair + ground) should be used to connect the machines and controller together. This cable has been fully tested and qualified for use with **BeaconMedaes** equipment and as such is the only CAN cable **BeaconMedaes** recommends

This cable is in accordance with ISO 11898 and allows network segments of maximum 250 meters. A total network length of 500 meters is possible, but then a repeater has to be used. Contact **BeaconMedaes** Technical Services department at 1-888-4MEDGAS (1-888-463-3427) for network lengths over 250m

2.8.2. Connector Cabling Procedure

Prepare the end of each cable (See FIG. 2.8.2. CAN Cable Preparation) for the CAN connector by removing either 1-3/4”(45mm) or 2-3/8”(60mm) of the cable insulation, depending on whether the cable is incoming or outgoing. Next, remove the plastic foil, leaving 3/8”(10mm) of cable shielding. Then remove the fill-up material and the white/blue conductor. Finally, remove 3/16”(5mm) of insulation from the blue, orange and white/orange conductors.

2.0 Installation

2.8.2. Connector Cabling Procedure (continued)

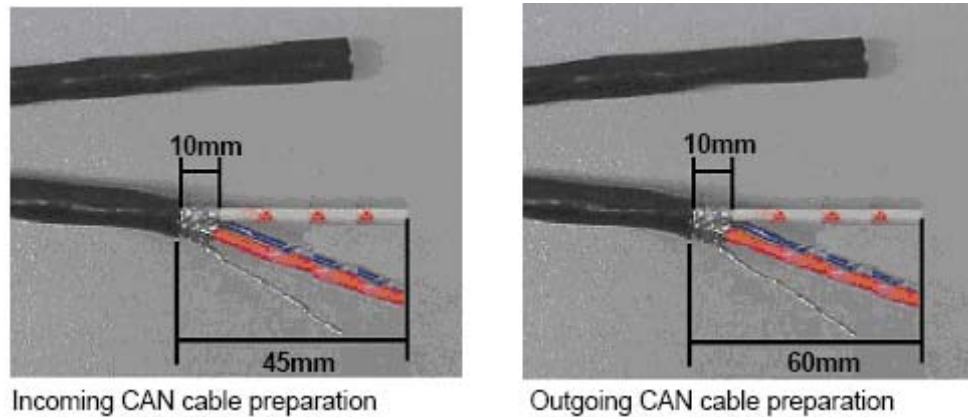


FIG. 2.8.2. CAN Cable Preparation

2.8.3 Terminal Connector Cabling

For the connector at the beginning and end of the network, the cable should be connected to the terminals designated 1C-, 1C+ and GND, as shown in FIG 2.8.3. Beginning/End Connector Wiring. Make sure that the wire shielding touches the shielding plate of the connector. Close the connector and set the terminating switch to “ON” (FIG 2.8.3a. Connector Switch Setting). The CAN wires should be connected inside the CAN connector as follows:

- Blue wire to terminal GND
- White/Orange wire to terminal 1C-
- Orange wire to terminal 1C+

The switch on the back of the connector should be in the “ON” position for connectors at the beginning and end of the network (See FIG 2.8.5 Connector Switch Setting). Plug the connector into the LAN port on the back of the Elektronikon controller.

Important: Be absolutely sure that the cable is connected to the correct terminals inside the start and end connectors. Failure to do this will prevent the network from functioning properly and the start and/or end machines will not be connected to the network.

2.0 Installation

2.8.3. Terminal Connector Cabling (continued)



FIG. 2.8.3. Beginning/End Wiring Connection



FIG. 2.8.3a. Connector Switch Setting

2.0 Installation

2.8.4 Node Connector Cabling

For the connectors in the middle of the network, connect the wires as follows (See FIG. 2.8.4 Middle Wiring Connections):

Incoming Wire

- Blue wires to terminal GND
- White/Orange wires to terminal 1C-
- Orange wires to terminal 1C+

Outgoing wire

- Blue wires to terminal GND
- White/Orange wires to terminal 2C-
- Orange wires to terminal 2C+

Make sure that the wire shielding touches the shielding plate of the connector. Close the connectors and set the terminating switch “OFF” (See FIG. 2.8.4a. Connector Switch Setting) Plug the connector into the LAN port on the back of the Elektronikon controller.



FIG. 2.8.4. Middle Wiring Connections

2.0 Installation

2.8.4 Node Connector Cabling (continued)

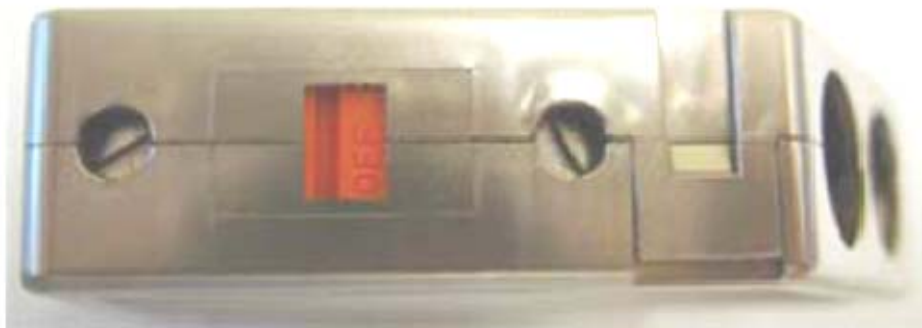


FIG. 2.8.4a. Connector Switch Setting

2.8.5 Line Terminations

Correctly “terminating” the CAN network is important for a properly functioning network. This is done by inserting so-called line termination resistors at the beginning and at the end of the network cable. In the connectors as specified in FIG 2.8.5, this termination function is included and can be set by means of a small terminator switch. Make sure this switch is in the “ON” position for both the first and last device, and in the “OFF” position for all other devices. Both connector types are equipped with this switch.

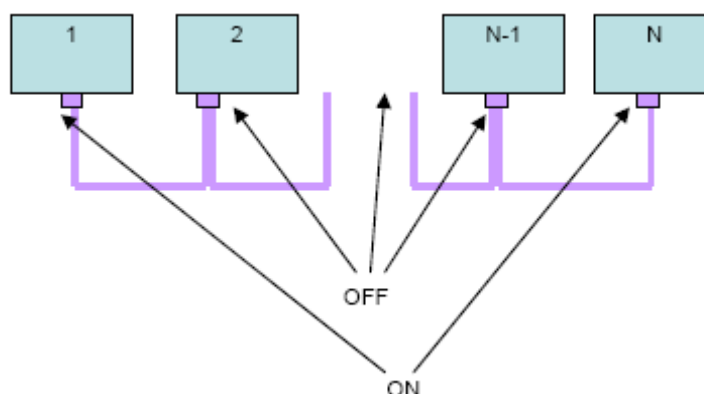


FIG. 2.8.5. Connector Switch Setting

2.9. Parts List

Description	Part No.	Qty Required
Normal Connector	1088001728	Each
Service Connector	1088001727	Each
Cable	0017261013	Per meter

3.0 System Operation

3.1 Prestart-up

The contractor should notify **BeaconMedaes** two weeks prior to start-up date to schedule an appointment for an authorized technician to review the installation prior to start-up.

CAUTION: Failure to install the unit properly and have a **BeaconMedaes** authorized technician start-up the system can void the manufacturer's warranties.

WARNING!
FOR PRE-STARTUP AND STARTUP PROCEDURES FOR THE COMPRESSOR UNITS, REFER TO THE INDIVIDUAL MANUALS SUPPLIED SEPERATELY WITH THOSE UNITS.

Prestart-up and start-up procedures should be performed for a new installation or when major maintenance has been performed.

WARNING!
PRIOR TO PUTTING THE Z-MED MEDICAL AIR SYSTEM INTO USE, THE MEDICAL FACILITY MUST HAVE A CERTIFIER PERFORM ALL INSTALLATION TESTS AS SPECIFIED IN NFPA 99. THE MEDICAL FACILITY IS ALSO RESPONSIBLE FOR ENSURING THAT THE SYSTEM MEETS THE MINIMUM REQUIREMENTS AS SPECIFIED IN NFPA 99.

WARNING!
HAVE MORE THAN ONE PERSON ON HAND DURING PRE-STARTUP AND STARTUP PROCEDURES TO ENSURE OPERATORS SAFETY AND TO FACILITATE CERTAIN CHECKS.

The main power source to the control panel should be "OFF" for the duration of the visual inspection.

Ensure that the equipment is installed on a solid level surface. Walk around the system to ensure that there is enough clearance on all sides to perform operational checks and maintenance.

Check all piping system joints that might have come loose during shipment and installation to ensure they are tight.

Check all of the compressors, dryers, air receiver and control panels for damage.

Check all valves for full open and full close travel. Ensure that the systems valves are positioned for proper operation. (Refer to labeling on valve handles.)

Check the Central Control System cabinet on the Dryer Module.

Verify electrical service. Before starting the Z-MED Medical Air System, check to see that voltage, amperage, and wire size are appropriate.

3.0 System Operation

CAUTION: Electrical service must be as specified or damage to equipment may occur.

Open the electrical cabinet by loosening the fasteners on the front.

WARNING!
TO PREVENT ELECTRICAL SHOCK, ENSURE THAT “ALL” ELECTRICAL POWER TO THE SYSTEM IS “OFF”. INCLUDING THE DISCONNECT SWITCHES AND H-O-A SWITCHES ON THE DRYER CONTROL PANEL. THE FACILITY’S CIRCUIT BREAKER SHOULD ALSO BE LOCKED OUT.

CAUTION: Vibration during shipment and installation can loosen electrical terminals, fuse inserts, and mechanical connections. Tighten as necessary.

Check the electrical cabinet for any broken switches, lights, etc.

Check that all motor starter connections are tight and that there are no loose objects such as terminal lugs, screws, nuts, etc., in the cabinet.

3.2 Initial System Startup

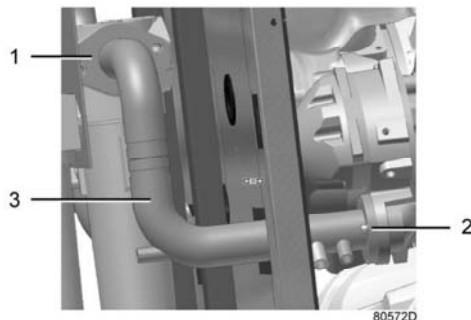
Before starting the system for the first time all parameters in the Central Control System on the Dryer module and individual compressor module controllers must be verified/set up.

- See **Appendix A.7.1** for complete list of parameter for the Central Control System.
- See **Appendix B.5** or **Appendix C.5** for complete list of parameters for the Compressor Controllers.

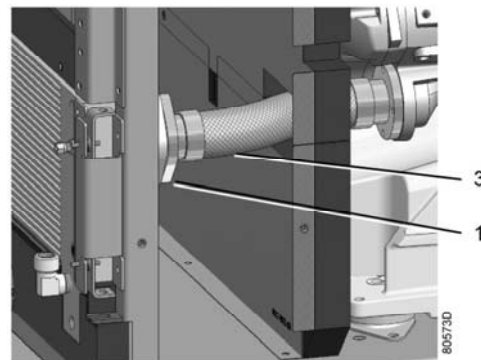
3.2.1 Compressor Initial Startup

(See also ZT/ZR Instruction Book provided with compressor)

1. A number of VCI (Volatile Corrosion Inhibitor) plates may be provided inside the bodywork and electrical cabinet to protect the compressor against corrosion. Remove the plates.
2. A silica gel bag is installed in the pipe (see FIG 3.2.1a) between the intercooler condensate trap and the high-pressure compressor element (a label is stuck on the pipe). Unscrew the bolts of flange (1), remove coupling and take out bag. Reposition the pipe using a new O-ring and tighten the flange.



Location of the silica gel bag (ZR)



Location of the silica gel bag (ZT)

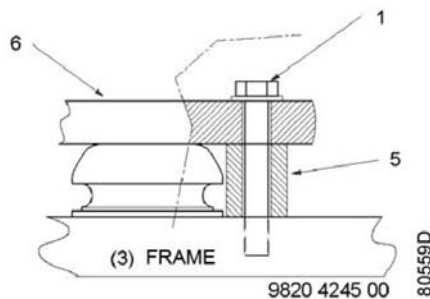
FIG. 3.2.1a Location of silica gel bag (typical examples)

3.0 System Operation

3.2.1 Compressor Initial Startup (continued)

3. The compressor and motor are secured to the frame, immobilizing the vibration dampers during transport (FIG. 3.2.1b) After installing compressor, remove the transport fixations which are painted red. Unscrew bolt (1) and remove transport bushing (5). Six transport fixations are provided: two at the gear casing side, two at the motor side, and two to support the intercooler.

Gear Casing Side / Motor Side
(1) (2)

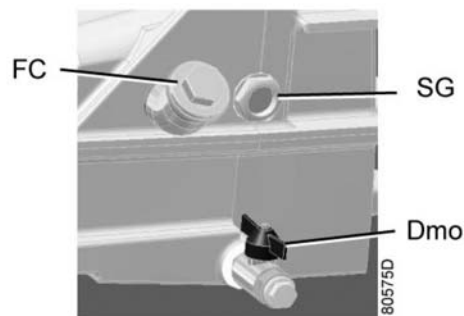


Components

- | | |
|---|------------------------------|
| 1 | Bolt |
| 2 | Nut |
| 3 | Bolt |
| 4 | Nut |
| 5 | Bush |
| 6 | Motor support or gear casing |

FIG. 3.2.1b Transport Fixations

4. Check that the gear casing is filled with oil, the level should be in the middle of the sight-glass. Add oil via the filler plug if necessary. (FIG. 3.2.1c)



Components

- | | |
|-----|------------------------------|
| FC | Filler Plug |
| SG | Sight Glass |
| Dmo | Oil drain valve, gear casing |

FIG. 3.2.1c Oil System Components

3.0 System Operation

3.2.1 Compressor Initial Startup (continued)

5. Check that the electrical connections correspond to the local codes. The installation must be earthed and protected by fuses in all phases. An isolating switch must be provided.
6. Check the connections at the primary sides of transformers (T1 and T2). *See the Service Diagram in Electrical Connections section of the ZT/ZR Instruction Book.*
On aircooled compressors, check the settings of circuit breaker (Q15) and overload relay (F21).
7. Close the manual drain valve of the condensate traps.
8. **On “ZR” Only:** Check that the cooling water drain valves (customer installed) in the inlet and outlet lines are closed. Open the water inlet and outlet valves (customer installed). Open the water flow regulating valves (1), (2) and (3) and check for water flow. (FIG. 3.2.1d)

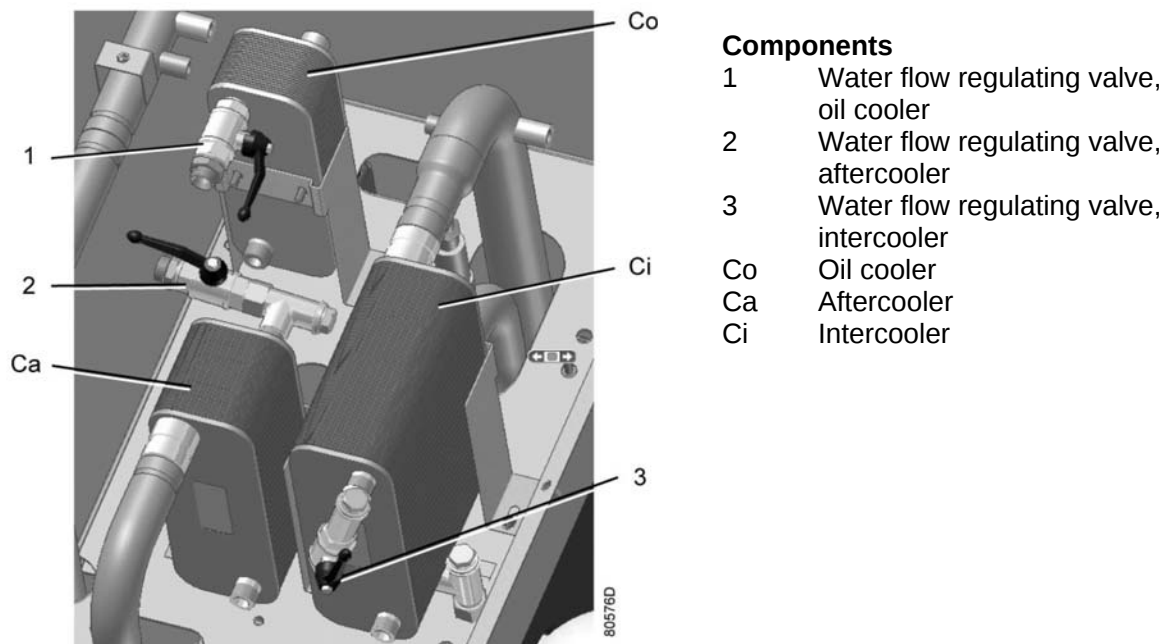


FIG. 3.2.1d Coolers and Water Valves (ZR)

9. **On “All” compressors:** Switch on the voltage. Start the compressor and stop it immediately. Check for correct direction of rotation while the motor is coasting to a stop. The arrow on the gear casing indicates the correct rotation direction. If the rotation direction is wrong, switch off the voltage and reverse two incoming electric lines. **On ZT**, check the rotation direction of the fan motor. Cooling air must be blown through the outlet grating on the roof. If the rotation direction is wrong, switch off voltage and reverse two connections at the terminals of circuit breaker (Q15).

3.0 System Operation

3.2.1 Compressor Initial Startup (continued)

10. **Oil Cooler on “ZR” compressors:** Read-out following parameters in the Elektronikon at stabilized load condition:

- Water inlet temperature (“Cooling Water In”)
- Oil injection temperature (“Oil Injection”)

Calculate $Dt_{OC} = \text{“Oil Injection”} - \text{“Cooling Water In”}$

If $Dt_{OC} > 20^{\circ}\text{C}$ (36°F), open ball valve (1) to decrease the oil injection temperature.

If $Dt_{OC} < 20^{\circ}\text{C}$ (36°F), close ball valve (1) to increase the oil injection temperature.

The oil injection temperature must be set at $20^{\circ}\text{C} \pm 2^{\circ}\text{C}$ ($38^{\circ}\text{F} \pm 3.6^{\circ}\text{F}$) above water inlet temperature.

11. **Intercooler on “ZR” compressors:** Read-out following parameters in the Elektronikon at stabilized load condition:

- Water inlet temperature (“Cooling Water In”)
- High-pressure element inlet temperature (“Element 2 Inlet”)

Calculate $Dt_{IC} = \text{“Element 2 Inlet”} - \text{“Cooling Water In”}$

If $Dt_{IC} > 25^{\circ}\text{C}$ (54°F), open ball valve (3) to decrease the temperature difference and increase the intercooler cooling.

If $Dt_{IC} < 15^{\circ}\text{C}$ (27°F), close ball valve (3) to increase the temperature difference and decrease the intercooler cooling.

The high pressure element inlet temperature must be set around 20°C (36°F) above the cooling water inlet temperature.

12. **Aftercooler on “ZR” Compressors:** Read-out following parameters in the Elektronikon at stabilized load condition:

- Water inlet temperature (“Cooling Water In”)
- Compressor outlet temperature (“Compressor Outlet”)

Calculate $Dt_{AC} = \text{“Compressor Outlet”} - \text{“Cooling Water In”}$

If $Dt_{AC} > 9^{\circ}\text{C}$ (16.2°F), open ball valve (2) to decrease the temperature difference and increase the aftercooler cooling.

If $Dt_{IC} < 5^{\circ}\text{C}$ (9°F), close ball valve (2) to increase the temperature difference and decrease the aftercooler cooling.

The aftercooler outlet temperature must be set at $6\text{--}8^{\circ}\text{C}$ ($10.8\text{--}14.4^{\circ}\text{F}$) above the cooling water inlet temperature.

3.0 System Operation

3.2.1 Compressor Initial Startup (continued)

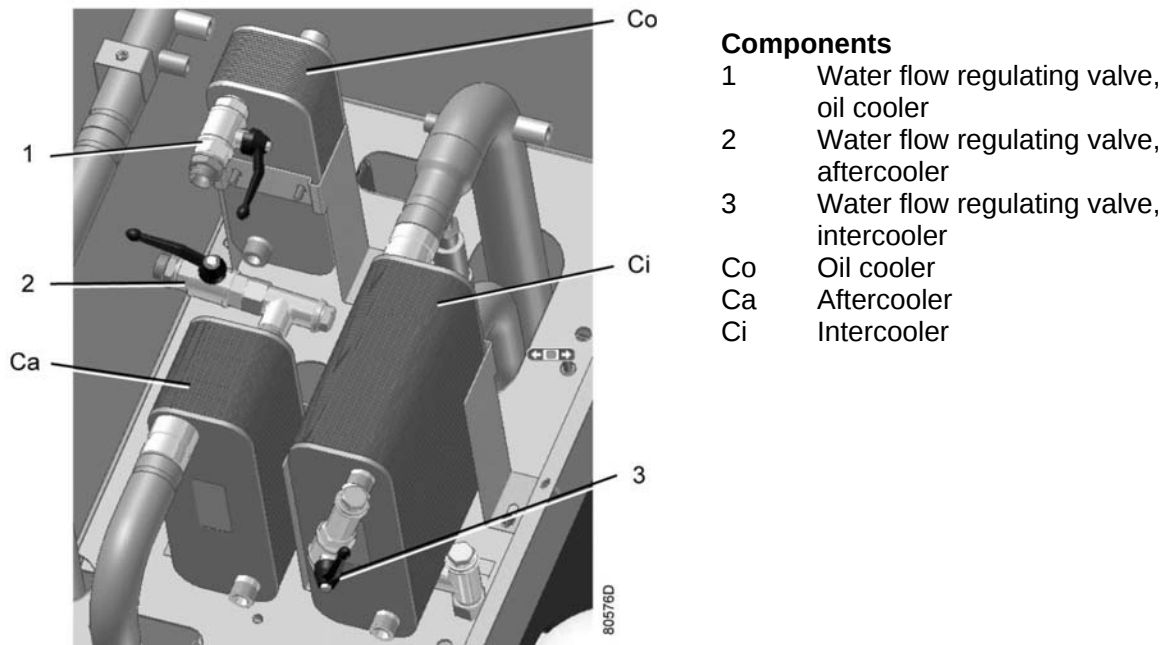


FIG. 3.2.1e. Water system on ZR compressors

13. **On “All” compressors:** Run the compressor for a few minutes and check that it operates normally.
14. Stop the compressor. If necessary, top off the gear casing with oil to the middle of the sight glass (FIG. 3.2.1c)

3.0 System Operation

3.2.2 Compressor Startup

WARNING!

THE OPERATOR MUST APPLY ALL RELEVANT SAFETY PRECAUTIONS, INCLUDING THOSE MENTIONED IN THE “OPERATION & MAINTENANCE MANUAL” SUPPLIED WITH EACH COMPRESSOR.

1. Check the oil level, which must be in the middle of the sight glass (SG - FIG 3.2.1c) top off, if necessary, with the correct type oil.
2. **On “ZR”**, check the setting of the valves (1, 2 & 3 - FIG 3.2.1e) as described in section 3.2.1. This can be overlooked if, after previous operation, the settings of these valves have not been disturbed.
3. Close the manual condensate drain.
4. Open the air outlet valve (customer installed).
5. Switch on the voltage and check that voltage on LED (6) lights up (FIG 3.2.2).
6. Press start button (1). The compressor starts running and automatic operation LED (8) lights up (FIG 3.2.3).

