Installation, Operation and Maintenance Instructions

Oil-Less Claw Medical Vacuum System

Part number 4107 9000 95
Revision 12
January 2, 2024

BeaconMedæs®

Part of the Atlas Copco Group

Lifeline
Medical Systems

Installation, Operation and Maintenance Manual

Oil-Less Claw Medical Vacuum System and O_2Assured Claw for WAGD Applications

- 2 - 15 Hp
- 5 - 15 Hp with Variable Speed Drive

This unit is purchased from: _____

Date purchased: _____

Model number: _____

Serial number: _____

Option(s) included: _____

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

BeaconMedæs
1059 Paragon Way
Rock Hill, SC 29730

Telephone: (888) 463-3427
Fax: (803) 817-5750

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Safety Precautions

The operator should carefully read the entire contents of this manual before installing, wiring, starting, operating, adjusting and maintaining the system.

The 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 vacuum from the affected components before removing, loosening, or servicing any covers, guards, fittings, connections, or other devices.
- Notify appropriate hospital personnel if repairs or maintenance will affect available vacuum levels.
- Prior to using the LifeLine® Claw Medical Vacuum 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 vacuum meets the minimum requirements as specified in NFPA 99.
- This is a high speed, rotating piece of machinery. Do not attempt to service any part while machine is in operation.
- To prevent automatic starting, disconnect all electrical power before performing any maintenance.
- Do not operate unit without guards, shields or screens in place.
- Make sure that all loose articles, packing material, and tools are clear of the package.
- Check all safety devices periodically for proper operation.
- The “Manual” mode of operation should only be used for emergencies such as a printed circuit board malfunction and should not be used for normal 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 all electrical connections prior to energizing the control panel.
- Proper ear protection is required in rooms or environments where the sound pressure level is at or above the locally specified dB(A) limit.

1.0 General Information

1.1 Component Description

NOTE: The features listed in this section are standard for NFPA 99 medical vacuum systems. In the case of special system configurations, these features may or may not be included with the system.

System Design
The LifeLine® Oil-Less Claw Medical vacuum package is fully compliant with NFPA 99. Designed and manufactured with ISO 13485 processes, each system is completely tested before shipment and includes:

• "Oil-less" claw rotary vacuum pumps with motors

• Integral pre-wired control panel (variable speed drive inverter optional)

• Air receiver with full-size three-valve bypass system sized for appropriate demand

• OSP-322-10 seismic pre-certification rating of 2.5 S_{DS}.

Vacuum Pump
Each pump is a direct driven, non-contacting claw type, capable of operating continuous duty at the following levels:

• 5.4 Hp at 28.4" Hg (sea level)

• 6.4 and 7.5 Hp at 27" Hg (sea level)

• 8.7 Hp at 25.5" Hg (sea level)

• 10 Hp and 15 Hp at 24" Hg (sea level)

The pumping chamber is oil free. The pump is completely aircooled with no water requirements. Each pump contains:

• Vacuum relief valve

• Check valve to prevent backflow through off-cycle units

• Flexible connector and isolation valve

• High discharge temperature sensor

• Oil drain valve and oil sight glass

Vacuum Pump Motor
Motors are continuous duty, C-face, TEFC, suitable for 230/460 or 208V, 60 hertz, 3-phase electrical service and 380V, 50 hertz, 3-phase electrical service.

Vacuum Filtration per NFPA 99
A HEPA inlet air filter, 0.3 micron, 99.97% efficiency, is mounted before each vacuum pump. A clear, glass collection canister is mounted below each HEPA filter, with quarter turn valve to isolate canister from filter during service. The inlet filter canister contains a bleed valve to relieve vacuum before servicing.

Intake Piping
Each vacuum pump has a factory piped intake with integral flex connector, isolation valve, and check valve. Interconnecting piping consists of powder-coated steel tubing and flanges.

Vacuum Receiver
The vacuum receiver is ASME Code stamped, and rated for a minimum 150 PSIG design pressure. The receiver has a full-size three-valve bypass system to allow for draining of the receiver without interrupting the vacuum service. A manual drain is provided on the receiver.

Exhaust Piping
Each vacuum pump module is factory piped to an exhaust manifold with integral flex connector and drip leg with ball valve and condensate drain. Interconnecting piping consists of powdercoated steel tubing and flanges. An exhaust muffler is shipped loose.

TotalAlert 360 Control System
The TotalAlert 360 control system is U.L. labeled. The control system provides automatic lead/lag sequencing and automatic alternation of all vacuum pumps based on first-on/first-off principle

1.0 General Information

with provision for simultaneous operation if required. Automatic activation of reserve unit, if required, will activate an audible alarm as well as a visual alarm on the display screen. Additional components include:

• NEMA 12 control panel enclosure

• Single variable speed drive inverter (optional)

• Circuit breaker disconnects for each motor with external operators

• Full voltage motor starters with overload protection

• 24V control circuit

• 65kAIC SCCR rating for control cabinet

The touch screen controls feature a 10" color, high resolution screen. Screen displays and functions include:

• Easy to read system vacuum level (VSD speed optional)

• Status of all units (Running, Available, Off, next to Run)

• Trend graphs for vacuum level and units running (VSD speed optional)

• Run time hour meters for each unit

• Visual/audible alarm indications with isolated contacts for all standard remote alarms

• Event log recording alarms and system activity

• Service alerts

• Event log recording service warnings and service history

• Integral cellular connectivity to MyMedGas, allowing electronic notifications of alarms and warnings

• Daily rounds uploadable to MyMedGas

• BTL listed, BACnet/IP communication

1.2 Electromagnetic Immunity

EN 61000-6-2 Medical Electrical Equipment needs special precautions regarding EMC and needs to be installed and put into service according to the EMC information provided in this manual.

Portable and mobile RF communications equipment can affect Medical Electrical Equipment.

The use of accessories, transducers, and cables other than those specified by the manufacturer, may result in decreased immunity of the TotalAlert 360 control system.

The TotalAlert 360 control system should not be used adjacent to other equipment. If adjacent use is necessary, the TotalAlert 360 control system should be observed to verify normal operation in the configuration in which it will be used.

1.0 General Information

EN 61000-6-2 (Cont.)

Guidance and manufacturer's declaration - electromagnetic immunity			
The TotalAlert 360 control system is intended for use in the electromagnetic environment specified below. The customer or the user of the TotalAlert 360 control system should assure that it is used in such an environment.			
Immunity test	IEC 60601 test level	Compliance level	Electromagnetic environment - guidance
Electrostatic Discharge (ESD) IEC 61000-4-2	±6 kV contact ±8 kV air	±6 kV contact ±8 kV air	Floors should be wood, concrete, metal or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30 %.
Electrical fast transient/burst IEC 61000-4-4	±2 kV for power supply lines ±1 kV for input/ output lines	±2 kV for power supply lines ±1 kV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	±1 kV differential mode ±2 kV common mode	±1 kV differential mode ±2 kV common mode	Mains power quality should be that of a typical commercial or hospital environment
Voltage dips, short Interruptions and voltage variations on power supply input lines IEC 61000-4-34	<5 % U_T (>95 % dip in U_T) for 0,5 cycle <40 % U_T (>60 % dip in U_T) for 5 cycles <70 % U_T (>30 % dip in U_T) for 25 cycles <5 % U_T (>95 % dip in U_T) for 5 sec	<5 % U_T (>95 % dip in U_T) for 0,5 cycle <40 