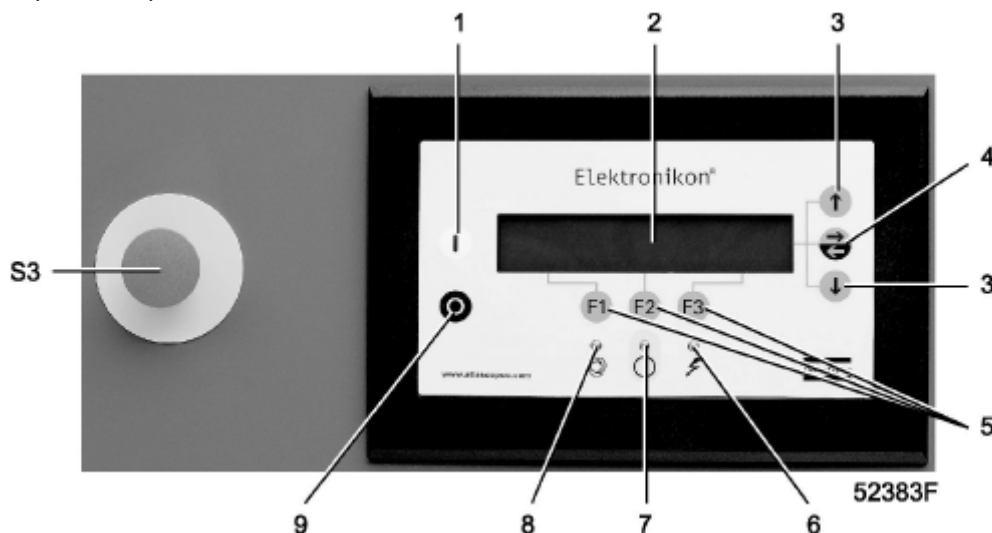


FIG. 3.2.2. Compressor Control Panel

WARNING!

WHEN THE COMPRESSOR IS STOPPED AND AUTOMATIC OPERATION LED (8) IS ON, THE COMPRESSOR MAY START AUTOMATICALLY. IF THE START/STOP TIMER IS ACTIVE, THE COMPRESSOR MAY START AUTOMATICALLY, EVEN IF IT WAS STOPPED MANUALLY. CONSULT THE USER MANUAL FOR ELEKTRONIKON REGULATOR, SECTION “PROGRAMMING CLOK FUNCTION” IN THE “OPERATION & MAINTENANCE MANUAL” SUPPLIED WITH EACH COMPRESSOR.

3.2.3 Dryer Initial Startup

Refer to **Section D.4.1 – Initial Start-up** section in Appendix D Desiccant Dryer.

3.0 System Operation

3.3. System Normal Start-Up

1. Hospital shut-off valve – CLOSED.
2. Dryer Outlet isolation valve – CLOSED.
3. Receiver bypass valve – CLOSED.
4. Compressor outlet valve – OPEN.
5. One dryer off-line – VALVES CLOSED.
6. One dryer on-line – VALVES OPEN.
7. Main electrical power on to system.
8. Compressor disconnect switched turned on.
9. Check That voltage LED light is “ON”, each compressor and Central Control System panel on dryer.
10. Set the appropriate dryer selector switch to “CONTINUOUS PURGE”.
11. Press start button on Central Control System panel (See Appendix A.4).
12. Air receiver pressure gauge increases to 100 PSI (689 kPa).
13. Check that each compressor shuts down as it reaches it’s off-limit pressure.
14. Check main line regulator on dryer discharge line. Verify it’s set for the desired outlet pressure.
15. Slowly open the dryer outlet isolation valve.
16. Slowly open the hospital shut-off valve.

NOTE: Opening the hospital valve may cause a pressure demand that brings the lag compressors back on-line. This is a normal sequence.

NOTE: The Medical Air System is now on-line and in normal Operating Mode (lead/lag operation).

To verify dryer operation, refer to Appendix D for desiccant dryers.

3.0 System Operation

3.4 Normal Operation

The Central Control System (CCS) controller is located on the dryer module and controls the Z-MED Medical Air System. The CCS regulates the net pressure of the system within the programmable limits by starting, loading, unloading and stopping the compressors connected according to the programmed sequence. It also controls the regeneration cycles of the desiccant dryers while monitoring the dew point and CO levels in the discharge air.

The CCS distributes the run time between multiple compressors connected in the CAN network (see Section 2.0 Installation). To connect the Elektronikon III controlled compressors to the CCS a dongle is required (see Appendix A, Fig A.2). The status of each compressor can be checked on the CCS control screen. Operating parameters of the system are accessible via the on screen menu.

- See **Appendix A- Central Control System** for complete Operating Instructions and settings.
- See **Appendix B** or **Appendix C – Compressor Controller** for complete Operating Instructions and settings

3.5 Maintenance Shut Down

WARNING!
WAIT UNTIL THE PRESSURE HAS BEEN COMPLETELY VENTED AND THE GAUGES READ “0” ON THE TOP OF THE TOWERS BEFORE PERFORMING ANY SERVICE TO THE DRYER.

!!WARNING!!
To protect the lives of patients, always notify the appropriate medical facility staff before shutting down the Dryer. Medical Air levels may be affected during this shutdown procedure.

3.5.1 Compressor - Stopping

1. Press the test button on top of the drains to discharge condensate.
2. Press Stop button (9); the compressor will stop and Automatic operation LED (8) will go out (Appendix B – FIG B.1or Appendix C – FIG C.1)
3. Close the air outlet valve (customer installed).
4. In case of emergency, press emergency stop button (S3) to stop the compressor immediately (FIG - 3.2.2)
5. Open the manual condensate drain (1– FIG 3.2.1d).
6. **On “ZR”**, close the cooling water inlet valve (customer installed)

3.0 System Operation

3.5.2 Compressor – Taking out of operation

At the end of the service life of the compressor, proceed as follows:

1. Close the air outlet valve and stop the compressor. Press the test button on top of the electronic water drains to depressurize and open the drain valve (FIG – 3.2.1d).
2. Switch off the voltage and disconnect the compressor from the mains.
3. Shut off and depressurize the part of the air net which is connected to the outlet valve.
4. Disconnect the compressor air outlet pipe from the air net.
5. Drain the oil and condensate circuits.
6. Disconnect the compressor condensate piping from the condensate drain net.
7. **On “ZR”**, drain the cooling water circuit and disconnect the cooling water pipes from the compressor.

3.5.3 Dryer Maintenance Shut Down

Refer to **Appendix D.4.4 Maintenance Shut Down** for Desiccant Dryer.

WARNING! DISPLAY PROMINENT NOTICES INDICATING THAT MAINTENANCE IS BEING CARRIED OUT.

4.0 Troubleshooting

For troubleshooting compressors refer to Section 6 – Problem Solving in the “ZT/ZR Instruction Book” manuals supplied separately with each compressor module.

4.0. Troubleshooting

Problem	Possible Causes	Solution
Failure to start	Main power disconnected	Turn on main power
	Power failure	Restore power
	Main fuse blown	Replace fuse
	Fuse blown in control circuit	Replace fuse
	Overload tripped on starter	Reset & check for system overload
	High temperature switch activated	Allow unit to cool; reset & check for over temperature condition
	Low Oil Pressure	Check oil level Check oil level switch operation
Power failure	Loose or faulty connection	Check & tighten all wire connections
Power failure	Main fuse blown	Replace fuse
	Fuse blown in control circuit	Replace fuse
Compressor shuts off unexpectedly	Overload tripped on starter	Reset & check for system overload
	Faulty pressure transducer	Adjust or replace
	High temperature switch activated	Allow unit to cool; reset switch & check for over temperature condition
	Low oil pressure	Check oil level Check oil level switch operation.
Compressor capacity or working pressure lower than normal	Air consumption exceeds capacity of compressor	Check pneumatic plant
	Safety valve leaking	Remove leaking valve, repair or replace valve
Oil pressure too low	Oil level to low	Top off oil level to middle of oil level sight glass
	Oil filter clogged	Replace filter

4.0 Troubleshooting

4.0. Troubleshooting (continued)

Problem	Possible Cause	Solution
Air temperature above normal	Inlet temperature too high due to bad room ventilation or recirculation of cooling air	Improve ventilation of compressor room and avoid cooling air recirculation
	Air filter clogged	Replace filter
	On “ZR” , insufficient cooling water flow	Check water temperature and increase cooling water flow
	On “ZR” restriction in cooling water system due to formation of scale or settling down of dirt	Contact BeaconMedaes
Condensate is not discharged from condensate traps during operation	Discharge flex line clogged	Check and correct as necessary
	Electronic water drain malfunctioning	Contact BeaconMedaes
Motor overheating	Low voltage	Check for proper supply voltage
	Defective motor	Contact BeaconMedaes
Compressor runs hot	Wrong rotation	Switch motor leads
	Incorrect pressure setting	Adjust pressure band parameters
	Faulty compressor valves	Contact BeaconMedaes
	Intake filter clogged	Clean or replace
Wrong direction of rotation	Motor wired incorrectly	Switch motor leads
Low discharge pressure	System piping leaks	Repair leaks
	Defective pressure gauge	Replace gauge
	Faulty pressure transducer	Adjust or replace
	Intake filter clogged	Clean or replace

4.0 Troubleshooting

4.0. Troubleshooting (continued)

Problem	Possible Cause	Solution
Compressor cycles too often	System undersized	Contact BeaconMedaes
	Incorrect pressure setting	Adjust pressure band parameters
	Faulty pressure transducer	Replace transducer
	System piping leaks	Repair leaks
	Safety valve leaks	Repair or replace valves
	Both dryers on line	Valve off one dryer
Compressor won't shut off	Water in air receiver	Drain air receiver
	Faulty pressure transducer	Adjust or replace
High air temperature	System piping leaks	Repair leaks
	Bad room ventilation	Improve room ventilation
	Air Filter Clogged	Replace filter
	Insufficient cooling water (ZR)	Check water temperature, increase water flow
Dryer not Cycling	Formation of scale/dirt	Contact BeaconMedaes
	Main power disconnected	Turn on main power
	Dryer power switch off	Turn on power switch
	Power failure	Restore power
	Main fuse blown	Replace fuse
	Fuse blown in control circuit	Replace fuse
	Solenoid valve failure	Check and replace or repair solenoid valve
	Smart Relay failure	Check and replace if defective
	Loose or faulty connection	Check & tighten all wire connections

4.0 Troubleshooting

4.0. Troubleshooting (continued)

Problem	Possible Causes	Solution
Dew point degradation	Incorrect purge gas flow Inlet gas temperature too high Liquid entering the dryer inlet Purge exhaust muffler restricted Desiccant is contaminated Piping component leaks at dryer outlet or downstream of dryer outlet	Check purge orifice for blockage. Clean or replace as required Check compressor aftercooler Inspect pre-filter cartridges. Replace if necessary Inspect Zero-loss drain valves. Replace if necessary Replace muffler Shutdown and depressurize the dryer. Inspect the desiccant and replace if fouled. Inspect prefilters if fouling is noted. Soap bubble test the dryer outlet and downstream piping. Repair all leaks noted
Backpressure on a desiccant chamber during regeneration cycle	Dirty or fouled muffler	Switch off power, remove purge muffler and clean or replace.
Maximum Capacity	System undersized Incorrect pressure setting Faulty pressure transducer System piping leaks Both dryers on line	Contact BeaconMedaes Adjust Pressure band parameters Replace transducer Repair leaks Valve off one dryer
High receiver water level	Manual isolation valve closed Automatic drain valve not functioning	Open valve Check electrical hookup Service, clean or replace internal parts Replace valve assembly

5.0 Maintenance

5.1 Maintenance Schedule

WARNING:
BEFORE STARTING ANY MAINTENANCE PROCEDURES, DISCONNECT ALL POWER TO THE EQUIPMENT BEING SERVICED.

Release all pressure from the package before removing, loosening, or servicing any covers, guards, fittings, connections, or other devices.

Never perform any maintenance functions while the unit is in operation.

Item	Frequency	Action
Check sight glass on filter body for condensate levels (Dryer)	Daily	Check auto drain. Clean if necessary
Check reading on display	Daily	Verify no warnings exist
Check condensate drains	Daily	Verify condensate is discharged during loading
Check oil level	Daily	Add oil if necessary
Check flow through dew point sensor	Weekly	Check for flow blockage
Check operation of safety valve	Weekly	Manually release pressure
Check nuts, bolts, fittings, etc.	Monthly	Inspect and tighten
Clean compressor	Every 3 months	Clean if necessary
Check for possible leaks	Every 3 months	Repair or replace components
Check compressor coolers	Every 3 months	Clean if necessary
Calibrate CO sensor	Every 6 months	See Appendix D
Check dew point sensor accuracy	Every 12 months	Verify dew point sensor accuracy (contact BeaconMedaes)
Replace pre-filters & after-filters	Every 12 months	Replace filter elements
Replace Dryer Desiccant	5 years	Contact BeaconMedaes
Compressor fan motor	Greased for life	Contact BeaconMedaes for replacement
Compressor Drive motor bearings (ZT15-ZT22)	Greased for life	Contact BeaconMedaes for replacement
Compressor Drive motor bearings (ZT/ZR30 – ZT/ZR45)	See Nameplate	Grease drive & non-drive ends

Recommended Grease: Esso Unirex N3 (never mix greases of different brands or types)

Oil specification: Use Atlas Copco Roto-Z oil which has been developed for oil free rotary compressors. This oil has a long service life and ensures optimum lubrication. Never mix oils of different brands or types. See chart for part numbers and available sizes.

Quantity	Part number
5-Liter Can	2908 8503 00
20-Liter Can	2908 8501 01
209-Liter Can	2908 8500 00

5.0 Maintenance

5.2 Spare Parts

For Desiccant Dryer spare parts see **Appendix-D.6.1 thru D.6.5.**

For Compressor spare parts and servicing procedures refer to “**ZT/ZR Instruction Book**” supplied with each compressor unit.

6.0 Maintenance Record

Model Number _____

Serial Number _____

Installation Date _____

Date of Service								
Hours								
Ambient Temp.								
Air Leaks								
Condensate Drains								
Inlet Filter								
Dryer Filters								
Manual Valve Oper.								
Dew Point Flow								
Oil Level								
Alarms								
Misc.								
Serviced By								

Notes:

6.0 Maintenance Record

Model Number _____

Serial Number _____

Installation Date _____

Date of Service								
Hours								
Ambient Temp.								
Air Leaks								
Condensate Drains								
Inlet Filter								
Dryer Filters								
Manual Valve Oper.								
Dew Point Flow								
Oil Level								
Alarms								
Misc.								
Serviced By								

Notes:

Appendix A – Central Control System

A.1 Safety Precautions

WARNING!

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

A.1.1 General Precautions

1. The operator must employ safe working practices and observe all related local work safety requirements and regulations.
2. If any of the following statements does not comply with local legislation, the stricter of the two shall apply.
3. Installation, operation, maintenance, repair work must only be performed by authorized, trained, specialized personnel.
4. Before carrying out any maintenance, repair work adjustments or any other non-routine checks, stop the device. In addition, the power isolating switch must be opened and locked.
5. Use only correct tools for maintenance and repair work.
6. Use only genuine **BeaconMedaes** spare parts. Contact **BeaconMedaes** Technical Services department at 1-888-4MEDGAS (1-888-463-3427) for technical support or to order spare parts.

A.2 Introduction

The ES-6 is a stand alone Central Control System. The Central Control System regulates the net pressure within programmable limits by starting, loading, unloading and stopping the compressors connected according to the programmed sequence. It also controls the regeneration cycles of the desiccant dryers while monitoring the dew point and CO levels in the discharge air.

The Central Control System distributes the running time between multiple compressors connected in the CAN network (see A.3 CAN Network Connection). To connect Elektronikon III controlled compressors a dongle is required (see Fig A.2). The status of each compressor can be checked on the control screen. Operating parameters are accessible via the menu.

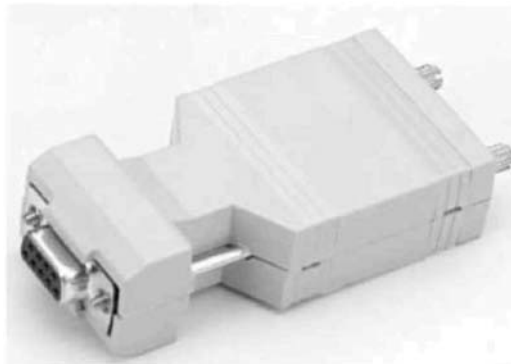


FIG. A.2 Dongle for Elektronikon III controlled compressors

Appendix A – Central Control System

A.2.1 Single Point Pressure Measurement

The ES-6 controls the system pressure by means of a pressure transmitter. Depending on the reading of the pressure transmitter the controller will start and stop the compressors in the network in order to keep the pressure within the limits of the pressure band.

A.2.2 Sequence Management

In order to maintain the system pressure the ES-6 has the following control functions:

1. Position of the measured pressure to the pressure band.
2. Priority scheme check.
3. Equal wear check.
4. Compressor availability check

Depending on the status of these functions the ES-6 will determine the sequence of starting and stopping of the connected compressors.

A.2.3 Priority Selection

Two priority schemes are available. In each priority scheme six levels can be set (level 1 will be started first; level 6 will be started last). Each compressor can be given a different priority. Compressors with the same priority level will have the same priority. **BeaconMedaes** recommends setting all compressors to level 1.

A.2.4 Equalized running hours

Within a group of compressors that have the same priority, the compressor with the least running hours will be started first, compressors with the most running hours will be stopped first.

A.2.5 Compressor availability

Before a compressor in a group is started, an availability check is performed. This means that only the compressors that are running in unloaded condition or are ready to be started will be taken into account.

A compressor can be unavailable due to:

- Minimum stop time
- Shut-down condition
- Emergency stop pressed
- No communication

Appendix A – Central Control System

A.2.6 Automatic restart after voltage failure

The controller has a function for automatic restart after voltage failure. For controllers leaving the factory, this function is made active.

After power restoring, the controller restarts regulation and returns to the condition experienced before the power failure. Programmed delay times and simultaneous start prevention will be taken into account.

A.3 CAN Network Connection

See “**Section 2.0 Installation**” for network cabling of compressors and cable end connector wiring and assembly.

Appendix A – Central Control System

A.4 Central Control Panel Parts and Functions

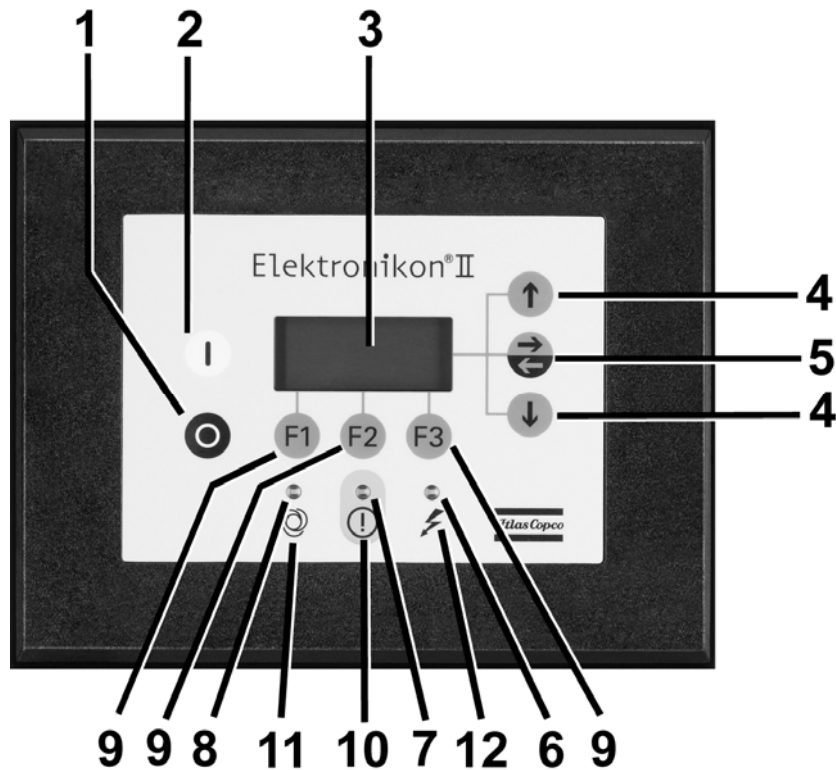


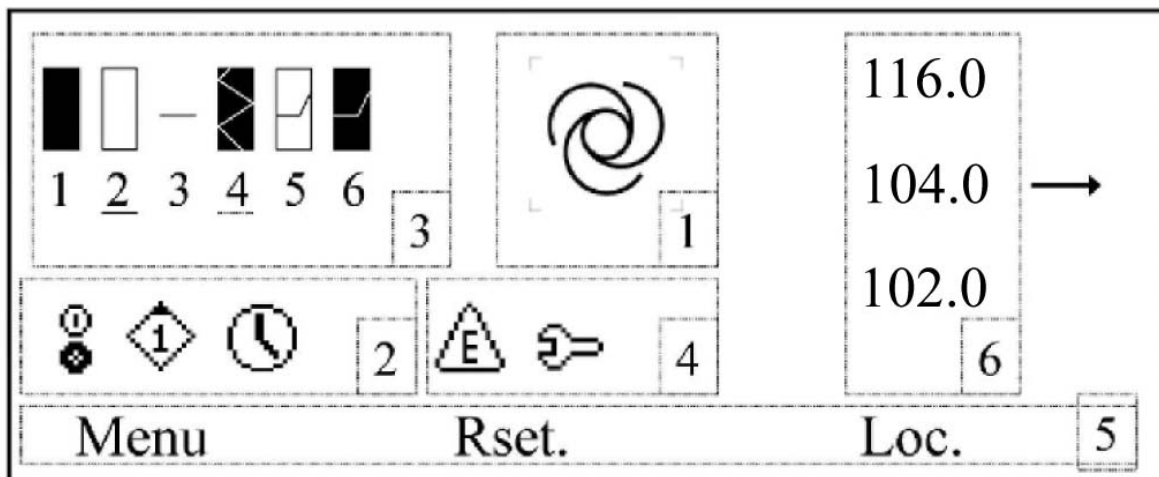
FIG. A.5 Dryer Central Control Panel

1. **Stop Button:** Button to stop Central Control Panel. LED (8) goes out. The compressors will stop after running in unloaded condition for about 30 seconds.
2. **Start Button:** Button to start the Central Control Panel and compressors. LED (8) lights up indicating that the air system is operative.
3. **Display:** Shows messages about the compressor operating condition, a service need or a fault.
4. **Scroll Keys:** Keys to scroll upwards or downwards through the display.
5. **Tabular 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.
6. **Voltage on LED:** Indicates that the voltage is switched on.
7. **General Alarm LED:** Is lit if warning, service warning or shut-down warning condition exists. Flashes if a shut-down condition exists, if an important sensor is out of order or after an emergency stop.
8. **Automatic Operation LED:** Indicates that the regulator is automatically controlling the compressor.
9. **Function Keys:** Keys to control and program the compressor. The functions of the keys vary depending on the displayed menu. The actual function is indicated just above the relevant key.
10. **Pictograph – Alarm**
11. **Pictograph – Automatic Operation**
12. **Pictograph – Voltage On**

Appendix A – Central Control System

A.5 Display Description

The main display gives an overview of different states, conditions, alarms, etc. The display consists of six main parts (see Fig A.5)



Part	Designation
1	ES 6 status
2	ES 6 controls
3	Status of connection channels (compressor loaded/unloaded/stopped)
4	Error, warnings and alarm status
5	Menu navigation text
6	ES 6 pressure band and measured pressure indication 116.0: Upper level pressure band 104.0: Actual pressure reading 102.0: Low level pressure band

FIG. A.5 Main Display

Appendix A – Central Control System

A.5.1 ES-6 Status

The status of the ES-6 is indicated in the center of the display (See 1 in Fig. A.5). The following table (See Fig. A.5.1) gives an overview of all statuses and corresponding descriptions.

Symbol	Description
	POWER UP: Displayed at start-up. Time required to initialize and to communicate with the connected compressors. As long as this start-up is running a rotating hourglass is displayed.
	AUTOMATIC OPERATION: The ES-6 is controlling the connected compressors based upon the pressure algorithm. The automatic symbol is shown
	MANUAL STOP: A stop condition is active which stops all compressors. The stop symbol does not only occur after an manual stop but can be shown after one of the following actions; • Manual stop button pressed • Stop action through weekly timer • Stop command over CAN • Stop action via a switch
	LOCAL OPERATION: Is shown when the ES-6 is set to “local”. This action disables the control of the ES-6 and gives the pressure control back to each connected compressor individually.
	SHUT DOWN, ALARM ES-6: A condition has occurred that requires a shutdown of the ES-6. A shut-down condition will appear in case of; • Emergency stop pressed on the ES-6 (if applicable) • Shutdown protection on the pressure sensor When a shut-down condition occurs, the ES-6 is no longer able to control the connected compressors. Therefore, the pressure control is given back to each compressor individually.

FIG. A.5.1 Status Symbols

Appendix A – Central Control System

A.5.2 ES-6 Controls

The ES-6 indicates which commands are active (See 2 in Fig. A.5). Three symbols can appear in this window and the table (see Fig A.5.2) gives an overview of all control statuses and corresponding designations.

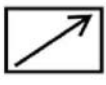
Symbol	Description
	On the left side the following symbols can appear
	ES-6 LOCAL START/STOP Indicates the ES-6 can be started or stopped from the Elektronikon module by using the start and stop buttons on the control panel.
	ES-6 REMOTE START/STOP The ES-6 can be started and stopped remotely by a switch. A switch needs to be connected and configured. If this symbol appears the ES-6 is in remote start/stop operation. The start/stop buttons on the Elektronikon module of the ES-6 are not active
	ES-6 LAN START/STOP The ES-6 is started and stopped over a LAN network. The commands can be given over a fieldbus interface (Modbus, Profibus) connected to the LAN network.
	In the middle the following symbols can appear
	ES PRIORITY SCHEME 1 Shows that priority scheme 1 is active. The priority scheme gives a priority to the connected compressors.
	ES PRIORITY SCHEME 2 Shows that priority scheme 2 is active. The priority scheme gives a priority to the connected compressors.
	On the right side the following symbols can appear
	ES 6 WEEK TIMER ACTIVE The week timer is active, programmed via the clock function commands (switching pressure band, system start/stop,...) will be executed based on the timer clock.
	ES 6 AUTOMATIC RESTART AFTER VOLTAGE FAILURE (ARAVF) FUNCTION ACTIVE When power fails and recovers within a specific time the ES-6 will automatically restart.

FIG. A.5.2 Status Symbols

Appendix A – Central Control System

A.5.3 Status of Connection Channels

The connected compressors are shown on the display (maximum 6) (See 3 in Fig. A.5). If one of the connection channels is not connected to a compressor it is shown on the display. Only the statuses of the active compressors are indicated. Two different types of compressors can be visualized:

- Fixed speed compressor
- Variable speed compressor

A.5.4 Basic Status

The basic status for each compressor is unique

- Stopped
- Unloaded
- Loaded

Symbol	Description Fixed speed compressor
	Status: compressor stopped
	Status: compressor unloaded
	Status: compressor loaded

Symbol	Description Variable speed compressor (VSD)
	Status: compressor stopped
	Status: compressor unloaded
	Status: compressor loaded

FIG. 5.4 Basic Status

Appendix A – Central Control System

A.5.4.1 Exception Status

The exception statuses are the same for the 3 compressor types. In the table below an overview of the exception statuses is given.

Symbol	Designation	Description Electro-pneumatic compressor
X	No valid compressor type	X is blinking when: • An unknown compressor type is detected • A second variable speed drive (VSD compressor) is detected
?	No communication	? is blinking when: • For fixed speed or variable speed compressors: No reply from the connected compressor within a timeout • For electro-pneumatic compressor: status read from the compressor is not consistent or illogical
!	No answer	! is blinking when the connected compressor is not responding (or not responding correctly) to the commands (example: no reaction on a load command).
—	Not available	- is blinking when the compressor is stopped and is counting down the minimum stop time. During this time the compressor is not available for the ES 6 control algorithm.
*	Compressor shutdown	* is blinking when the compressor is in shut-down condition

A.5.5 Compressor Status

The ES-6 continuously monitors and re-calculates which compressor will be started next and which compressor will be stopped next (see Fig. A.5.5).

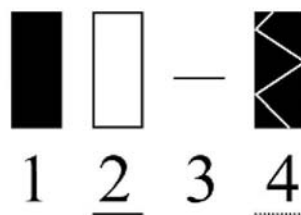


FIG. A.5.5 Example of the Compressor Status

To indicate which compressor will be started next a full line is placed under the compressor figure (e.g. compressor 2).

To indicate which compressor will be stopped next a dashed line is placed under the compressor figure (e.g. compressor 4).

Appendix A – Central Control System

A.5.6 Errors, Warnings and Alarm Status

Different errors, warnings or alarms can be shown on the ES-6 (See 4 in Fig. A.5). The display shows maximum 2 symbols at the same time. If more symbols are required they are shown in a cycling way in groups of two symbols (see Fig A.5.6).

Symbol	Description
	SENSOR ERROR The main pressure sensor (4-20mA) indicates an error
	I/O ERROR An I/O buss error occurred. This can be one of the following errors: • Dongle required • Dongle no longer present
	WARNING
	SERVICE REQUIRED If a service warning protection is set to an input of the ES-6 controller (by default no service protections are set) and the service level is reached, this symbol is shown.

FIG. A.5.6 Error, warnings and Alarm Symbols

Appendix A – Central Control System

A.6. Parameters

The Central Controller parameters are separated into the two following sections: A.6.1.1 Parameters and A.6.1.2 Configuration. The two sections are located under “Modify Parameters” on the compressor controller.

A.6.1.1. Parameter Listing: See A.6.2.7 (Modify Parameters – Parameters) for screen navigation to view parameter settings

Name	Description	Controller Default value	Beacon Medaes value
'Pressure Band 1 Low'	Low pressure level of Pressure band 1	7 bar	90 psi
'Pressure Band 1 High'	High pressure level of Pressure band 1	8 bar	105 psi
'Pressure Band 2 Low'	Low pressure level of Pressure band 2	7 bar	90 psi
'Pressure Band 2 High'	High pressure level of Pressure band 2	8 bar	105 psi
'Number of Comp.'	Number of compressors that will be connected to the ES 6 (maximum 6)	1	# of comp. in system
'Remote to Local'	Time before the next compressor is set to Local control (in case of a Go to local manual action)	20 seconds	20 seconds
'Unload time'	Time before the next compressor starts running unloaded (valid in Automatic Operation)	5 seconds	15 seconds
'Start/Load time'	Time before the next compressor is started (valid in Automatic Operation)	20 seconds	30 seconds
'Start/Load React. ID1'	Start + Load Reaction time of connection channel 1 Time which the compressor has to run in load condition after a start command	20 seconds	30 seconds
'Start/Load React. ID2'	Start + Load Reaction time of connection channel 2	20 seconds	30 seconds
'Start/Load React. ID3'	Start + Load Reaction time of connection channel 3	20 seconds	30 seconds
'Start/Load React. ID4'	Start + Load Reaction time of connection channel 4	20 seconds	30 seconds
'Start/Load React. ID5'	Start + Load Reaction time of connection channel 5	20 seconds	30 seconds
'Start/Load React. ID6'	Start + Load Reaction time of connection channel 6	20 seconds	30 seconds
'Stop Reaction'	Time which the compressor has to stop after a stop command	35 seconds	35 seconds
'Unload Reaction'	Time which the compressor has to run in unload condition after an unload command	5 seconds	5 seconds
'Load Reaction'	Time which the compressor has to run in load condition after start command	10 seconds	10 seconds
'Forced time'	When for a number of days the same compressors are running in loaded condition, another compressor will be started to force again another compressor to change condition.	7 days	1 days

Appendix A – Central Control System

A.6.1.1. Parameter Listing (continued)

Name	Description	Controller Default Value	Beacon Medaes value
'Delta Time'	Maximum allowed difference in running hours between a stopped and an unloaded compressor. This is to prevent the compressor running unloaded is always used in favor of the stopped compressor, although the difference in running hours is high.	168 hours	168 hours
'S1 ID1 Priority'	Scheme 1. Priority level for connection channel 1	1	1
'S1 ID2 Priority'	Scheme 1. Priority level for connection channel 2	1	1
'S1 ID3 Priority'	Scheme 1. Priority level for connection channel 3	1	1
'S1 ID4 Priority'	Scheme 1. Priority level for connection channel 4	1	1
'S1 ID5 Priority'	Scheme 1. Priority level for connection channel 5	1	1
'S1 ID6 Priority'	Scheme 1. Priority level for connection channel 6	1	1
'S2 ID1 Priority'	Scheme 2. Priority level for connection channel 1	1	1
'S2 ID2 Priority'	Scheme 2. Priority level for connection channel 2	1	1
'S2 ID3 Priority'	Scheme 2. Priority level for connection channel 3	1	1
'S2 ID4 Priority'	Scheme 2. Priority level for connection channel 4	1	1
'S2 ID5 Priority'	Scheme 2. Priority level for connection channel 5	1	1
'S2 ID6 Priority'	Scheme 2. Priority level for connection channel 6	1	1
'Running Hours ID1'	Counter running hours for connection channel 1	0	0
'Running Hours ID2'	Counter running hours for connection channel 2	0	0
'Running Hours ID3'	Counter running hours for connection channel 3	0	0
'Running Hours ID4'	Counter running hours for connection channel 4	0	0
'Running Hours ID5'	Counter running hours for connection channel 5	0	0
'Running Hours ID6'	Counter running hours for connection channel 6	0	0
'Power Recovery Time'	Maximum allowed power down time to accept the Automatic Restart After Voltage Failure (ARAVF)	10 seconds	oo! sec*
'Restart Delay'	Start delay after the voltage is restored	5 seconds	5 seconds
Communication Time-Out**	Delay time prior to activating a communication general fault alarm, when communication to connected machines has been lost or not re-established after power outage.	5 seconds	30 seconds

* - Controller display will show “oo! sec” when “Auto Restart” parameter is set to infinite.

** - Can only be updated using a laptop and FSP+ Software.

Appendix A – Central Control System

A.6.1.2. Configuration Listing: See A.6.2.10 (Modify Parameters – Configuration) for screen navigation to view parameter settings

Name	Description	Controller Default Value	Beacon Medaes value
'C.C.M.'	ES6 Control Mode (Local, Remote, LAN)	Local	Local
'Pressure Band Selec'	Allows manual selection between pressure band 1 or 2	Press Band 1	Press Band 1
'Digital PB sel.'	When this function is activated the pressure band will be controlled by a switch (connected to a digital input). Once this function is activated, the switch position overrules the selection in the menu.	Not Activated	Not Activated
'Scheme Used'	Allows manual selection between priority scheme 1 or 2	Scheme 1	Scheme 1
'Digital Scheme sel.'	When this function is activated the priority scheme will be controlled by a switch (connected to a digital input). Once this function is activated, the switch position overrules the selection in the menu.	Not Activated	Not Activated
'System Stop'	If Enabled, it starts the function system stop. A function key (see text on the menu above the function keys) will be available in the menu to stop all of the connected compressors.	Disabled	Not Activated
'System Forced'	If Enabled, it starts the function system forced: When for x days the same compressors are running in loaded condition; another compressor will be started. The x is set in the parameter Forced Time.	Disabled	Activated
'Auto Restart'	Allows the ES 6 to restart after a power failure	Not Activated	Infinite*
'Password'	This feature allows the parameters to be protected by a user defined password.	Not Activated	Activated**
'Node ID'	ES 6 Node Identification number on the CAN network	31	30
'Comp. 1 Connection'	This parameter determines how the compressors are connected to the ES 6 regulator Physical connection: LAN or Digital Link (= Hardwired) Physical connection for connection channel 1	LAN	LAN
'Comp. 2 Connection'	Physical connection: LAN or Digital Link (= Hardwired) Physical connection for connection channel 2	LAN	LAN
'Comp. 3 Connection'	Physical connection: LAN or Digital Link (= Hardwired) Physical connection for connection channel 3	LAN	LAN
'Comp. 4 Connection'	Physical connection: LAN or Digital Link (= Hardwired) Physical connection for connection channel 4	LAN	LAN
'Comp. 5 Connection'	Physical connection: LAN or Digital Link (= Hardwired) Physical connection for connection channel 5	LAN	LAN

* - Requires pass code to activate (pass code = 4735)

** - Requires password to change parameters and configuration (password = 4735)

Appendix A – Central Control System

A.6.1.2. Configuration Listing (continued)

Name	Description	Controller Default Value	Beacon Medaes value
'Comp. 6 Connection'	Physical connection: LAN or Digital Link (= Hardwired) Physical connection for connection channel 6	LAN	LAN
'Language'			English
'Time'			Local Time
'Date'			Current
'Date Format'	Selects how the date is shown on the display: DD/MM/YY, MM/DD/YY, YY/MM/DD	DD/MM/YY	MM/DD/YY
'Pressure Unit'	Selects which unit for pressure is used: Bar, Kg/cm2, MPa, psi	Bar	psi
'Temperature Unit'	Selects which unit for temperature is used: °C, K, °F		°C

A.6.1.3. Setting Parameter Password in controller

(Refer to Fig. A.5. for central control panel description)

- Press function button “F1” under “Menu” on display screen
- Scroll down to “Modify Parameters” using the down scroll arrow
- Select “Modify Parameters” by pressing the tabular button
- Scroll down to “Password” then press “F2” function button under “Modify” on display screen
- Set the password to “4735” using the scroll buttons to select the number and tabular button to move between the numbers
- Select function button “F1” under “Prog.” on display screen.
- Re-enter “4735” to confirm password.
- Select function button “F1” under “Prog.” on display screen to activate password.

Appendix A – Central Control System

A.6.2.1. Navigating through the On-Screen Menu (Ref. FIG A.5 Central Control Panel)

To view the existing ES-6 controller settings and current operating conditions press the downward scroll key on the main control panel. To return to the main screen at any time press the “Main” button (F1). (See FIG. 6.2.1. General Settings Menu Flow Diagram)

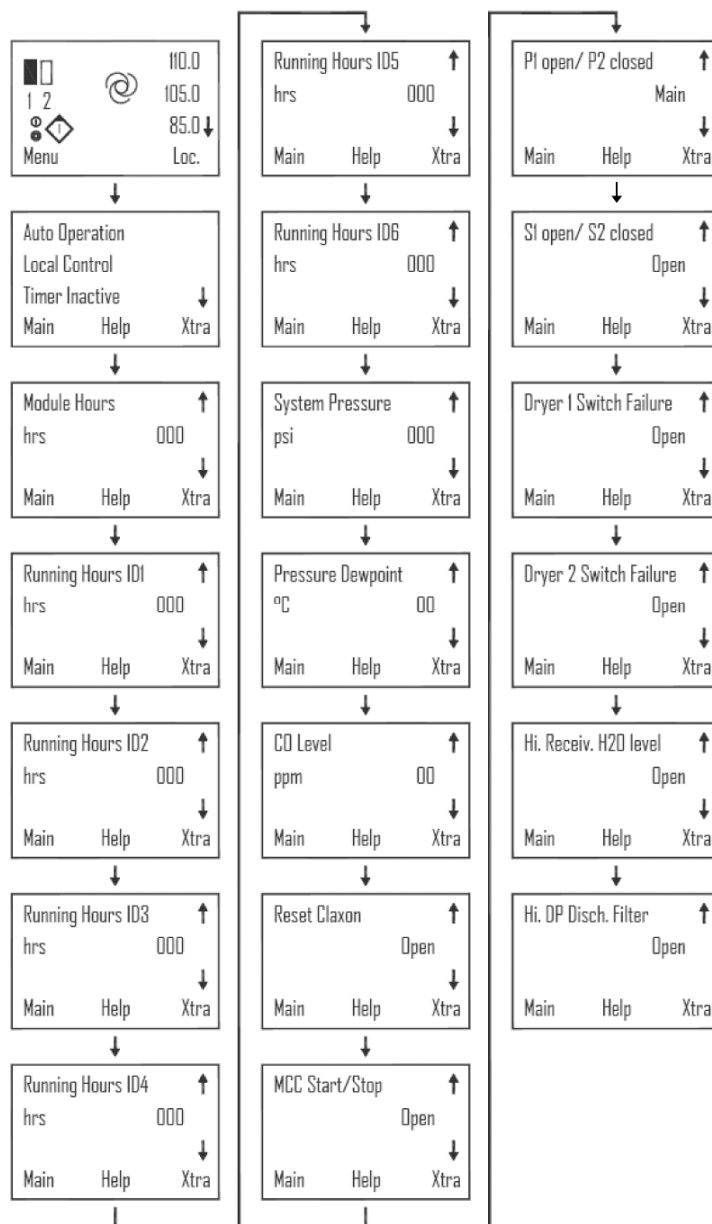


FIG. 6.2.1. General Settings Menu Flow Diagram

Appendix A – Central Control System

A.6.2.2. Main Menu

The ES-6 controller menu consists of six main categories (Status Data, Measured Data, Counters, Test, Modify Parameters and Saved Data) and can be accessed by selecting “Menu” (F1) on the main display. The following menu flow diagrams will show how to navigate through each main category.

A.6.2.3. Status Data

The “Status Data” menu displays the status of all the shutdown and “Measured data” warnings. (See FIG. 6.2.3. Status Data Menu Flow Diagram)

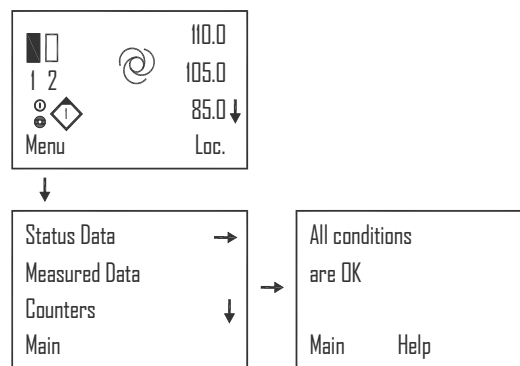


FIG. 6.2.3. Status Data Menu Flow Diagram

Appendix A – Central Control System

A.6.2.4. Measured Data

The “Measured Data” menu displays all the current conditions of the system and will allow you to view the warning settings for certain conditions. (See FIG. 6.2.4. Measured Data Menu Flow Diagram)

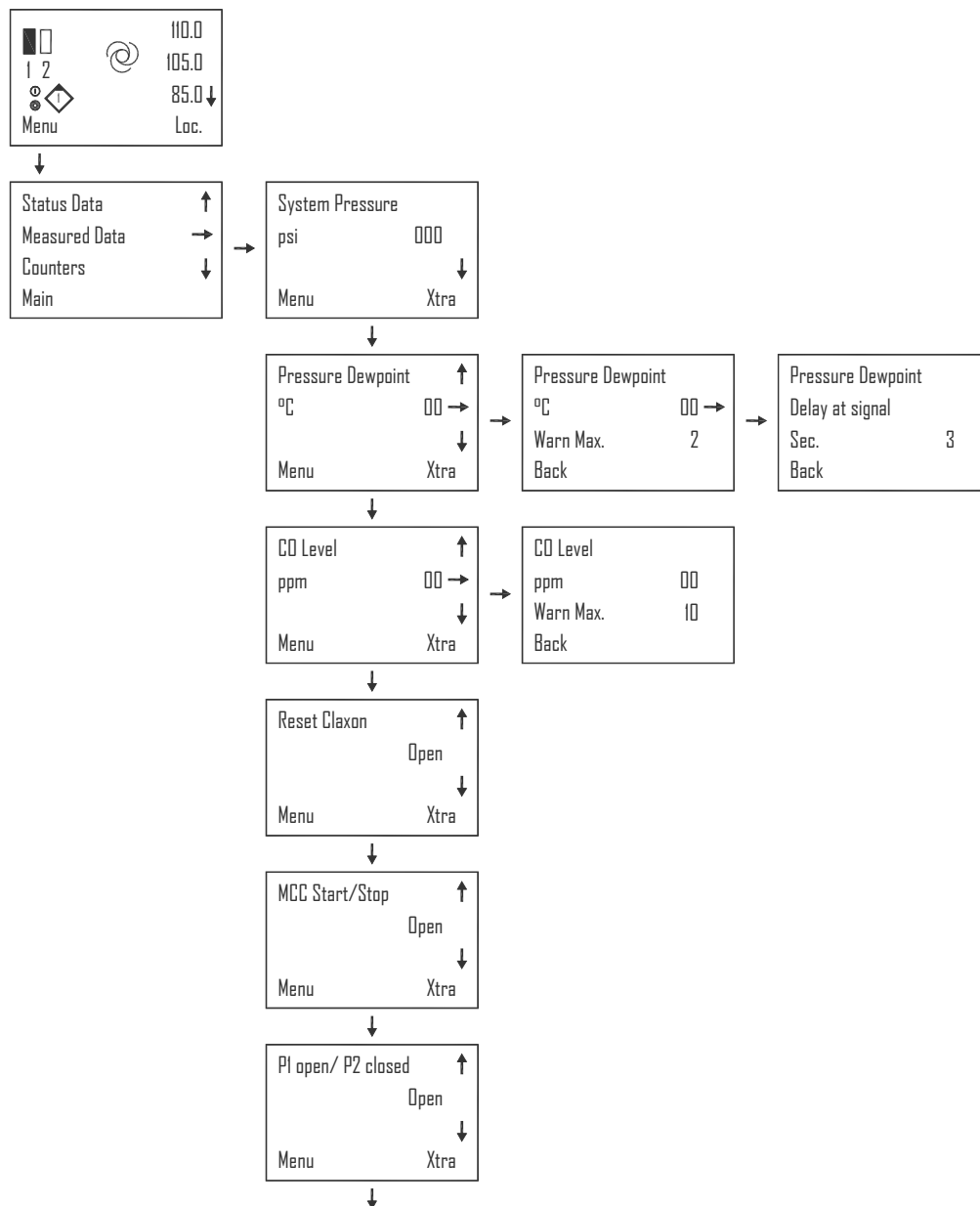


FIG. 6.2.3. Measured Data Menu Flow Diagram

Appendix A – Central Control System

A.6.2.4. Measured Data (continued)

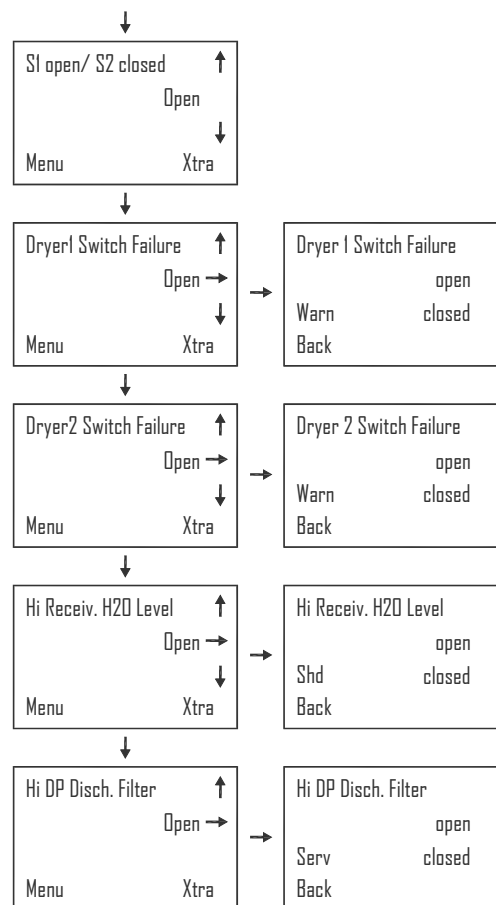


FIG 6.2.4. Measured Data Menu Flow Diagram

Appendix A – Central Control System

A.6.2.5. Counters

The “Counters” menu displays the Module (system) total run time and the run time for each compressor in the module. (See FIG. 6.2.5. Counters Menu Flow Diagram)

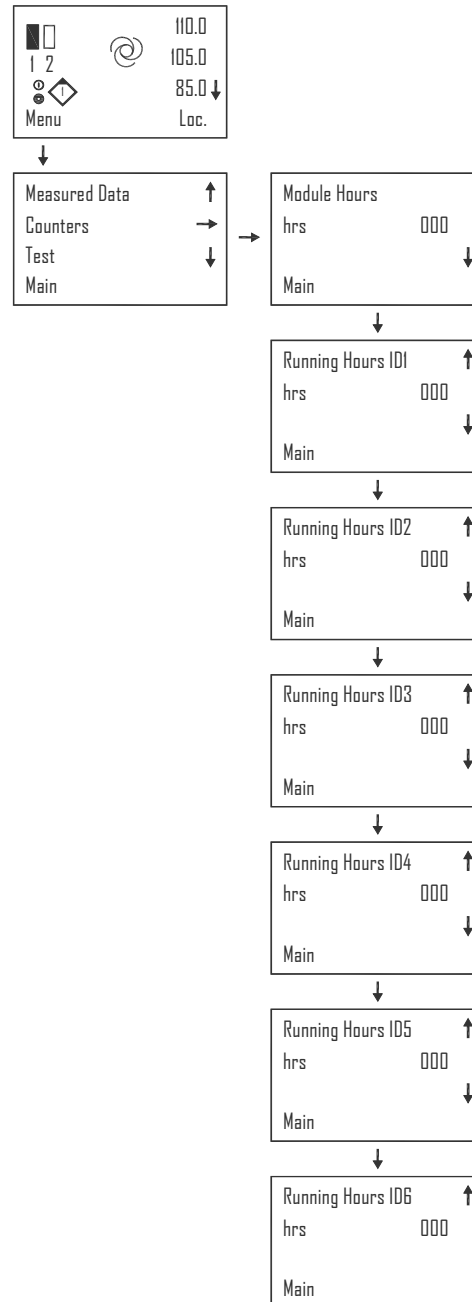


FIG. 6.2.5. Counters Menu Flow Diagram

Appendix A – Central Control System

A.6.2.6. Test

The “Test” menu allows the user to test the display and test the operation of the 9 NO/NC outputs from the Elektronikon. Refer to the Electrical Schematic included with the unit to identify the operations controlled by each output from the Elektronikon. **Note:** The Elektronikon must be in “local” mode before you can test the controllers’ outputs. To do so, press “F3” when at the main screen. The display “Loc.” just above the “F3” button will turn off and the center display will change from “automatic operation” to “local operation” (See A.5.1 ES-6 Status for respective operation symbols) Once in local mode navigate to the “Test” menu to test outputs (See FIG. 6.2.6. Test menu flow diagram). To return the system to “automatic operation” press the start button on the left side of the controller.

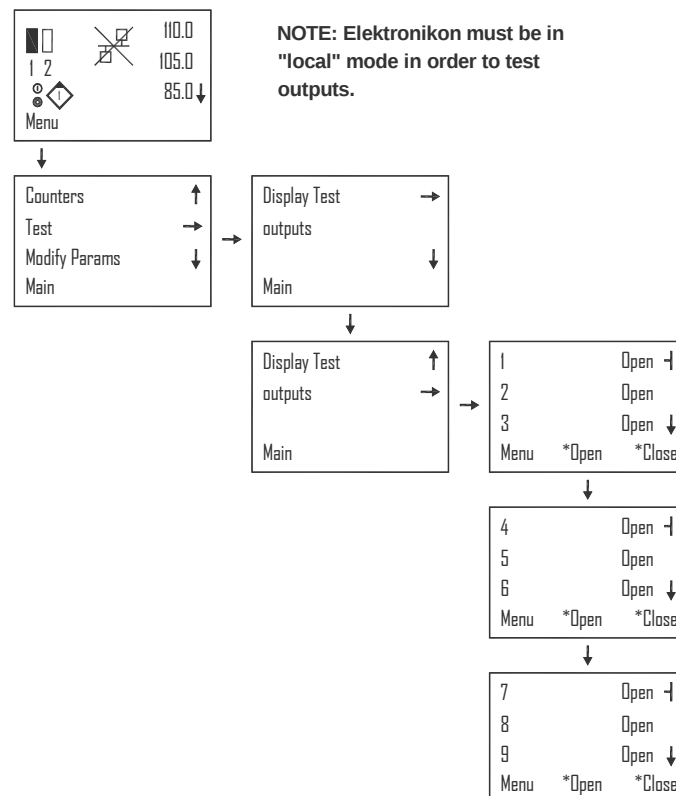


FIG. 6.2.6. Tests Menu Flow Diagram

Appendix A – Central Control System

A.6.2.7. Modify Parameters - Parameters

The Parameters section is password protected and can only be changed by a certified **BeaconMedaes** service technician. Contact **BeaconMedaes** Technical Services department at 1-888-4MEDGAS (888-463-3427) for assistance. (See FIG. 6.2.7. Parameters menu flow diagram).

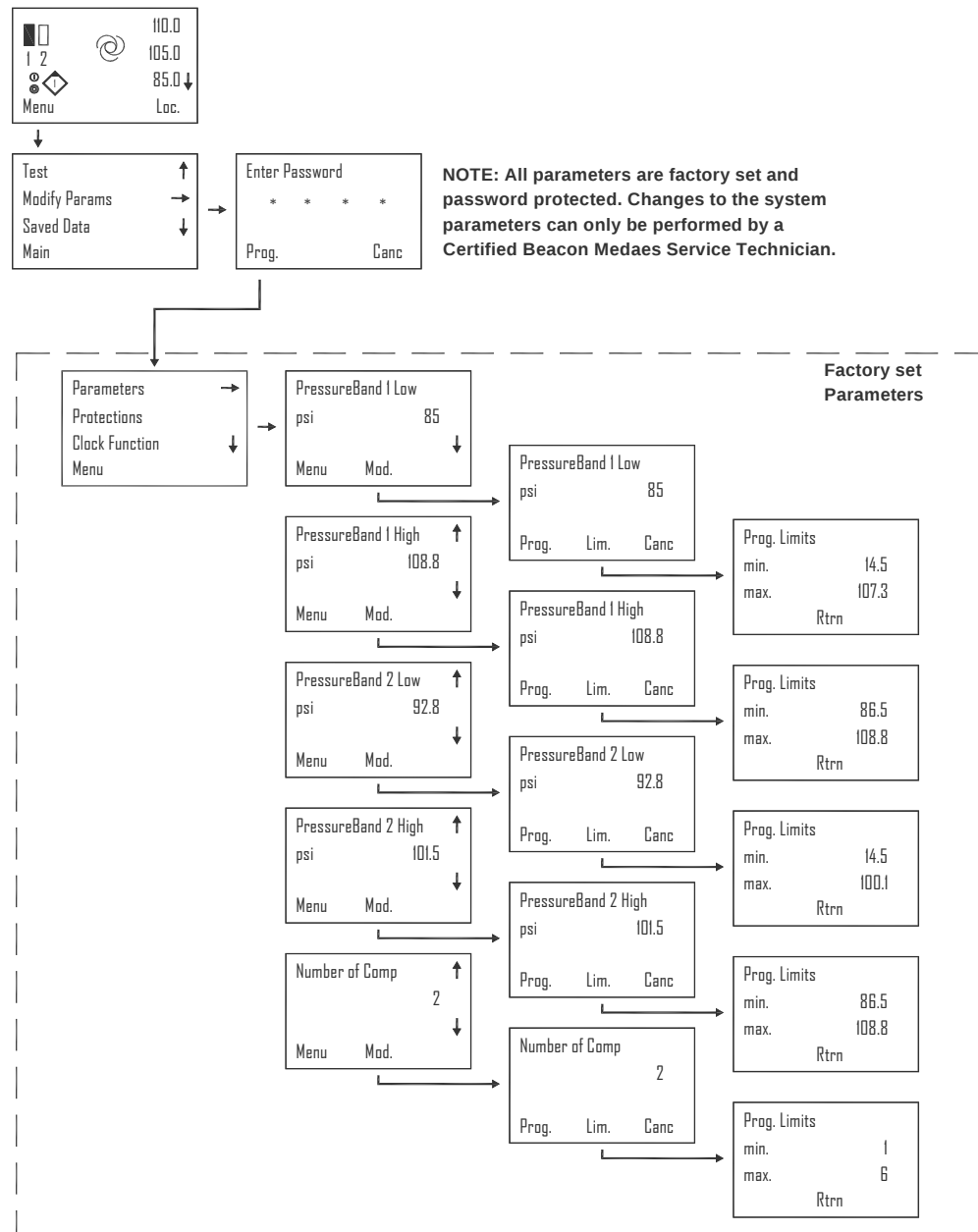


FIG. 6.2.7. Parameters Menu Flow Diagram

Appendix A – Central Control System

A.6.2.7. Modify Parameters (continued)

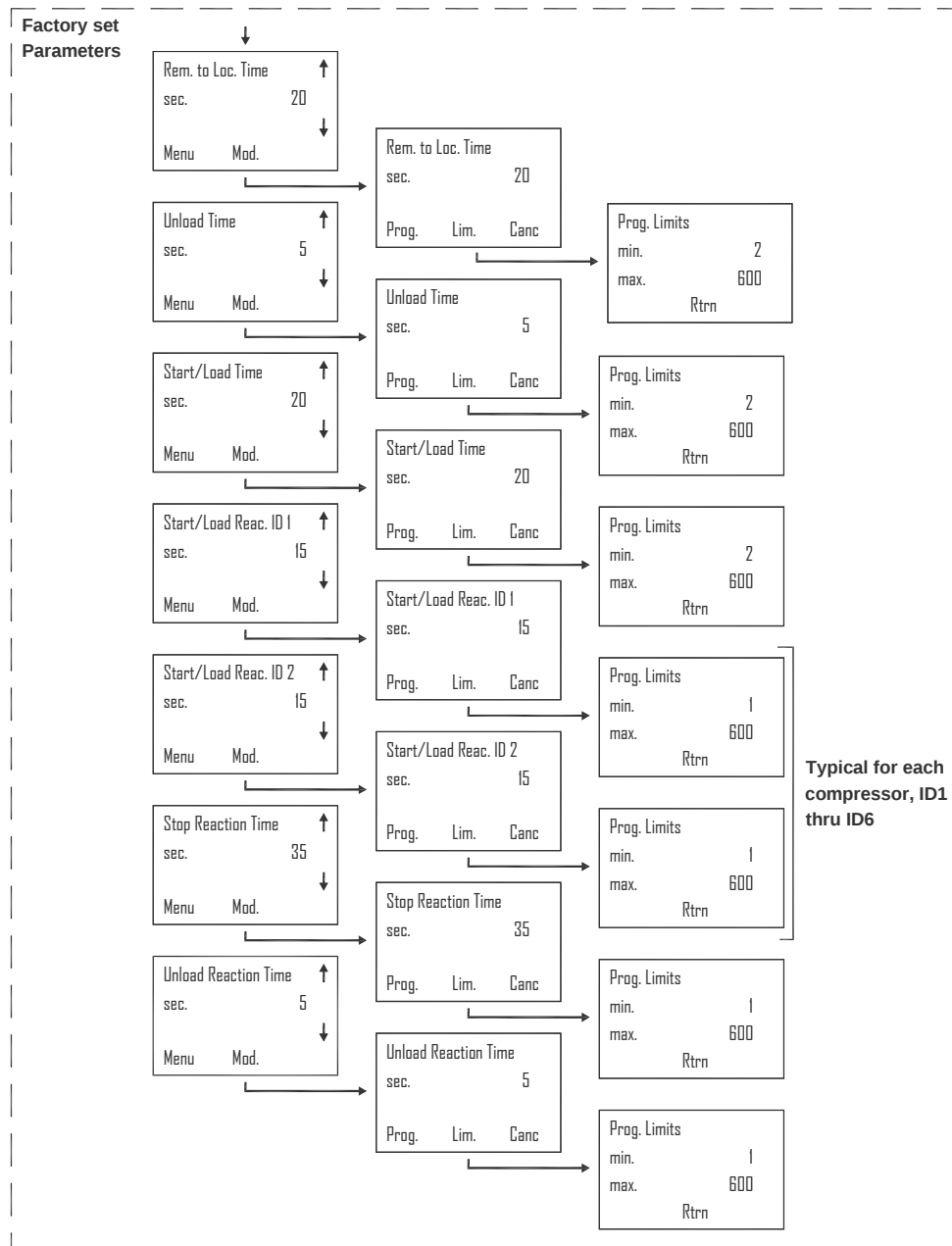


FIG. 6.2.7. Parameters Menu Flow Diagram (continued)

Appendix A – Central Control System

A.6.2.7. Modify Parameters (continued)

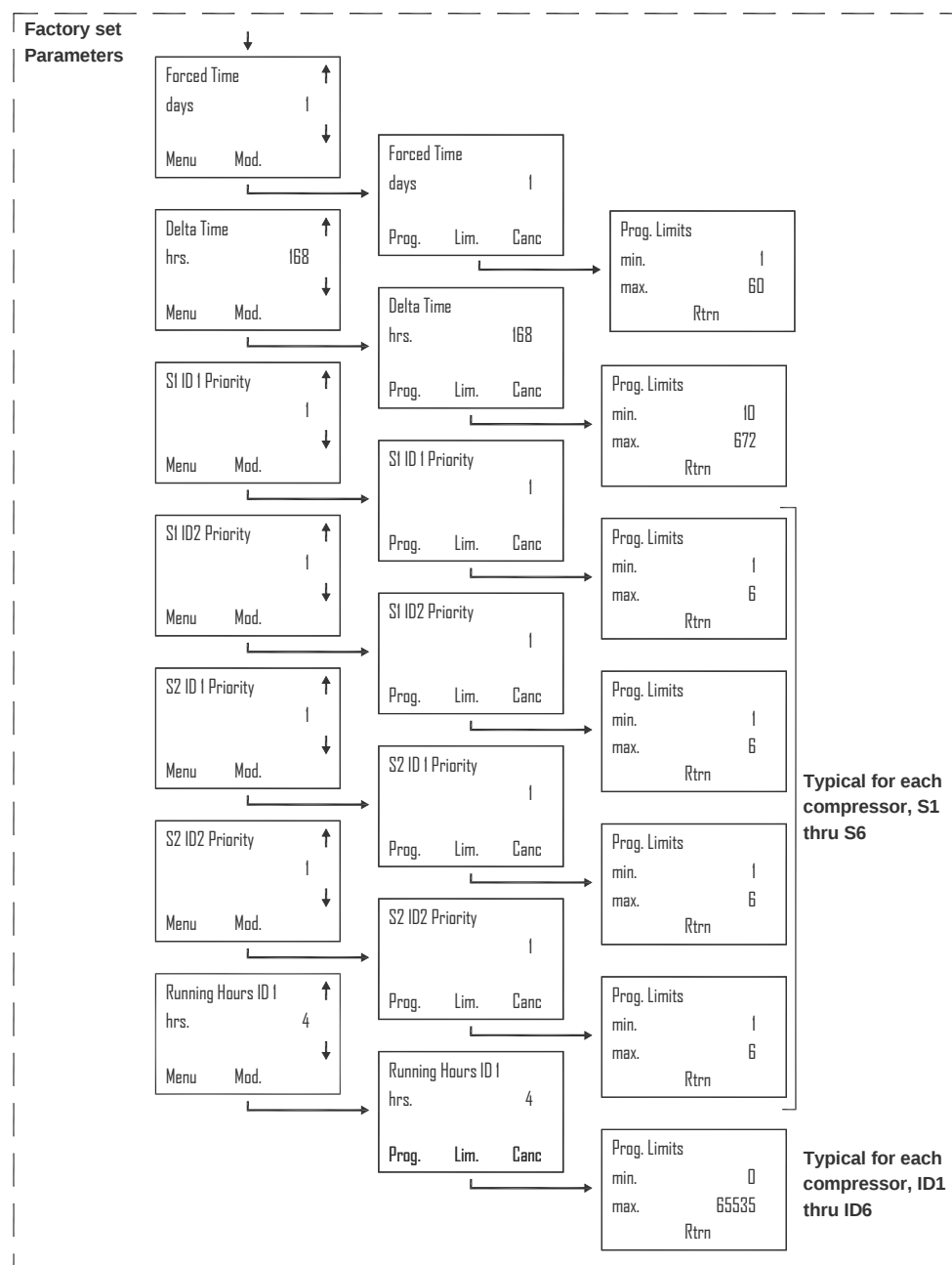


FIG. 6.2.7. Parameters Menu Flow Diagram (continued)

Appendix A – Central Control System

A.6.2.7. Modify Parameters (continued)

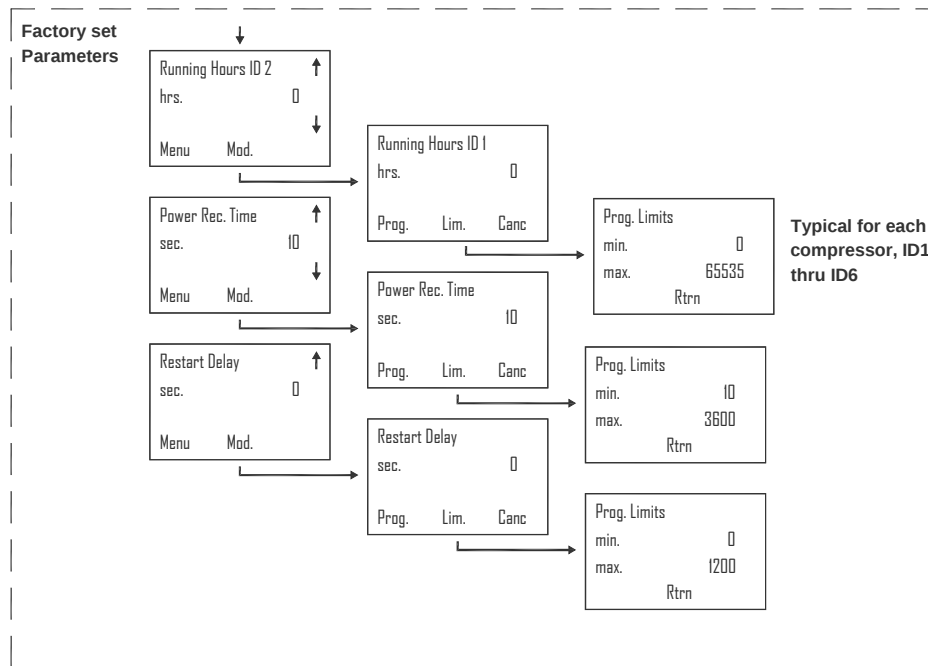


FIG. 6.2.7. Parameters Menu Flow Diagram (continued)

Appendix A – Central Control System

A.6.2.8. Modify Parameters – Protections

The Protections section is password protected and can only be changed by a certified **BeaconMedaes** service technician. Contact **BeaconMedaes** Technical Services department at 1-888-4MEDGAS (888-463-3427) for assistance.

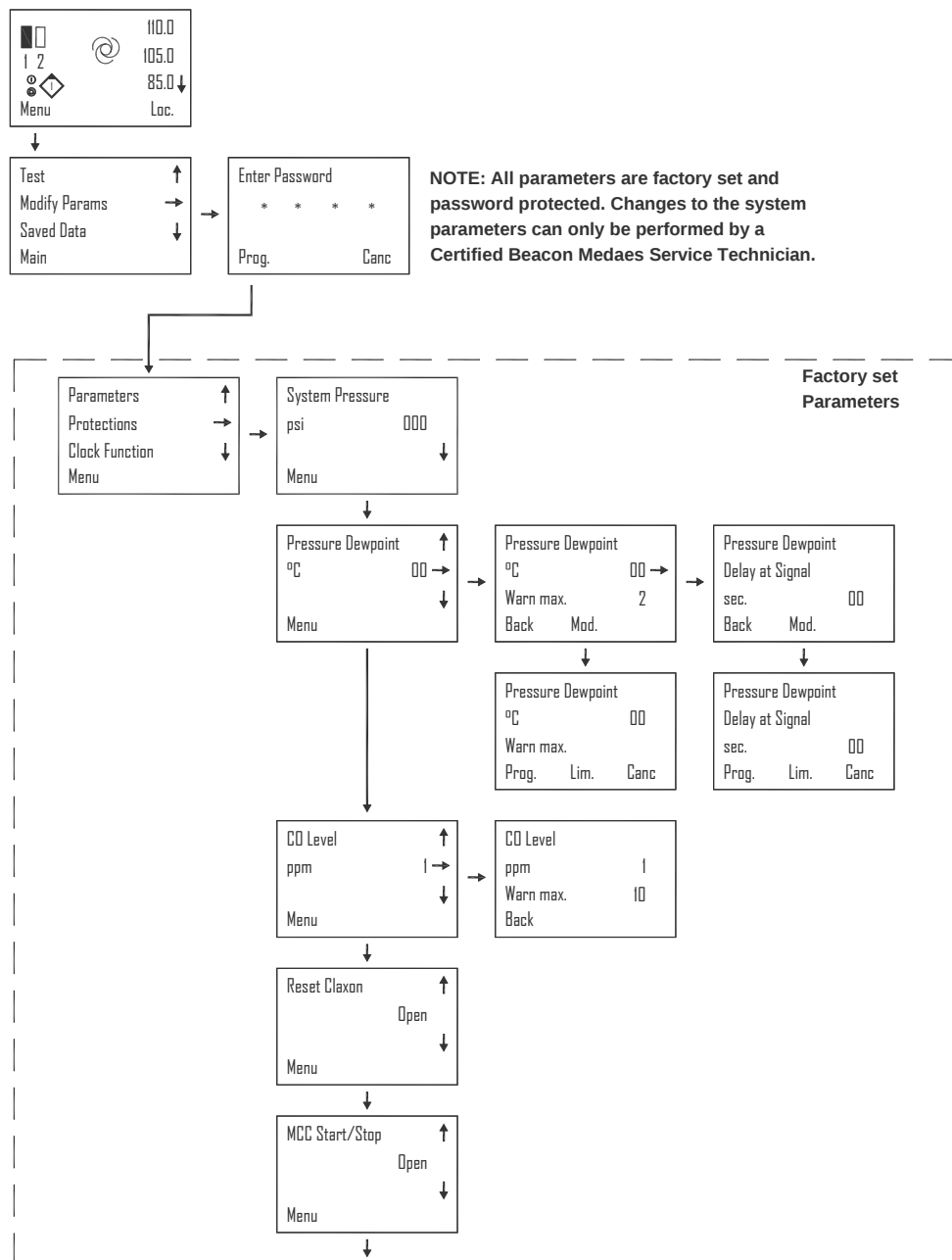


FIG. 6.2.8. Protections Menu Flow Diagram

Appendix A – Central Control System

A.6.2.8. Modify Parameters – Protections (continued)

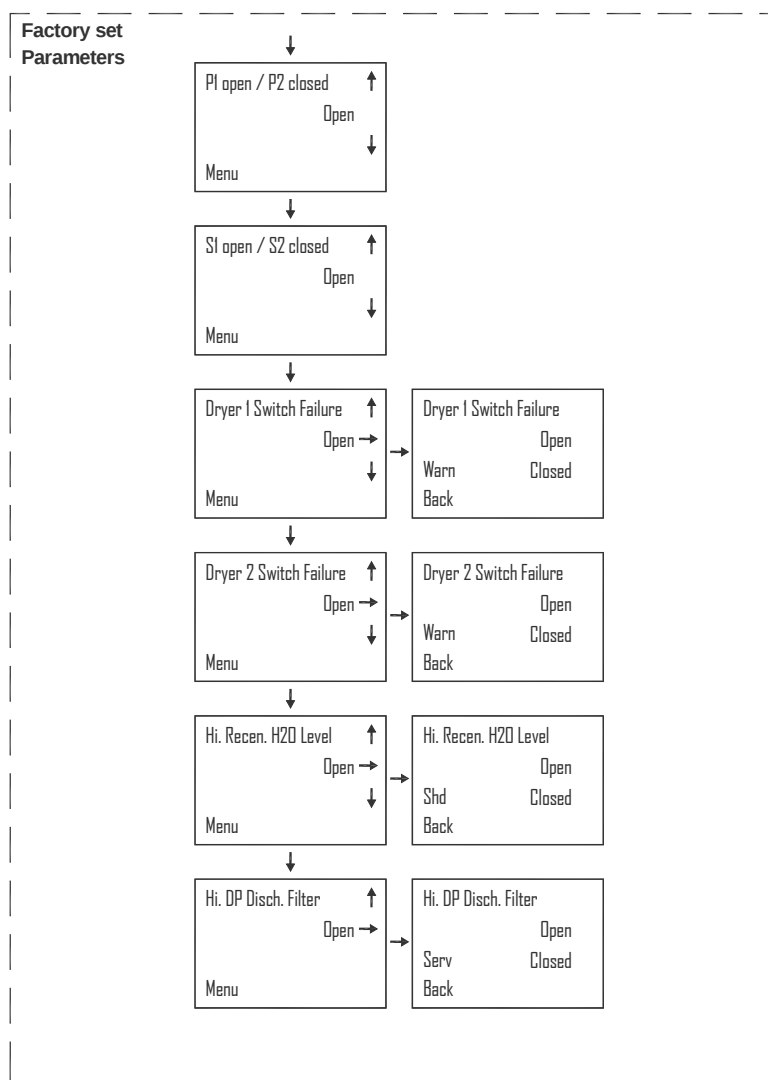


FIG. 6.2.8. Protections Menu Flow Diagram (continued)

Appendix A – Central Control System

A.6.2.9. Modify Parameters – Clock Functions

The Clock Functions section is password protected and can only be changed by a certified **BeaconMedaes** service technician. Contact **BeaconMedaes** Technical Services department at 1-888-4MEDGAS (888-463-3427) for assistance.

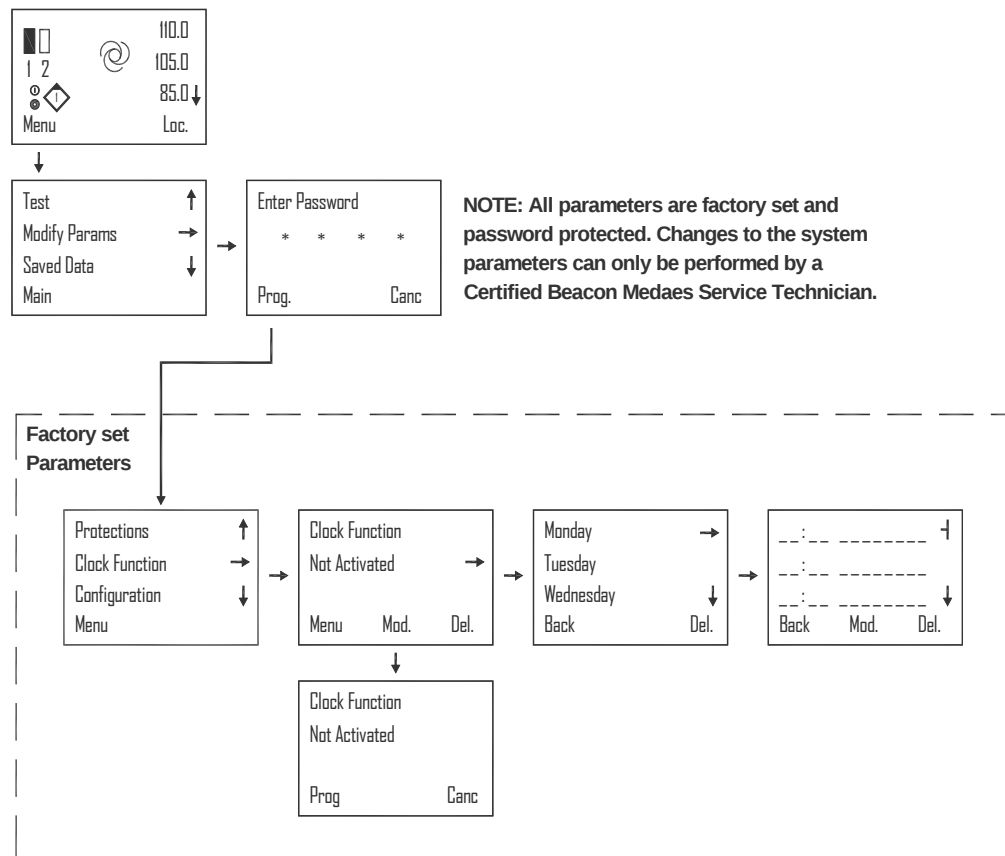


FIG. 6.2.9. Clock Function Menu Flow Diagram

Appendix A – Central Control System

A.6.2.10. Modify Parameters – Configuration

The Configuration section is password protected and can only be changed by a certified **BeaconMedaes** service technician. Contact **BeaconMedaes** Technical Services department at 1-888-4MEDGAS (888-463-3427) for assistance.

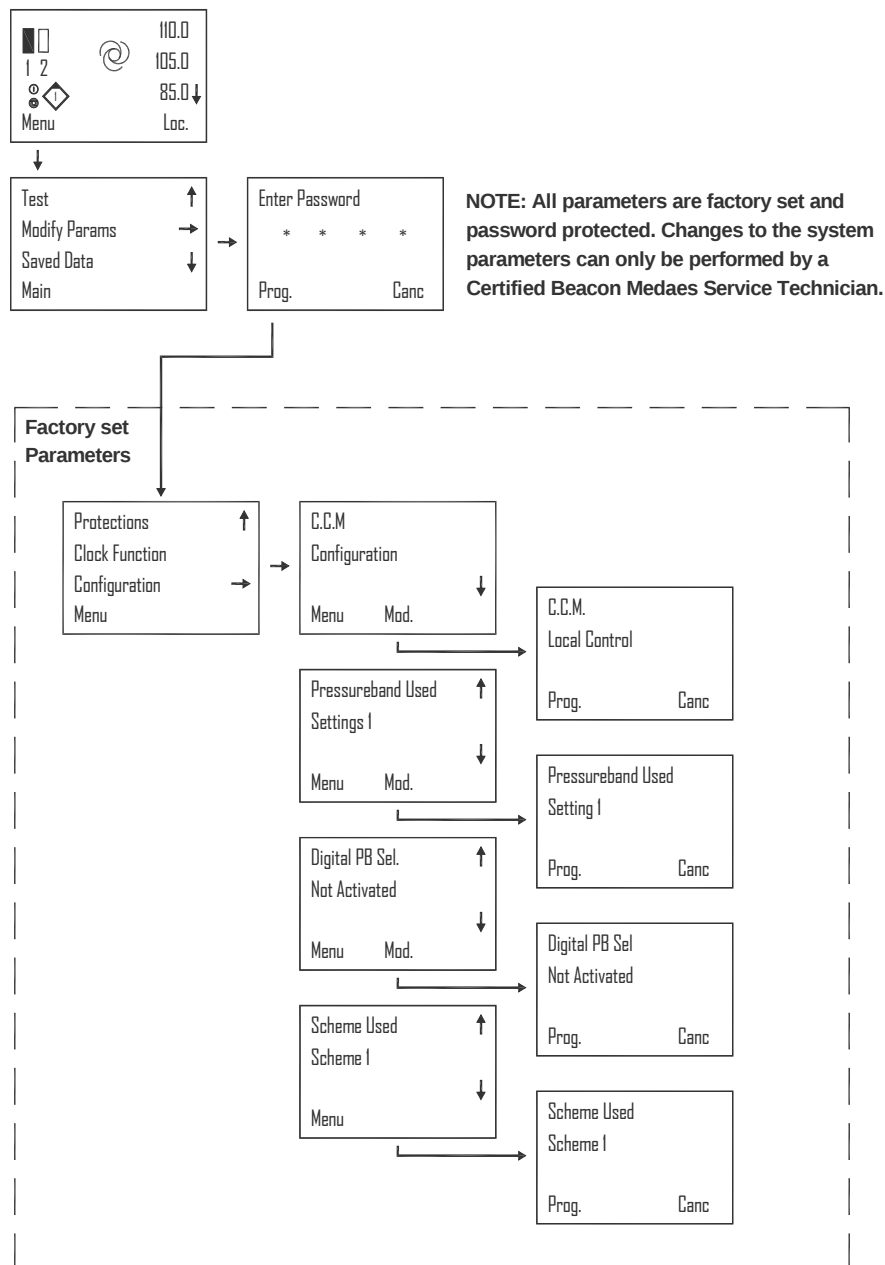


FIG. 6.2.10. Configuration Menu Flow Diagram

Appendix A – Central Control System

A.6.2.10. Modify Parameters – Configuration (continued)

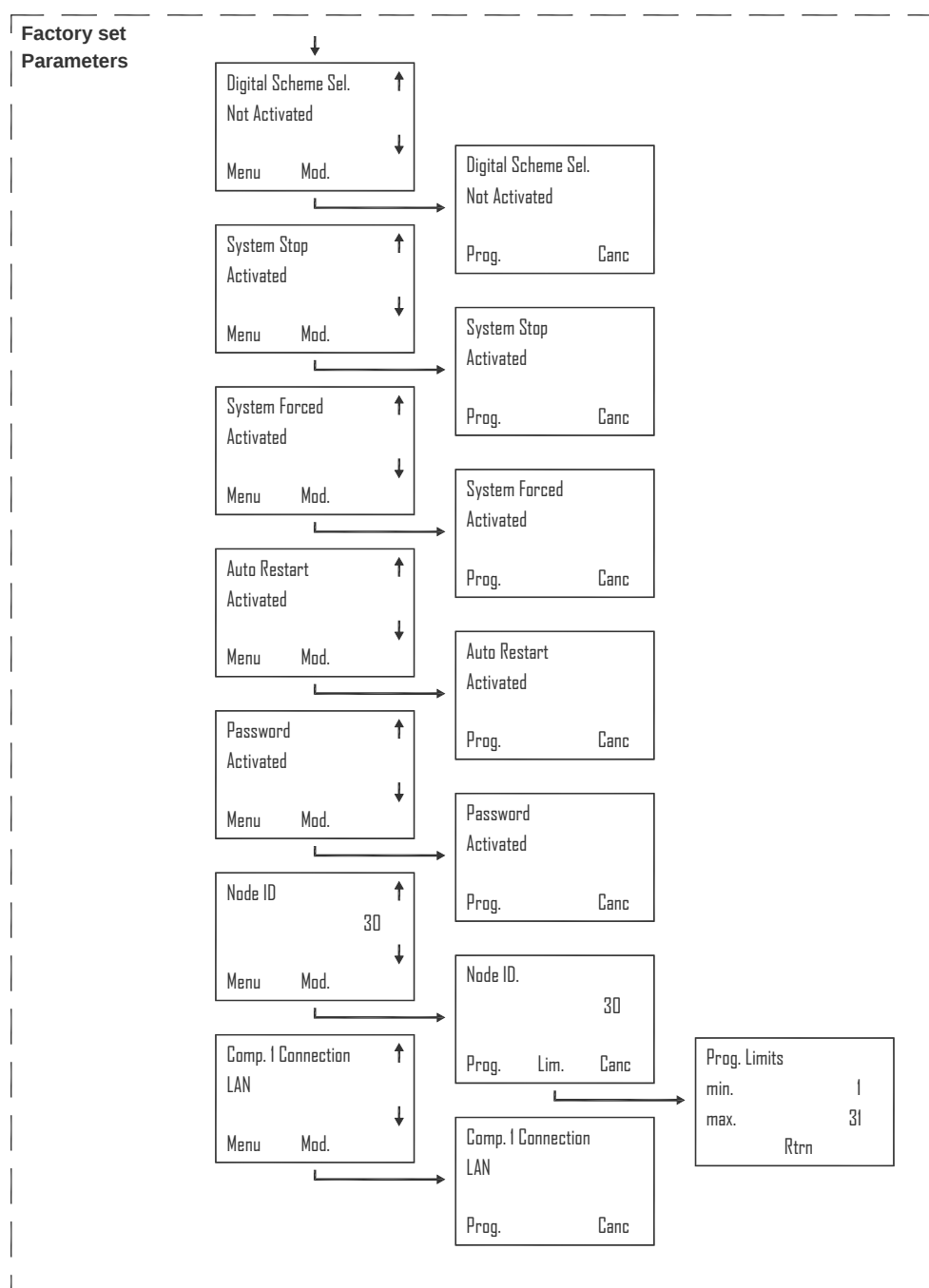


FIG. 6.2.10. Configuration Menu Flow Diagram (continued)

Appendix A – Central Control System

A.6.2.10. Modify Parameters – Configuration (continued)

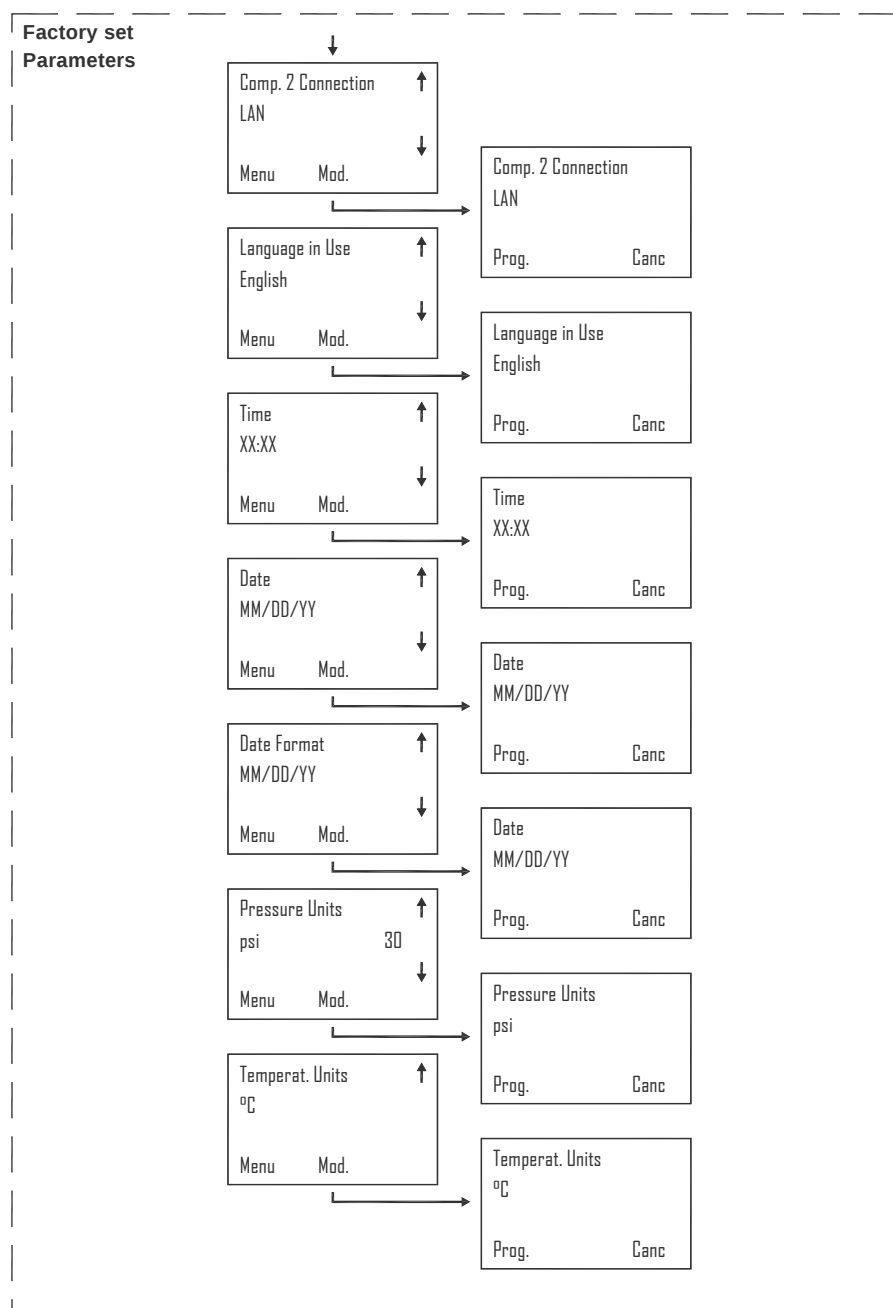


FIG. 6.2.10. Configuration Menu Flow Diagram (continued)

Appendix A – Central Control System

A.6.2.11. Saved Data

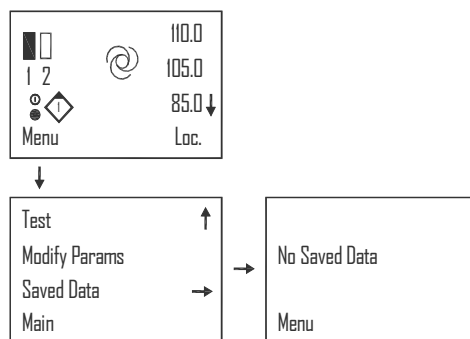


FIG. 6.2.11. Saved Data

Appendix A – Central Control System

A.7. Integrating Compressors

In general, the Elektronikon control system has the following functions:

- Controlling the compressors
- Protecting the compressors
- Monitoring components subject to service
- Automatic restart after voltage failure

A.7.1.1. Controlling the Compressor

The CCS maintains the net pressure between programmable limits by automatically loading and unloading the compressor depending on the air consumption. The regulator takes into account a number of programmable settings, such as:

- The unload pressure
- The loading pressure
- The minimum stop time
- The maximum number of motor starts

The CCS stops the compressor whenever possible (when the expected unloading period exceeds a programmed value) to reduce the power consumption and restarts it automatically when the net pressure decreases. In case the expected unloading period is below a programmed value, the CCS keeps the compressor running to prevent too-short standstill periods.

When the compressor has stopped automatically and the net pressure decreases, the CCS will start the compressor before the net pressure has dropped to the loading pressure to prevent the net pressure from falling under the programmed minimum level.

When stopping the compressor manually, the regulator will unload the compressor for a programmed time and then stop the compressor.

A.7.1.2. Protecting the Compressor

Several temperature and pressure sensors are provided on the compressor. If one of these measurements exceeds the programmed shut-down level, the compressor will be stopped. This will be indicated on the control display.

A.7.1.3. Shut-Down warning

If the CCS detects a temperature or pressure just below the programmed shut-down level, this will be indicated on the control panel to warn the operator before the shut-down level is reached. The message disappears as soon as the warning condition disappears.

Appendix A – Central Control System

A.7.1.4. Service warning

A number of service operations are grouped in plans (called service plan A, B, C...). Each service plan has a programmed time interval. If a time interval is exceeded, a message will appear on the display to warn the operator to carry out the service actions belonging to that plan.

A.7.1.5. Automatic restart after voltage failure

The CCS has a built in function to automatically restart the compressor if the voltage is restored after voltage failure. For compressors leaving the factory, this function is made inactive. This function should be made active by a **BeaconMedæS** service representative at start-up.

WARNING!
IF ACTIVATED AND PROVIDED THE MODULE WAS IN THE AUTOMATIC OPERATION MODE, THE COMPRESSOR WILL AUTOMATICALLY RESTART IF THE SUPPLY VOLTAGE TO THE MODULE IS RESTORED WITHIN THE PROGRAMMED TIME PERIOD.

The power recovery time (the period within which the voltage must be restored to have an automatic restart) can be set between 15 and 3600 seconds or to infinite. If the power recovery time is set to infinite, the compressor will always restart after a voltage failure, no matter how long it takes to restore the voltage. A restart delay can also be programmed, allowing e.g. two compressors to be restarted one after the other.

A.7.1.6. Start commands during programmed stop time and minimum stop time

Programmed Stop Time

After pressing stop button, the compressor will run unloaded for a programmed time period. The compressor then stops. A start command during this period is ignored.

Minimum Stop Time

After stopping, the module prevents the motor from restarting within a programmed time period. A start command during this time will be memorized and executed after running out of this period.

Appendix A – Central Control System

A.8 Preparations for Initial Start-Up

It is not necessary to stop compressors running in cascade to integrate the ES-6 into the compressor installation.

- Stick labels on the control panels of the compressors connected to the ES 6 as well as on an obvious place inside these compressors, warning the operator that the compressor is remotely started and stopped by a separate controller. These labels must warn the operator that, after voltage failure, the controller can remotely start and stop the compressors, depending on the air demand and programmed values.
- Connect the power supply cables of the ES 6 controller to an appropriate single-phase voltage.
- Switch on the voltage.
- Have the network configured (commissioned) by BeaconMedæs Service Personnel.
- Check that the default parameters for the ES-6 Controller on the Dryer Control Module have been changed to the BeaconMedæs values per Section A.6.1 Parameter Listing.
- Check that the default parameters for the Elektronikon Controller on the compressors have been changed to the BeaconMedæs values per section A.7.5. Parameter Listing - Compressor

Appendix B – Compressor Controller (Mk4)

B.1 Safety Precautions

WARNING!

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

B.1.1 General Precautions

1. The operator must employ safe working practices and observe all related local work safety requirements and regulations.
2. If any of the following statements does not comply with local legislation, the stricter of the two shall apply.
3. Installation, operation, maintenance, repair work must only be performed by authorized, trained, specialized personnel.
4. Before carrying out any maintenance, repair work adjustments or any other non-routine checks, stop the device. In addition, the power isolating switch must be opened and locked.
5. Use only correct tools for maintenance and repair work.
6. Use only genuine **BeaconMedaes** spare parts. Contact **BeaconMedaes** Technical Services department at 1-888-4MEDGAS (1-888-463-3427) for technical support or to order spare parts.

Appendix B – Compressor Controller (Mk4)

B.2. Compressor Control Panel Parts and Functions (Mk4)

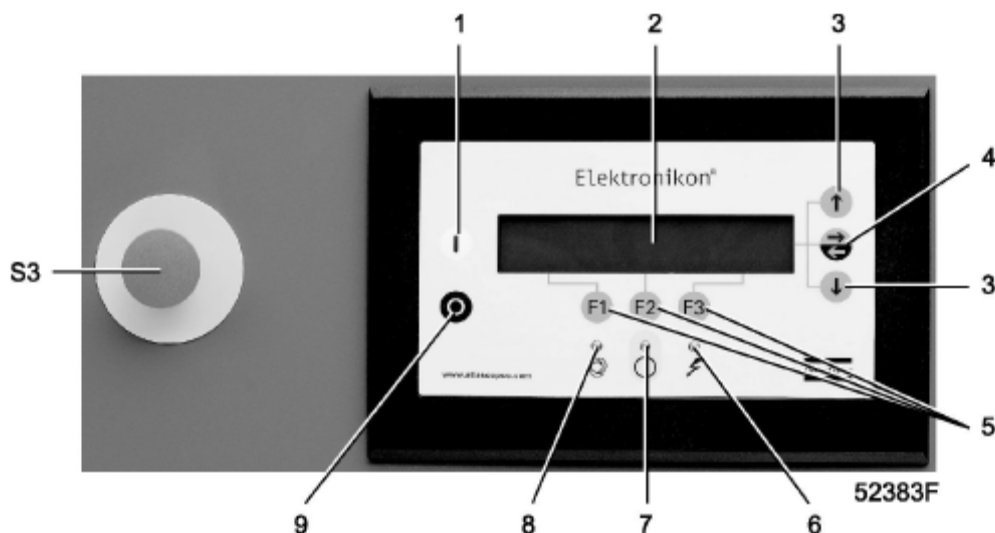


FIG. B.1. Compressor Control Panel

1. **Start Button:** Push button to start the compressor. LED (8) lights up indicating that the regulator is operative (in automatic operation).
 2. **Display:** Shows messages about the compressor operating condition, a service need or a fault.
 3. **Scroll Keys:** Keys to scroll upwards or downwards through the display.
 4. **Tabular 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.
 5. **Function Keys:** Keys to control and program the compressor. The functions of the keys vary depending on the displayed menu. The actual function is indicated just above the relevant key.
 6. **Voltage on LED:** Indicates that the voltage is switched on.
 7. **General Alarm LED:** Is lit if warning, service warning or shut-down warning condition exists. Flashes if a shut-down condition exists, if an important sensor is out of order or after an emergency stop.
 8. **Automatic Operation LED:** Indicates that the regulator is automatically controlling the compressor.
 9. **Stop Button:** Button to stop compressor. LED (8) goes out. The compressor will stop after running in unloaded condition for about 30 seconds.
- S3. Emergency Stop Button:** Push button to stop the compressor immediately in case of emergency. After remedying the trouble, unlock the button by pulling it out and press reset key 5.

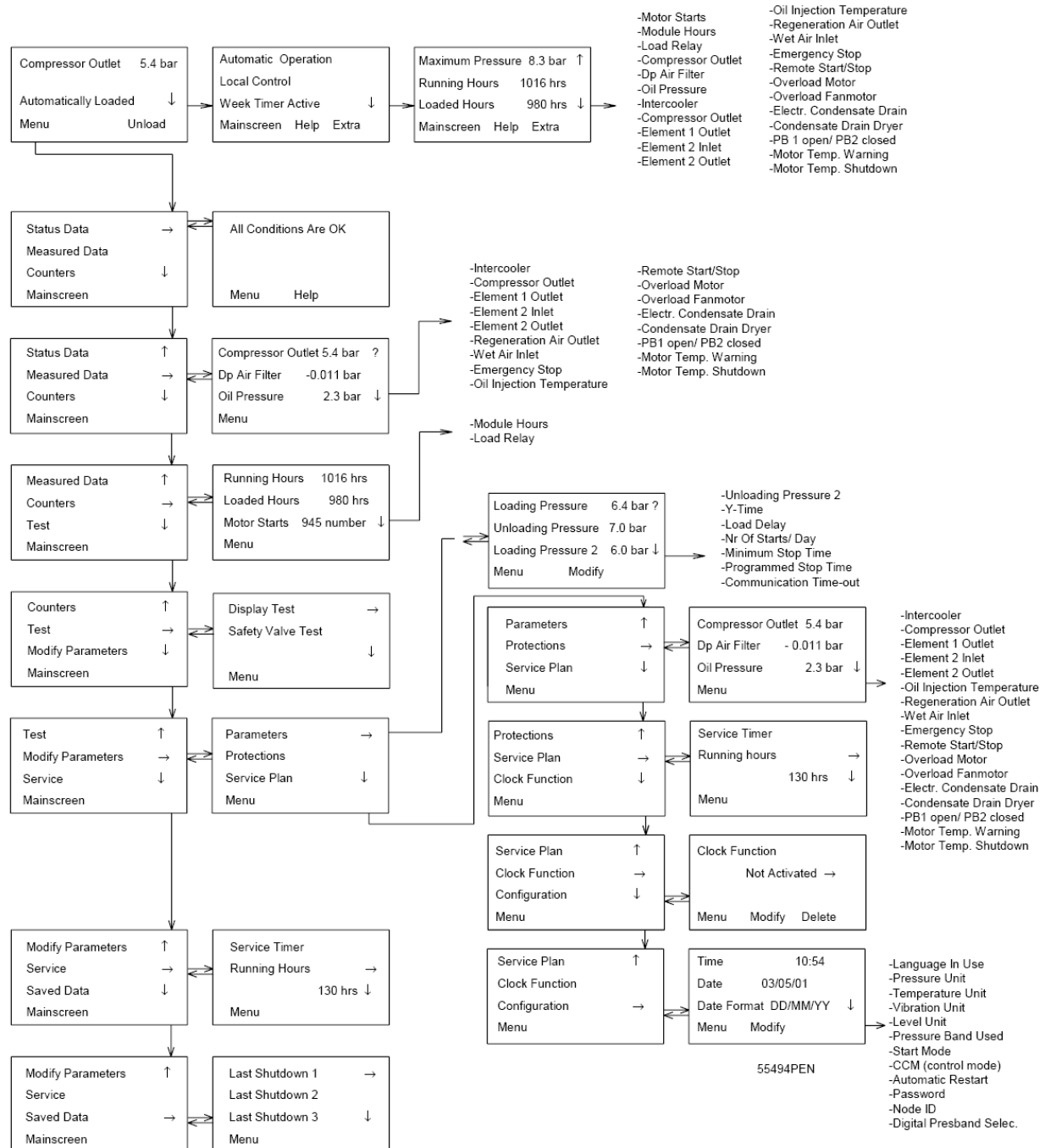
Appendix B – Compressor Controller (Mk4)

B.3. Function of control programs

Program/Function	Description
Main Screen	Shows in short the operation status of the compressor. It is the gateway to all functions
Status data	Calling up the status of the compressor protection functions: shut-down, shut-down warning, service warning, warning. Resetting of a shut-down, motor overload and service condition.
Measured data	Calling up the actually measured data and the status of a number of inputs.
Counters	Calling up the number of running hours, loaded hours, motor starts, ...
Test	Allows a display test.
Modify Parameters	Modifying the parameters for: - parameters (e.g. loading pressure) - protections (e.g. air temperature shut-down level) - service plans - clock functions (automatic compressor start/stop/pressure band commands) - configuration (time, date, display language, ...)
Service	Calling up service plans and resetting the timers
Saved data	Calling up saved data: last shut-down, last emergency stop data

Appendix B – Compressor Controller

B.4. Navigating through the On-Screen Menu – Fixed Speed Compressor (Ref. FIG B.2.1. Compressor Control Panel)



Appendix B – Compressor Controller

B.5. Parameters – Fixed Speed Compressor

The compressor parameters are separated into the two following sections: B.5.1 Parameters and B.5.2 Configuration. The two sections are located under “Modify Parameters” on the compressor controller. See B.4 for on-screen navigation diagram.

B.5.1 Parameter Listing

Name	Description	Controller Default value	BeaconMedaes value
'Pressure Band 1 Low'	Low pressure level of Pressure band 1	7 bar	90 psi
'Pressure Band 1 High'	High pressure level of Pressure band 1	8 bar	105 psi
'Pressure Band 2 Low'	Low pressure level of Pressure band 1	7 bar	90 psi
'Pressure Band 2 High'	High pressure level of Pressure band 1	8 bar	105 psi
'Start/Load Reac. IDT'	Start + Load Reaction time of connection channel 1 Time which the compressor has to run in load condition after a start command	20 seconds	20 seconds
'Y-Time'		10 seconds	10 seconds
'Load Reaction'	Time which the compressor has to run in load condition after start command	10 seconds	10 seconds
'Stop Reaction'	Time which the compressor has to stop after a stop command	35 seconds	35 seconds
'Unload Reaction'	Time which the compressor has to run in unload condition after an unload command	5 seconds	5 seconds
'Load Delay'		0 seconds	0 seconds
'Restart Delay'	Start delay after voltage is restored	5 seconds	5 seconds
'Number of Starts/Day'	Limits the number of times the compressor can be started and stopped in a day	240	240
'Minimum Stop Time'	Time which the compressor has to stop before restarting	20 seconds	20 seconds
'Communication Timeout'		30 seconds	30 seconds

Appendix B – Compressor Controller

B.5.2. Configuration listing

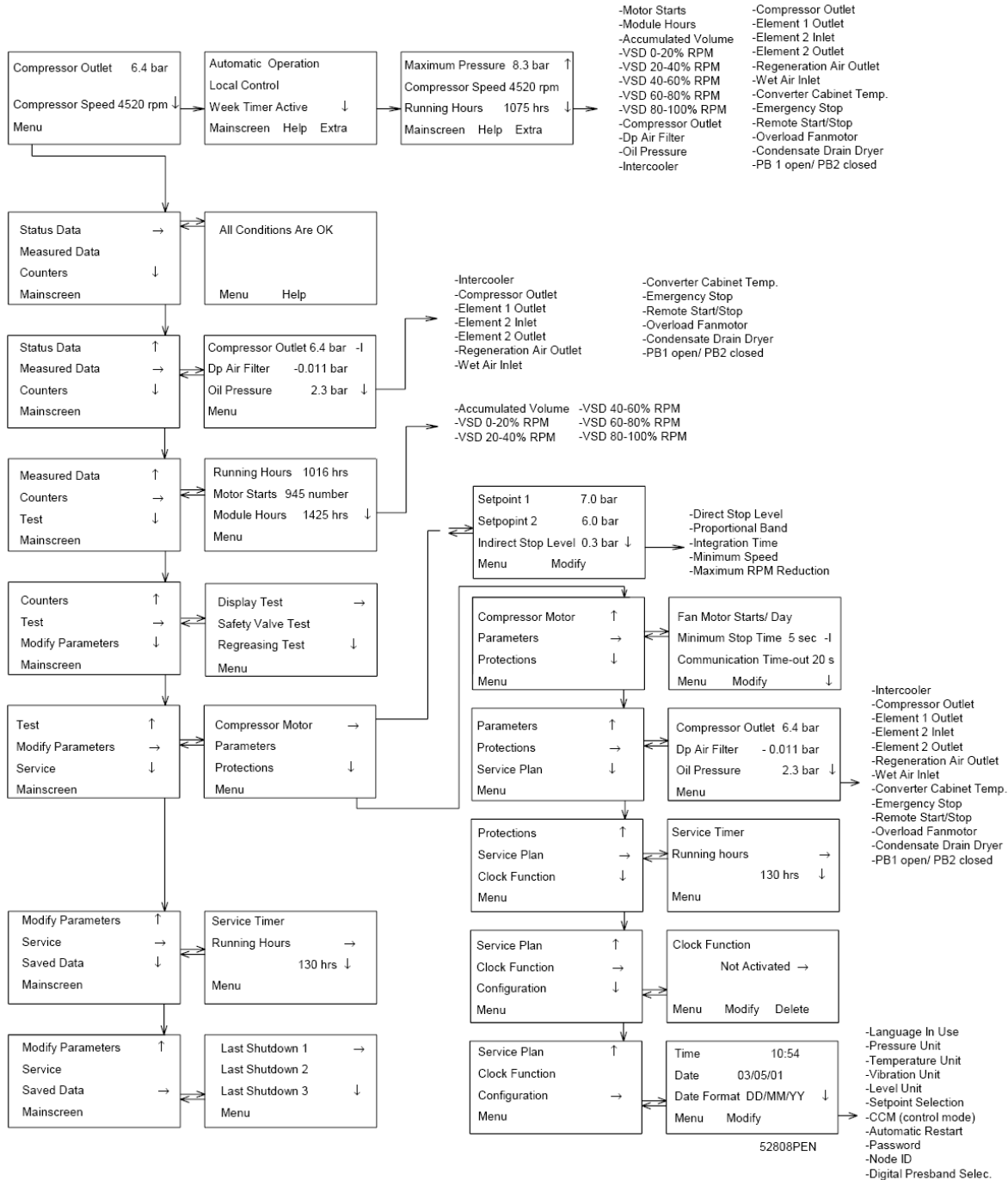
Name	Description	Controller Default value	BeaconMedaes value
'Power Recovery Time'	Maximum allowed power down time to accept the Automatic Restart After Voltage Failure (ARAVF)	3600 seconds	Infinite*
'C.C.M. '	ES6 Control Mode (Local, Remote, LAN)	Local	LAN
'Pressure Band Selec'	Allows manual selection between pressure band 1 or 2	Press Band 1	Press Band 1
'Auto Restart'	Allows the ES6 to restart after a power failure	Not Activated	Infinite
'Password'	This feature allows the parameters to be protected by a user defined password	Not Activated	Activated**
'Language'		English	English
'Time'		E.S.T.	E.S.T.
'Date'		Current	Current
'Date Format'		DD/MM/YY	MM/DD/YY
'Pressure Units'		Bar	psi
'Temperature Units'		°C	°C
'Vibration Units'		microns	microns
'Level Units'		mm	mm
'Flow Units'		LPS	CFM
'Volume Units'		Liter	Liter

* Controller display will show “oo! Sec” when “Auto Restart” parameter is set to infinite

** Requires password to change parameters and configuration (password = 4735)

Appendix B – Compressor Controller

B.6. Navigating through the On-Screen Menu – Variable Speed Compressor (VSD) (Ref. FIG B.2.1. Compressor Control Panel)



Appendix B – Compressor Controller

B.7 Parameters – Variable Speed Compressor (VSD)

The compressor parameters are separated into the three following sections: B.7.1 Compressor motor, B.7.2 Parameters and B.7.3 Configuration. All three sections are located under “Modify Parameters” on the compressor controller. See B.6 for on-screen navigation diagram.

B.7.1 Compressor Motor listing

Name	Description	Controller Default value	BeaconMedaes value
'Set point 1'		95 psi*	95 psi*
'Set point 2'		95 psi	95 psi
'Indirect stop level 1'***		4 psi	4 psi
'Direct stop level 1'		15 psi	15 psi
'Indirect stop level 2'***		4 psi	4 psi
'Direct stop level 2'		15 psi	15 psi
'Proportional band'		10 percent	10 percent
'Integration time'		6 seconds	6 seconds
'Minimum speed'	Minimum motor speed	Varies	Default
'Maximum rpm reduction'		100 percent	100 percent

B.7.2 Parameter listing

Name	Description	Controller Default value	BeaconMedaes value
'Fan Motor Start/Day'	Limits the number of times the fan motor can be started and stopped in a day	240	240
'Minimum stop time'	Minimum time between start and stop	5 seconds	5 seconds
'Power recovery time'	Maximum allowed power down time to accept the Automatic Restart After Voltage Failure (ARAVF)	3600 seconds	oo! sec**
'Restart Delay'	Start delay after voltage is restored	5 seconds	5 seconds
'Communication Time-out'		30 seconds	30 seconds
'Set point 1'		95 psi*	95 psi*
'Set point 2'		95 psi	95 psi
'Indirect stop level 1'		4 psi	4 psi
'Direct stop level 1'***		15 psi	15 psi
'Indirect stop level 2'		4 psi	4 psi
'Direct stop level 2'***		15 psi	15 psi
'Proportional band'		10 percent	percent
'Integration time'		6 seconds	seconds
'Minimum speed'	Minimum motor speed	Varies	Default
'Maximum rpm reduction'		100 percent	100 percent

* Typical settings for lead compressor. Lower these settings by 5 psi for each remaining compressor so each has a different local set point.

** Controller display will show “oo! Sec” when “Auto Restart” parameter is set to infinite.

*** It may be necessary to use FSP (Field Service Program) to set this parameter, contact BeaconMedaes Technical Support for additional information.

Appendix B – Compressor Controller

B.7.3 Configuration listing

Name	Description	Controller Default value	Beacon Medaes value
'C.C.M.'	ES6 Control Mode (Local, Remote, LAN)	LAN	LAN
'Setpoint selection'		Setpoint 1	Setpoint 1
'Node ID'		1	1
'Language in use'		English	English
'Time'		Current	Current
'Date'		Current	Current
'Date Format'		DD/MM/YY	MM/DD/YY
'Pressure Units'		Bar	psi
'Temperature Units'		°C	°F
'Vibration Units'		microns	microns
'Level Units'		mm	inch
'Flow Units'		LPS	CFM
'Volume Units'		Liter	Gallon
'Automatic restart'	Allows the ES6 to restart after power failure	Not activated	Infinite*
'Password'	This feature allows the parameters to be protected by a user defined password. (See B.8 to set	Not activated	Activated**
'M.C.C.'		Not activated	Not activated
'Digital pressure band selection'		Not activated	Not activated

* Requires pass code to activate (pass code = 4735)

** Requires password to change parameters and configuration (password = 4735)

Appendix B – Compressor Controller

B.8 Setting Parameter Password in controller

(Refer to Fig. B.2.1. for compressor control panel description)

- Press function button “F1” under “Menu” on display screen
- Scroll down to “Modify Parameters” using the down scroll arrow
- Select “Modify Parameters” by pressing the tabular button
- Scroll down to “Password” then press “F2” function button under “Modify” on display screen
- Set the password to “4735” using the scroll buttons to select the number and tabular button to move between the numbers
- Select function button “F1” under “Prog.” on display screen.
- Re-enter “4735” to confirm password.
- Select function button “F1” under “Prog.” on display screen to activate password.

Appendix C - Compressor Controller (Mk5)

C.1 Safety Precautions

WARNING:

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

C.1.1 General Precautions

1. The operator must employ safe working practices and observe all related local work safety requirements and regulations.
2. If any of the following statements does not comply with local legislation, the stricter of the two shall apply.
3. Installation, operation, maintenance, repair work must only be performed by authorized, trained, specialized personnel.
4. Before carrying out any maintenance, repair work adjustments or any other non-routine checks, stop the device. In addition, the power isolating switch must be opened and locked.
5. Use only correct tools for maintenance and repair work.
6. Use only genuine BeaconMedæs spare parts. Contact BeaconMedæs Technical Services department at 1-888-4MEDGAS (1-888-463-3427) for technical support or to order spare parts.

Appendix C - Compressor Controller (Mk5)

C.2 Compressor Control Panel Parts and Functions (Mk5 Controller)

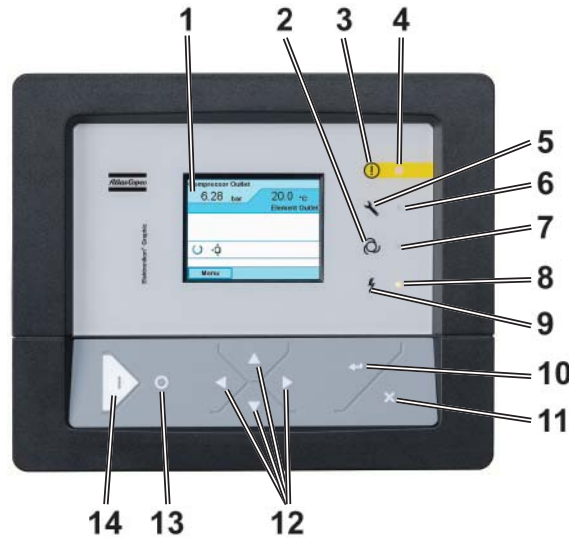


FIG. C.1. Compressor Control Panel

1. **Display:** Shows the compressor 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 shutdown 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 compressor.
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 compressor. LED (7) goes out.
14. **Start Button:** Button to start the compressor. LED (7) lights up indicating that the Elektronikon regulator is operative.

Appendix C - Compressor Controller (Mk5)

C.3 Icons Used (Mk5 Controller)

C.3.1 Status Icons

Name	Icon	Description
Stopped / Running		When the compressor is stopped, the icon stands still. When the compressor is running, the icon is rotating.
Compressor Status		Motor stopped
		Running unloaded
		Running loaded
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

Appendix C - Compressor Controller (Mk5)

C.3.2 Input Icons

Icon	Description
	Pressure
	Temperature
	Digital input
	Special protection

C.3.3 System Icons

Icon	Description
	Compressor element (LP, HP, ...)
	Dryer
	Fan
	Frequency Converter
	Drain
	Filter
	Motor
	Failure expansion module
	Network problem
	General alarm

Appendix C - Compressor Controller (Mk5)

C.3.4 Menu Icons

Icon	Description
	Inputs
	Outputs
	Alarms (Warnings, shutdowns)
	Counters
	Test
	Settings
	Service
	Event history (saved data)
	Access key / User password
	Network
	Setpoint
	Info

C.3.5 Navigation Arrows

Icon	Description
	Up
	Down

Appendix C - Compressor Controller (Mk5)

C.4 Function of Control Programs (Mk5 Controller)

Program/Function	Description
Main Screen	Shows in status of the compressor operation and is the gateway to all functions implemented in the controller. There are four sections on the Main Screen: • Section A shows information regarding the compressor operation (e.g. the outlet pressure, temperature at the compressor outlet). • Section B shows Status Icons. • 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, and to have access to all data collected by the regulator.
Inputs Menu	Call up information regarding the actually measured data and the status of some inputs such as the emergency stop switch.
Outputs Menu	Call up information regarding the actual status of some outputs such as the condition of the Fan overload contact, the Emergency stop contact, etc.
Menu Icon, Counters	Call up the running hours, the loaded hours, the number of motor starts, the number of hours that the regulator has been powered, and the number of load cycles.
Service Menu	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, and modify the programmed service intervals.
Menu Icon, Settings	Display and modify a number of general settings (e.g. Time, Date, format, Language, units...).
Menu Icon, Event History	Call up the last shut-down and last emergency stop data.
Menu Icon, Test	Carry out a display test, i.e. to check whether the display and LEDs are still intact.
Menu Icon, Password	If the password option is activated, it is impossible for non-authorized persons to modify any setting.

Appendix C - Compressor Controller (Mk5)

C.5 Parameters - Fixed Speed Compressor (Mk5 Controller)

The compressor parameters are separated into the two following sections: C.5.1 Regulation and C.5.2 General. The two sections are located under “Settings” on the compressor controller.

C.5.1 Regulation

Name	Description	Controller Default Value	BeaconMedaes Value
Unloading Pressure 1	High pressure level of Pressure band 1	8 bar	105 psi ¹
Loading Pressure 1	Low pressure level of Pressure band 1	6.4 bar	96 psi ¹
Unloading Pressure 2	High pressure level of Pressure band 1		
Loading Pressure 2	Low pressure level of Pressure band 1		
Pressure Band Used		1	1
Digital Pressure Selection Band		Off	Off
Minimum Stop Time	Time which the compressor has to stop before restarting	20 seconds	20 seconds
Unload Time		30 seconds	30 seconds
Start check time		20 seconds	20 seconds
Automatic Restart ²		Not activated	Infinite ²
Maximum Power Down		15 seconds	15 seconds
Restart		0 seconds	0 seconds
Ethernet		On	On
CAN ³	CAN must be off to change CAN address and communication profile	Off	On ³
CAN Address		31	Node ID
Communication Profile		Mk4	Mk4

1. Typical settings shown for lead compressor. Lower these settings by 5 psi for each remaining compressor so that all compressors have a different local set point.
2. Password required to set “Auto Restart” parameter to infinite (4735)
3. CAN must be off to change CAN address and communication profile.

Appendix C - Compressor Controller (Mk5)

C.5.2 General

Name	Description	Controller Default Value	BeaconMedaes Value
Language in use	Language used	English	English
Time	Clock function	Local	Local
Date		Date	Date
Date Format		DD/MM/YY	MM/DD/YY
Password	This feature allows the parameters to be protected by a user defined password	Not activated	Activated
Pressure Units		Bar	Bar
Temperature Units		°F	°F
Vibration Unit		Mils	Mils
Level Unit		Inch	Inch
Flow Units		CFM	CFM
Volume Unit		Gallon	Gallon
Display Timeout		5 min	5 min
Access Level		User	User
C.C.M.	ES6 Control Mode (Local, Remote, LAN)	Local	LAN

Appendix C - Compressor Controller (Mk5)

C.6 Parameters - Variable Speed Drive Compressor (VSD) (Mk5 Controller)

The compressor parameters are under settings and are separated into the three following sections: C.6.1 Regulation, and C.6.2 Network, and C.6.3 General. All three sections are located under “Menu” on the compressor controller.

C.6.1 Regulation

Name	Description	Controller Default Value	BeaconMedaes Value
Reduced Set Point		102 psi ¹	95 psi ¹
Set Point 1		102 psi ¹	95 psi ¹
Indirect Stop Level 1		116 psi ¹	116 psi ¹
Direct Stop Level 1		123 psi ¹	123 psi ¹
Set Point 2			
Indirect Stop Level 2			
Direct Stop Level 2			
Set Point Used		Set Point 1	Set Point 1
Digital Pressure Band Selection	Requires password to activate (4735)	Off	Off
Minimum Stop Time		5 seconds	5 seconds
Minimum Speed		Varies	Default
Minimum Speed Factor		0%	0%
Proportional Band		10%	10%
Integration Time		6 seconds	6 seconds

1. Typical settings shown for lead compressor. Lower these settings by 5 psi for each remaining compressor so that all compressors have a different local set point.

C.6.2 Network

Name	Description	Controller Default Value	BeaconMedaes Value
CAN		Ethernet	CAN
CAN ¹	CAN must be off to modify address or profile.	Off	Indefinite ¹
CAN Address		1	Node ID
Communication Profile		Mk4	Mk4

1. CAN must be off to change CAN address and communication profile.

Appendix C - Compressor Controller (Mk5)

C.6.3 General

Name	Description	Controller Default Value	BeaconMedaes Value
Language in use	Language used	English	English
Time	Clock function	Local	Local
Date		Date	Date
Date Format		DD/MM/YY	MM/DD/YY
Pressure Units		Bar	PSI
Temperature Units		°C	°F
Vibration Unit		MM	MM
Flow Units		LPS	CFM
Volume Unit		Liter	Gallon
Display Timeout		5 min	5 min
Automatic Restart	Allows the machine to restart after power failure	Not activated	Infinite ¹
Password	This feature allows the parameters to be protected by a user defined password	Not activated	Activated ²
C.C.M.	ES6 Control Mode (Local, Remote, LAN)	Local	LAN

1. Requires pass code to activate (pass code = 4735)
2. Requires password to change parameters and configuration (password = 201)

C.7 Setting Parameter Password in Controller

Starting from the Main screen,

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

Appendix D - Desiccant Dryer

D.1 General Information

CAUTION: This manual is designed to serve as the operation and maintenance guide for your dryer. The contents of this manual should be carefully read BEFORE attempting any phase of operation or maintenance. Failure to follow the operating and maintenance procedures of the instruction manual could result in personal injury or property damage.

All information, specifications and illustrations within this manual are those in effect at the time of printing. The manufacturer reserves the right to change or make improvements without notice and without incurring any obligation to make changes or add improvements to products previously sold.

When requesting information, service, ordering of spare parts, etc., please reference all information supplied on the serial number plate located inside the dryer control panel.

To facilitate maintenance, recommended spare parts for your specific dryer model are available. Failure to maintain recommended spare parts and filter cartridges might result in expensive and unnecessary downtime for which the manufacturer cannot be responsible. To request a quotation of, or place an order for, recommended or emergency spare parts, please contact your local distributor.

D.1.1 Drying Cycles

This fully automatic, heatless type dryer alternately cycles the compressed, process gas flow through two desiccant charged towers where the entrained, vaporous moisture content of the gas is adsorbed. One desiccant tower is always on-line in a drying cycle throughout normal dryer operation. The opposite, off-line tower is in a regeneration cycle for removal of the previously adsorbed moisture content. (See D.2 and D.3 for Basic Dryer operation)

D.1.2 Continuous Purge Mode

When the dryer selector switch on the Central Control System (CCS) panel is in the “continuous purge” position, the dryer will shift towers based on a factory pre-set time interval regardless of dew point reading. This time interval setting will vary based on dryer size. At normal operating conditions, one tower will be at the system pressure while the other tower is at “0” psi. During tower changeover, the second tower will go through a re-pressurization cycle to equalize the pressure between the two towers and then switch to the second tower. The first tower will then be exhausted, and then the tower goes through the regenerating (purge) cycle.

D.1.3 Controlled Purge Mode

When the dryer selector switch on the Central Control System (CCS) panel is in the “controlled purge” position, the dew point monitor controls the dryer tower switching based on the dew point condition. When the dew point reading is above the setpoint of -10°C (14°F), the dryer will function normally (one tower at system pressure, one tower at “0” psi.). When the dew point is below the setpoint of -10°C (14°F) on the dew point monitor, the dryer will continue to use the first tower until it can no longer maintain the dew point setting. At this time the dryer will go through the process of switching to the second tower and regenerate (purge) tower one. The dryer will continue to flow gas through the second tower until tower two can no longer hold the set dew point and then switch back to the first tower.

Appendix D - Desiccant Dryer

D.2 Basic Dryer Operation CD35 - 70 (See Fig. D.2)

Compressed air enters the dryer through the inlet filter. Solenoid valve E1 closes and solenoid valve E2 opens, directing the incoming air to TOWER 1 through the inlet valve (A). The air enters the bottom of the tower and the dried air exits the tower at the top and passes through the outlet valve (B) and after filter (C). A small portion of dried air is used to regenerate TOWER 2, the dried air passes through a small orifice (D) into TOWER 2 and expands to atmospheric pressure. This extremely dry, low pressure air flows downward through the tower regenerating the desiccant. The regenerating air is then exhausted through a purge valve (E2) and exhaust muffler (F2) to atmosphere.

After a set time, the “SMART relay” closes the purge/exhaust valve (E2) allowing TOWER 2 to repressurize slowly.

At the end of 3 minutes (when operating on a 6 minute cycle), the purge/exhaust valve (E1) opens, switching the compressed air flow to TOWER 2 and begins the purge cycle on TOWER 1. The main air flow is now dried by TOWER 2 while TOWER 1 is regenerated.

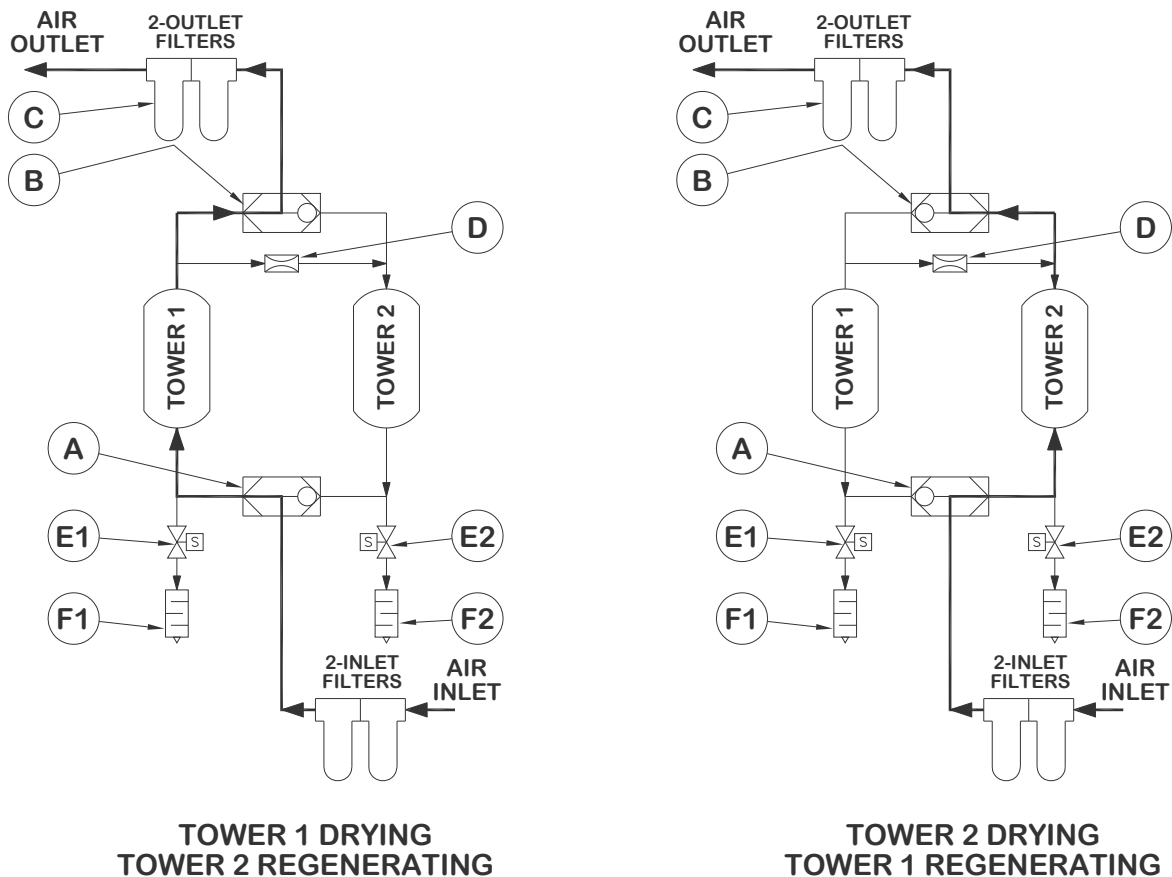


FIG. D.2 CD35 - 70 Flow Schematic

Appendix D - Desiccant Dryer

D.3 Basic Dryer Operation CD100 - 300 (See Fig. D.3)

Compressed air enters the dryer through the inlet filter and is directed to TOWER 1 through a three-way valve (A). The air enters the bottom of the tower and the dried air exits the tower at the top and passes through a non-return valve (B) and after filter (C). A small portion of dried air is used to regenerate TOWER 2, the dried air passes through a small orifice (D) into TOWER 2 and is expands to atmospheric pressure. This extremely dry, low pressure air flows downward through the tower regenerating the desiccant. The regenerating air is then exhausted through a purge valve (E2) and exhaust muffler (F2) to atmosphere.

After a set time, the “SMART relay” closes the purge/exhaust valve (E2) allowing TOWER 2 to repressurize slowly.

At the end of 3 minutes (when operating on a 6 minute cycle), the three-way valve (A) switches and the purge/exhaust valve (E1) opens to begin the purge cycle on TOWER 1. The main air flow is now dried by TOWER 2 while TOWER 1 is regenerated.

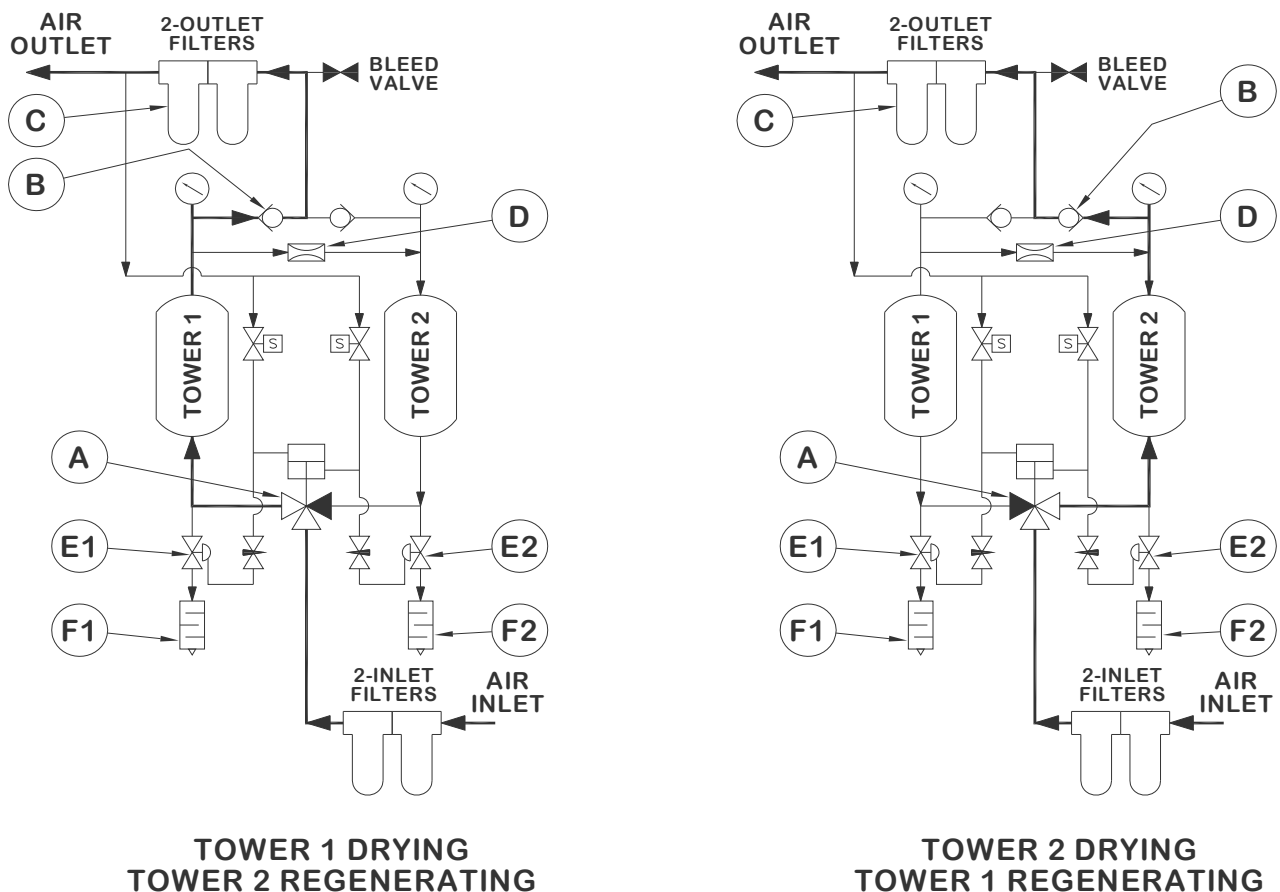


FIG. D.3 CD100 - 300 Flow Schematic

Appendix D - Desiccant Dryer

D.4 Operation

D.4.1 Initial Start-Up

1. Close the dryer source isolation valve.
2. Switch on the electrical supply to the dryer.
3. CLOSE the dryer isolation valves. (2 inlet valves, 2 outlet valves)
4. Check that the compressed air supply is **on**.
Let the system come up to pressure
5. Slowly OPEN the two dryer inlet isolation valves.
6. Rotate the dryer selector switch to the “continuous purge” position. The dryer will now begin to cycle.
7. Check that purge air is flowing from the purge muffler.
8. Slowly OPEN the two dryer outlet isolation valves. (**Do Not Open Dryer Source Isolation Valve**)
9. Open the dew point and CO sensor (if supplied) isolation valves.
10. Check for airflow at the dew point sensor orifice.
11. Adjust CO regulator (if supplied) to obtain a flow rate of .5-.9 SCFM.
12. Operate the dryer for five to ten minutes with the source isolation valve **closed**.
13. During the conditioning run (see 11 above) test all joints to check for any leaks. Tighten or repair any leaks and retest.

NOTE: Any small leaks on the dryer outlet side will cause a deterioration of the dew point.
14. Rotate the dryer selector switch to the “controlled purge” position. Verify proper operation as described in D.2 or D.3.
15. On the completion of the conditioning run, **slowly open** the source isolation valve. The dryer will now be fully operational.

D.4.2 Procedure to Switch Off the Dryer

1. Put second dryer on line by repeating steps 4 thru 7 above.
2. CLOSE the dryer outlet isolation valve.
3. SWITCH OFF the electrical supply to the dryer.
4. CLOSE the dryer inlet isolation valve. Dryer should de-pressurize

WARNING: Wait at least 2 minutes for pressure in the dryer to decay before performing any service to the dryer.

Appendix D - Desiccant Dryer

D.4.3 Normal Start-up

This procedure is to be followed when the dryer has been shut down for a short period during which time the desiccant has not been exposed to wet gas.

1. Start up the compressor if shut down.
2. Set the appropriate dryer selector switch to controlled purge.
3. Slowly OPEN the dryer inlet isolation valve.
4. Slowly OPEN the dryer outlet isolation valve.
5. Check operation of the dryer.

D.4.4 Maintenance Shut Down

1. CLOSE the dryer outlet isolation valve.
2. CLOSE the dryer inlet isolation valve.
3. Allow the dryer to continue to cycle until the purge exhaust fully depressurizes both chambers.
4. Switch off electrical power to the dryer by removing the fuse.

WARNING: Display prominent notices indicating that maintenance is being carried out.

D.5 Troubleshooting

WARNING:

To protect the lives of patients, always notify the appropriate medical facility staff before performing any maintenance or service procedures on the air system. Compressed air levels may be affected during maintenance or service procedures.

WARNING:

Some of the following trouble-shooting checks are conducted while the dryer's electrical power supply is energized. THEREFORE, A POTENTIAL ELECTRICAL SHOCK HAZARD EXISTS. A qualified electrical technician should conduct these checks. The dryer's electrical power supply must be de-energized before any electrical maintenance or repair work is conducted.

WARNING:

Ensure that the dryer and associated pre-filter(s) and afterfilter(s) are valve isolated and fully depressurized before attempting to remove or disassemble any subassemblies or components. Failure to do so may result in serious personal injury and/or equipment damage.

CAUTION: Each component has been selected to compliment the performance of the other components of the system. Therefore, use of unauthorized parts or improper operation will degrade system performance.

Appendix D - Desiccant Dryer

D.5 Troubleshooting

IMPORTANT: Water molecules can diffuse through a pinhole size leak even though pressure inside the piping is several hundred PSIG. It is not at all uncommon to have a minute pinhole leak in a gas line cause an increase in dew point from -40°F to -10°F at a distance of forty or more feet downstream of the leak.

Problem	Possible Causes	Solution
Dryer not cycling	Main power disconnected	Turn on main power
	Power failure	Restore power
	Main fuse blown	Replace fuse
	Fuse blown in control circuit	Replace fuse
	Timer failure	Check and replace if defective
	Dryer selector switch in off position	Rotate switch to controlled purge position
	Loose or faulty connection	Check & tighten all wire connections
Dew point degradation	Switching valve failure	Replace switching valve
	Incorrect purge air flow	Check purge orifice for blockage. Clean or replace as required.
	Excessive system flow rate	Reduce inlet flow rate and/or increase operating pressure.
	Inlet air temperature is above the dryer's design inlet working temperature.	Check the compressor aftercooler and cooling system. Adjust as necessary to bring the dryer inlet temperature to less than the maximum design working temperature of 43°C (110°F).
	Liquids entering the dryer inlet	Isolate and depressurize the pre-filter assembly. Inspect pre-filter cartridges and end seals for loosening and/or damage. Tighten or replace as necessary. Inspect the pre-filter automatic drain valve. Ensure that it is not clogged, and is draining properly. Repair or replace as necessary, if a problem is noted.
	Purge muffler restricted	Replace muffler

Appendix C - Desiccant Dryer

D.5 Troubleshooting (continued)

Problem	Possible Causes	Solution
Dew point degradation	Desiccant is contaminated. The “white” desiccant beads may appear discolored and dirty if contamination has occurred.	Shutdown and depressurize the dryer. Inspect the desiccant and replace if fouled. Inspect any existing pre-filter if fouling is noted.
	Union or other piping/component leaks at dryer outlet manifold or downstream of dryer outlet	Soap test the dryer outlet manifold and piping downstream of dryer. Repair all leaks noted.
Back pressure on a desiccant chamber during regeneration cycle.*	Dirty or fouled purge muffler	Switch off power and remove purge muffler and clean using an air nozzle, or replace.
	Outlet check valve leaking	Replace check valve

*NOTE: The presence of backpressure will result in insufficient regeneration followed by dew point degradation. An off-line chamber’s pressure **MUST be less than 3 psig** throughout all regeneration cycles.

D.6 Maintenance

WARNING:

To protect the lives of patients, always notify the appropriate medical facility staff before performing any maintenance or service procedures on the air system. Compressed air levels may be affected during maintenance or service procedures.

WARNING:

Compressed air can be dangerous unless safety precautions are observed in the use of compressed air and compressed air equipment. Completely vent the internal air pressure to the atmosphere before disassembling any subassemblies or components and before doing any work on compressed air equipment. To vent internal air pressure, follow the maintenance shutdown instructions.

A compressed air dryer should give long and trouble free operation if the recommended preventative maintenance program is carried out.

The following is a recommended schedule:

1. **Quarterly procedure** - Clean the auto drain in the coalescing filter. Monitor the backpressure on the purging tower. If the gauge reads more than 0 psig (when purging), check the purge muffler for blockage and replace if necessary.
2. **Annual procedure** - Replace all filter cartridges and purge muffler(s). Check the automatic drain function in the coalescing filter. Refer to chart located in Section D.6.1 thru D.6.4 for correct system size and part numbers. Contact your local distributor for parts.
3. **Five-year procedure** - Change all annual parts. Change desiccant, check valves, and purge valve(s) See chart in Section D.6.1 thru D.6.4 for correct system size and part numbers.

Appendix D - Desiccant Dryer

D.6.1 Replacement Filter Element Kit

(Includes element, element O-rings, bowl O-ring and drain valve O-ring)

Dryer Size	Filter Type	Pre-filter (DD) Part No.	Qty.	Pre-filter (PD) Part No.	Qty.	After-filter (DDp) Part No.	Qty.	After-filter (QD) Part No.	Qty.
CD-35, 74 SCFM	44	2901 0529 00	2	2901 0530 00	2	2901 0529 00	2	2901 0531 00	2
CD-70, 148 SCFM	60	2901 0532 00	2	2901 0533 00	2	2901 0532 00	2	2901 0534 00	2
CD-100, 211 SCFM	120	2901 0535 00	2	2901 0536 00	2	2901 0535 00	2	2901 0537 00	2
CD-150, 318 SCFM	150	2901 0538 00	2	2901 0539 00	2	2901 0538 00	2	2901 0540 00	2
CD-185, 392 SCFM	175	2901 0541 00	2	2901 0542 00	2	2901 0541 00	2	2901 0543 00	2
CD-250, 530 SCFM	280	2901 0544 00	2	2901 0545 00	2	2901 0544 00	2	2901 0546 00	2
CD-300, 636 SCFM	280	2901 0544 00	2	2901 0545 00	2	2901 0544 00	2	2901 0546 00	2

D.6.2 Drain Valve Kit

(Automatic Drain on DD & PD Filters, Manual Drain on DDp & QD Filters)

Dryer Size	Filter Type	Pre-filter (DD) Part No.	Qty.	Pre-filter (PD) Part No.	Qty.	After-filter (DDp) Part No.	Qty.	After-filter (QD) Part No.	Qty.
CD-35, 74 SCFM	44	2901 0563 00	2	2901 0563 00	2	2901 0611 00	2	2901 0611 00	2
CD-70, 148 SCFM	60								
CD-100, 211 SCFM	120								
CD-150, 318 SCFM	150								
CD-185, 392 SCFM	175								
CD-250, 530 SCFM	280								
CD-300, 636 SCFM	280								

D.6.3 Flange/Head O-Ring

Dryer Size	Filter Type	Pre-filter (DD) Part No.	Qty.	Pre-filter (PD) Part No.	Qty.	After-filter (DDp) Part No.	Qty.	After-filter (QD) Part No.	Qty.
CD-35, 74 SCFM	44	0663 2101 97	2	0663 2101 97	2	0663 2101 97	2	0663 2101 97	2
CD-70, 148 SCFM	60								
CD-100, 211 SCFM	120	0663 2104 75	2	0663 2104 75	2	0663 2104 75	2	0663 2104 75	2
CD-150, 318 SCFM	150								
CD-185, 392 SCFM	175								
CD-250, 530 SCFM	280	0663 2104 98	2	0663 2104 98	2	0663 2104 98	2	0663 2104 98	2
CD-300, 636 SCFM									

Appendix D - Desiccant Dryer

D.6.4 Purge Silencer

Dryer Size	Part No.	Qty.
CD-35, 74 SCFM	1617 6173 00	2
CD-70, 148 SCFM		
CD-100, 211 SCFM	1617 6164 03	2
CD-150, 318 SCFM		
CD-185, 392 SCFM		
CD-250, 530 SCFM	1617 6164 04	2
CD-300, 636 SCFM		

D.6.5 Desiccant

Dryer Size	Part No.	Qty.
CD-35, 74 SCFM	1624 0576 80	4
CD-70, 148 SCFM	1624 0576 80	8
CD-100, 211 SCFM	1310 2565 01	620 lbs
CD-150, 318 SCFM	1310 2565 01	750 lbs
CD-185, 392 SCFM	1310 2565 01	885 lbs
CD-250, 530 SCFM	1310 2565 01	1150 lbs
CD-300, 636 SCFM	1310 2565 01	1325 lbs

D.7 Systems Specifications

Type	Desiccant Heatless
Design Pressure	160 PSIG
Operating Pressure	100 PSIG
Max. Ambient Temperature	105°F (40°C)
Pressure Dew Point Capability @ 100 PSIG	-40°F (-40°C)
Desiccant	Activated Alumina
Power	115V or 230V

Appendix E – Dew Point Transmitter

E.1 General Information

CAUTION: This manual is designed to serve as the operation and maintenance guide for your Dew Point Transmitter. The contents of this manual should be carefully read BEFORE attempting any phase of operation or maintenance. Failure to follow the operating and maintenance procedures of the instruction manual could result in personal injury or property damage

!!WARNING!!

Before starting any installation, maintenance or service procedure, disconnect ALL power to the system to prevent electrical shock.

Before making or breaking any medical gas line connections, make sure the system is depressurized in order to avoid personal injury.

Before removing the dew point transmitter, verify that the source of line pressure has been closed and the line pressure reduced to atmospheric pressure.

An alarm condition on dew point indicates a dew point level exceeding the maximum set point, or a faulty dew point transmitter. Immediate action should be taken to reduce the possibility of high dew point in the Medical Air line.

If the dew point transmitter flowmeter becomes clogged, dew point readings may be inaccurate, allowing moisture to accumulate undetected.

E.2 Introduction

The dew point transmitter is a continuous, on-line instrument that measures the absolute moisture content in the final air line. The transmitter measures dew point with excellent long term stability. The Advanced Ceramic Moisture sensor is durable and has been designed for ruggedness and simplicity. The transmitter is fully calibrated at the factory prior to shipment

E.3 Specifications

1. Dew point Temperature: -100° to 20°C (-148° to 68°F)
2. Operating Temperature: 0° to 60°C (32° to 140°F)
3. Dew point accuracy: $\pm 2^{\circ}\text{C}$ ($\pm 3.6^{\circ}\text{F}$)
4. Air Consumption: 0.75 LPM (1.6 SCFH)

E.3.1 Output

1. Analog output: 4 - 20 mA.

Appendix E – Dew Point Transmitter

E.3.2 General

1. Operation Voltage: 12 - 28 VDC
2. Probe material: Stainless Steel (316)
3. Sensor protection: Ceramic

E.4 Operation

Although the correct operation of the transmitter is not sample flow dependent, it is important that flow velocity through the sample source to the sample block is high enough to avoid long lead time lags in response to changes in moisture at the sample source. A flowmeter has been installed and set at 1.0 - 2.0 scfh to ensure proper flow velocity. This flowmeter should be checked weekly to see if it has any blockages.

E.5 Alarms

Dew points that exceed set points shall cause an alarm condition at the Central Control Panel (CCP). When the dew point exceeds the alarm set point, the CCP contacts are de-energized. The alarm remains de-energized until the alarm condition is cleared by the operator.

!!WARNING!!

Respond to alarm conditions immediately. An alarm condition on the dew point indicates a dew point level exceeding the maximum set point. Immediate action to correct the problem should be taken. Prolonged exposure to condensing moisture can damage the Medical Air equipment.

E.6 Maintenance

E.6.1 Repair Policy

Do not use a unit that is not functioning properly until all necessary repairs have been made and the unit has been tested to determine that it is functioning in accordance with the manufacturer's published specifications. Contact **BeaconMedaes** Technical Services department at 1-888-4MEDGAS (888-463-3427) for assistance.

Note: To ensure full reliability, have all maintenance and testing done by a qualified technician. If this cannot be done, maintenance and testing of those parts discussed in this manual may be undertaken by a competent, trained individual having experience in the repair of devices of this nature

!!WARNING!!

Electrical shock hazard

No repair should ever be attempted by anyone not having experience in the repair of devices of this nature. Failure to follow proper repair procedures can result in serious injury.

Appendix E – Dew Point Transmitter

CAUTION: No maintenance and testing should ever be undertaken or attempted by anyone not having general experience in the repair of devices of this nature. Also, to avoid damaging the unit or any of its components, no maintenance and testing should be undertaken by qualified individuals who are not familiar with the procedures in this manual.

Replace damaged parts with components from **BeaconMedaes**. Test the unit after installation of replacement parts to make certain that it complies with the published specifications.

E.6.2 Maintenance Schedule

Maintenance	Frequency	Action
Check flow through flowmeter	Weekly	Check for proper flow (1.0 – 2.0 scfh)
Check Transmitter Accuracy	Every 12 months	Verify dew point sensor accuracy (contact BeaconMedaes)
Recalibration	Every 2 years	See Section E.8
Replace sensor	Every 5 years	See Section E.9

E.7 Troubleshooting

!!WARNING!!

Before removing the dew point transmitter, verify that line pressure has been valved off or reduced to atmospheric pressure.

Before servicing the dew point transmitter, do the following:

1. Close dew point transmitter isolation valve
2. Allow transmitter piping to depressurize through the flowmeter until it reduces to atmospheric pressure.
3. Disconnect sensor cable and remove transmitter from piping.

Note: Remote alarms will be activated

Problem	Possible Cause	Solution
Slow system response	Insufficient flow through dew point sensor	Check flow
No power	No incoming power	Verify line power is being supplied
Erratic Display	Unit defect	Contact Beacon Medaes
High Dew point	Air is not being dried. Faulty sensor.	Verify that the dryer is not being bypassed Check flow Replace sensor

Appendix E – Dew Point Transmitter

E.8 Dew Point Sensor Calibration

The dew point sensor is shipped to you pre-calibrated, no user calibration is required. Contact Beacon Medaes to check accuracy and/or external calibration of the sensor.

E.9 Dew Point Sensor Replacement

Check the response time of the sensor by removing it from the sensor chamber and covering the probe with your hand. The dew point reading should rise rapidly. If the dew point does not rise or is slow to respond, it is time to replace the sensor. To replace, disconnect the power to the instrument, unplug and remove the sensor from the dew point sensor chamber, replace sensor and reassemble.

Description	Part No.	Qty Required
Sensor	1089 9481 51	1
Cable	CBL03-004	1

Appendix F - CO Transmitter

F.1 General Information

CAUTION: This manual is designed to serve as the operation and maintenance guide for your CO Transmitter. The contents of this manual should be carefully read BEFORE attempting any phase of operation or maintenance. Failure to follow the operating and maintenance procedures of the instruction manual could result in personal injury or property damage.

WARNING:

Before starting any installation, maintenance or service procedures, disconnect ALL power to the system to prevent electrical shock hazard.

Before making or breaking any medical gas line connections, make sure the system is depressurized in order to avoid personal injury.

An alarm condition on the Central Control Panel indicates a CO level exceeding the maximum set point, or a faulty CO sensor. Immediate action should be taken to reduce the possibility of CO in the Medical Air line.

F.2 Introduction

The CO transmitter is a continuous, on-line instrument that measures the carbon monoxide level in the final product line. The instrument's electronics are enclosed in a NEMA-4 corrosion resistant case. The unit operates on 24 VDC power supplied from the central control panel and sends a 4-20mA signal to the Central Control Panel monitor. The transmitter uses a state-of-the-art electrochemical cell for detecting carbon monoxide. The sensor has a life expectancy of approximately two years. It is easily replaced and should be periodically calibrated as its output diminishes during its life especially during the final months. Contact **BeaconMedaes** Technical Services department at 1-888-4MEDGAS (1-888-463-3427) for technical support or to order spare parts.

F.3 Specifications

1. Analog output: 4-20mA
2. Operation Voltage: 24 VDC
3. Sensor body material: Aluminum
4. Air Consumption: Minimum 0.5 to 0.9 CFH (14 to 25 lph)

F.4 Power Connection

This is a two wire transmitter. Connect to 24VDC power supply only (See Fig 9.1).

Appendix F - CO Transmitter

F.5 Alarms

Co levels that exceed 10 ppm set point shall cause an alarm condition at the Central Control Panel (CCP). When the CO level exceeds the set point, the CCP contacts are de-energized. The alarm remains de-energized until the alarm condition is cleared by the operator.

F.6 Operation

Caution: At initial startup, if the unit is reading a gas level, do not make any adjustments for a few hours until the unit has a chance to settle in and stabilize.

If gas readings remain high or below zero (-0), re-calibration may be needed. We also recommend checking the compressor's air intake first.

F.7 Maintenance

WARNING:
Electrical Shock Hazard. No repair should ever be attempted by anyone not having experience in the repair of devices of this nature. Failure to follow proper repair procedures can result in serious injury.

Replace damaged parts with components from **BeaconMedaes**. Test the unit after installation of replacement parts to make certain that it complies with the published specifications. Contact **BeaconMedaes** Technical Services department at 1-888-4MEDGAS (1-888-463-3427) for technical support or to order spare parts.

F.7.1 Maintenance Schedule

Maintenance	Frequency	Action
Re-calibration	Every 6 months	See section F.9
Replace Sensor	Every 2 years	See section F.8

F.8 Sensor Checkout and Replacement

To check a sensor's response, test gas has to be placed on the sensor. When it fails to show a gas response during calibration, a new sensor is required. Most sensors will last from one and one-half years to two and one-half years.

To replace the sensor (see Fig 9.1), disconnect the power to the unit, disconnect the inlet air connection and unscrew the cover to access the inside of the transmitter. Next, unplug the CO sensor from the bottom of the internal PC board. Then remove the cap on the bottom of the transmitter and remove the CO sensor and wiring. Unplug the wiring from the sensor and replace it with a new one. Reinstall the sensor in the reverse order. Once the sensor is installed go through steps F.9.1 and F.9.2 to calibrate and verify the proper operation of the CO sensor.

Appendix F - CO Transmitter

F.9 Calibration

F.9.1 Zeroing Transmitter

The following procedure should be used for zeroing the transmitter. (See F.11 Accessories and Replacement Parts for zero gas part numbers)

- Turn on the power and allow the transmitter to warm up for several hours to stabilize.
- Disconnect the inlet air line to the transmitter and connect the air line from the zero gas cylinder.
- Allow the calibration gas from the cylinder to flow across the sensor for approximately 3 minutes to stabilize the sensor.
- Remove the cover from the transmitter housing and locate the two test point sockets (See Fig 9.1)
- Connect voltage meter leads to the two test point sockets and set the meter to VDC.
- Locate the blue pot (marked “Z”) and adjust the pot until the meter reads 0.04 VDC. Turning the adjusting screw counterclockwise will reduce the voltage output. Turning it clockwise will raise the voltage output.
- Proceed to F.9.2 for calibrating the transmitter.

F.9.2 Transmitter Calibration

The following procedure should be used to calibrating the transmitter. (See F.11 Accessories and Replacement Parts for calibration kit part numbers)

- Zero the transmitter prior to calibration, see F.9.1 for zeroing procedure.
- Disconnect the zero gas cylinder from the transmitter and connect the air line from the 20 ppm CO gas cylinder.
- Allow the calibration gas from the cylinder to flow across the sensor for approximately 3 minutes to stabilize the sensor.
- Connect voltage meter leads to the two test point sockets and set the meter to VDC (See Fig. 9.1).
- Locate the dark blue pot (marked “C”) and adjust the pot until the meter reads 0.051VDC. Turning the adjusting screw counterclockwise will reduce the voltage output. Turning it clockwise will raise the voltage output.
- Repeat the zeroing procedure and calibration procedure once more to ensure the transmitter is set properly.
- Reinstall the cover on the transmitter.
- Reconnect the inlet air line from the dryer.

Appendix F - CO Transmitter

F.9 Calibration

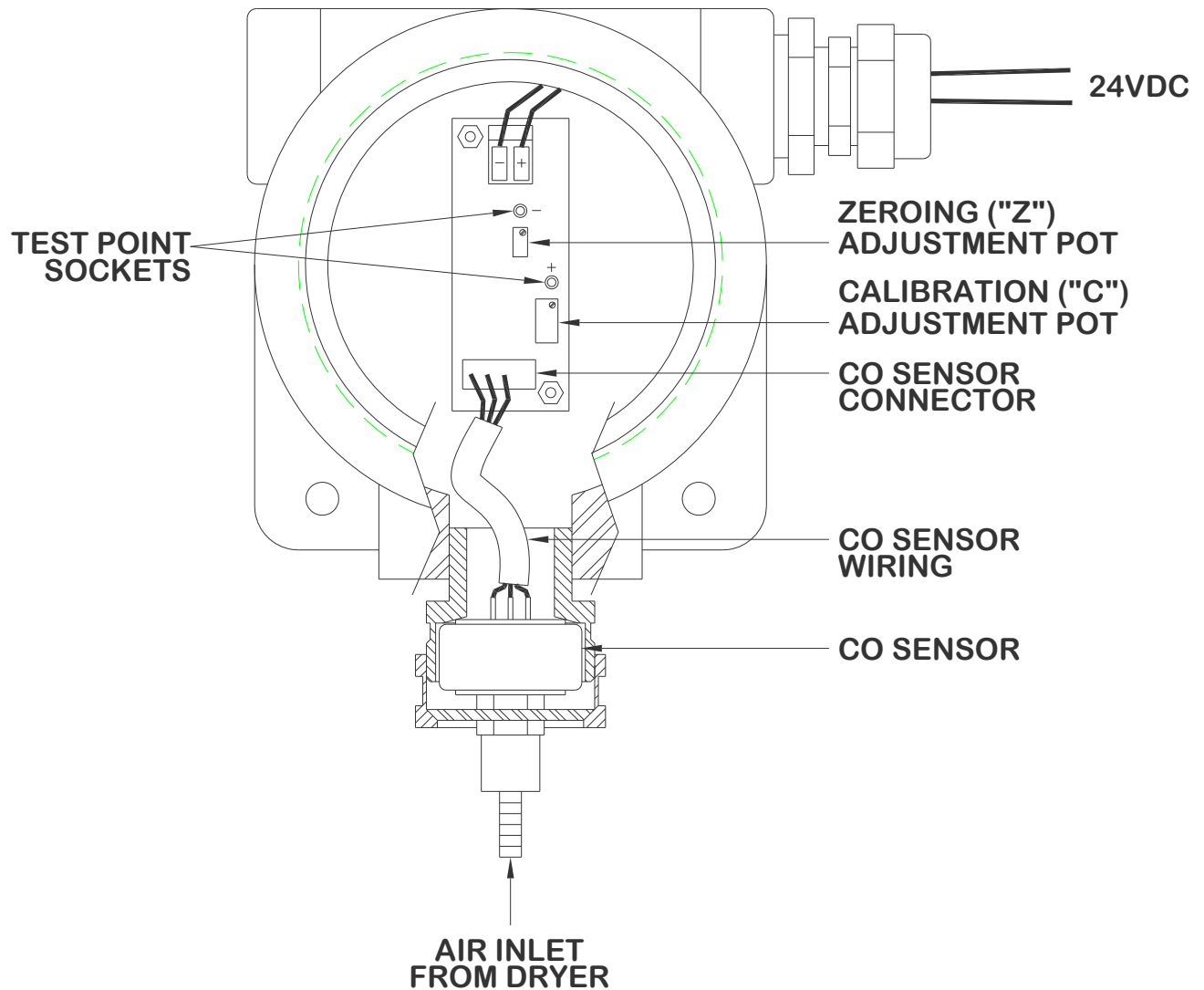


FIG. F.9.1. CO Transmitter Assembly

Appendix F - CO Transmitter

F.10 Troubleshooting

WARNING:

Before removing the CO sensor, verify that line pressure has been valved off or reduced to atmospheric pressure.

Before servicing the CO sensor, do the following:

1. Unplug sensor(s) or turn off monitor.
2. Depressurize the CO sensor.

Note: Remote alarms will be activated.

Problem	Possible Causes	Solution
CO Alarm - 10 ppm or above	Inlet air to the medical air system is contaminated	Move air inlet location or remove source of CO contamination
Monitor will not calibrate	Sensor depleted	Replace sensor
CO Alarm - CO reading erratic	Incoming power feed to control panel adjacent to CO signal wires	Separate incoming power feed from CO signal wires

F.11 Accessories and Replacement Parts

Description	Part No.	Qty Required
CO Sensor	4107 6530 69	1
Calibration Kit *	4107 4004 63	1
20ppm Carbon Monoxide	4107 6525 14	1
Impurity Free Air (Zero Gas)	4107 6525 13	1

(*) Kit includes calibration connector, 20ppm test gas, and 0ppm test gas in carrying case.

Appendix G – Oil Indicator

G.1 General Information

CAUTION: This manual is designed to serve as the operation and maintenance guide for your Oil Entrainment Indicator. The contents of this manual should be carefully read BEFORE attempting any phase of operation or maintenance. Failure to follow the operating and maintenance procedures of the instruction manual could result in personal injury or property damage.

All information, specifications and illustrations within this manual are those in effect at the time of printing. The manufacturer reserves the right to change or make improvements without notice and without incurring any obligation to make changes or add improvements to products previously sold.

To facilitate maintenance, recommended spare parts for Oil Indicator are available. Failure to maintain recommended spare parts might result in expensive and unnecessary downtime for which the manufacturer cannot be responsible. To request a quotation of, or place an order for, recommended or emergency spare parts, please contact **BeaconMedaes** Technical Services department at 1-888-4MEDGAS (888-463-3427).

G.2 Function

The Oil Indicator is a calibrated measuring instrument used to detect aerosol mist levels of oil entrainment that may be present in the medical air system. Sensitivity of the indicator is limited only by the total number of hours it is allowed to remain on the air supply system. The indicator is sensitive enough to measure a concentration of oil entrainment as low as .01 PPM (.012mg/m³) in a compressed air system. It can be used in systems with line pressures between 10 and 125 PSIG (70 and 875 kPa). Inline pressure regulator for oil indicator factory set at 50 PSIG. NFPA requires a 0.05ppm ±0.03ppm reading or better in the air stream.

!!WARNING!!

If the pressure exceeds 125 PSIG or the retaining nut is loosened, the oil indicator tube could blow out of the compression fitting, creating a hazardous condition.

Appendix G – Oil Indicator

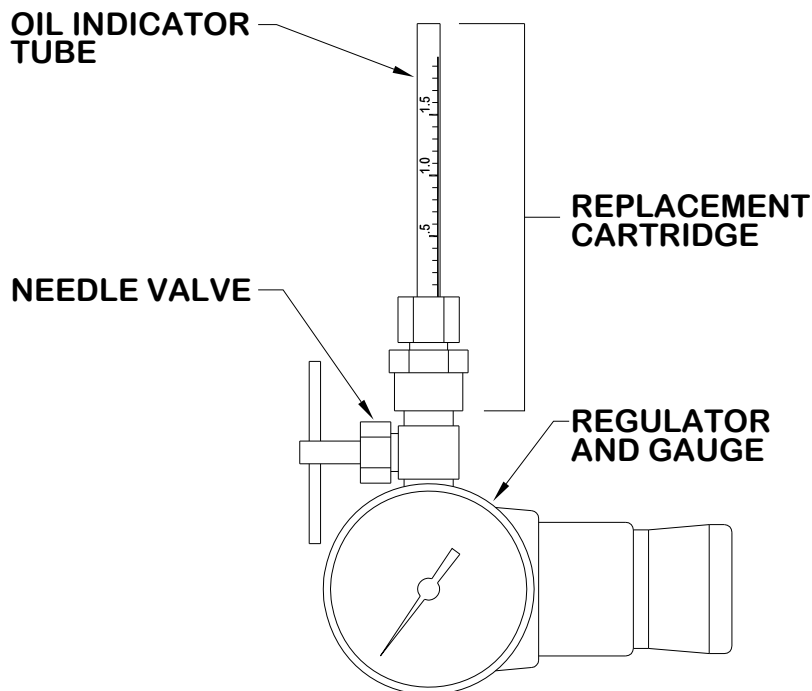


Fig. G-1. Oil Indicator Assembly

G.3 Operation

When the needle valve of the oil indicator is open, filtered medical air will flow through the calibrated plastic tube. Any oil present in the air will then carry a red oil soluble dye up the tube, coloring a white material in the tube. The rate of color travel will be proportional to the amount of oil present. The parts per million (ppm) value of oil entrained in the air can be determined using the conversion chart below (Fig. G-2). After use the needle valve should be closed and left in line and the cartridge removed. At the time of the next test, a replacement cartridge will need to be installed on the needle valve fitting.

G.4 Reading and Measurements

1. Before taking a measurement, fill out the record tag furnished with the oil indicator. Record the line pressure.
2. Fully rotate the needle valve handle counterclockwise to open and record the time start time. Slide the record tag over the oil indicator to avoid misplacing it.
3. When checking for oil entrainment, visually inspect the oil indicator after 40 hours and measure only to the top of the dark red column, not light pink area if present. If dark red column is not visible, discontinue test, there is no measurable amount of oil present in the air stream.
4. If dark red column is visible, record the actual time and unit mark on the indicator and close the needle valve.

Appendix G – Oil Indicator

G.5 Oil Concentration Determination

1. To find the Rate of Color travel, divide the units traveled by the total number of hours.
2. Using the chart in Fig G-2, find the Rate of Color travel on the left side of the chart and the pressure on the bottom. The point where Rate and Pressure intersect is the parts per million of oil concentration.

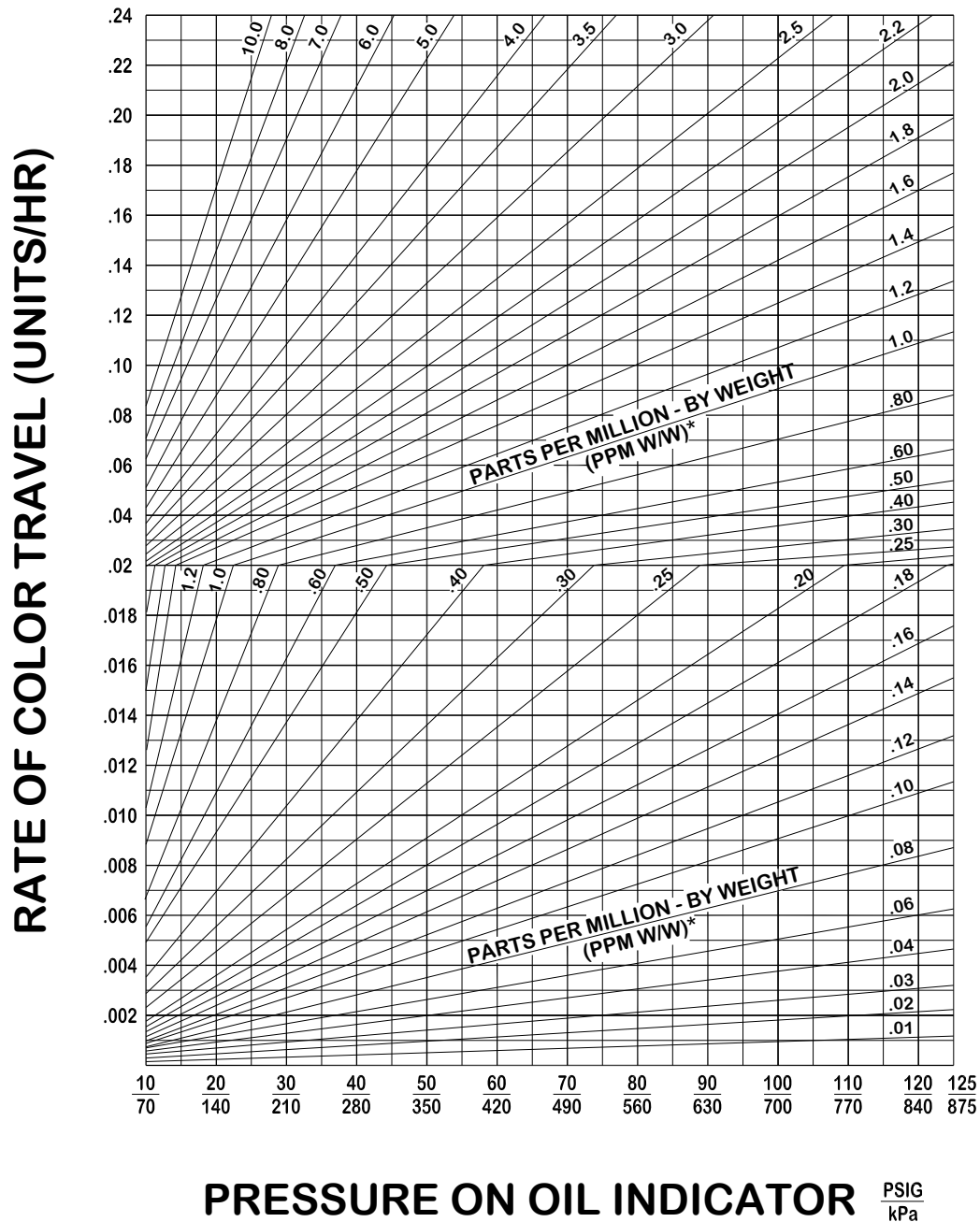


Fig. G-2. Conversion Chart for Oil Indication

Appendix G – Oil Indicator

G.6 Oil Indicator Replacement Cartridge

NOTE: The oil indicator tube must be replaced with a new cartridge after each test

1. Before removing cartridge close the needle valve and leave the valve in place.
2. Remove the old cartridge by unscrewing the fitting holding the indicator tube. The new cartridge comes with a new fitting with the tube installed.
3. Install the new cartridge on the needle valve and only open the valve when a new test begins.

!!WARNING!!

Do not disturb the factory adjusted torque on the retaining nut that holds the indicator plastic tube in place. Tampering with the nut can cause serious personal injury or property damage.

G.7 Oil Indicator Replacement Cartridge

Part No.	Qty Required
GAG08-002	1



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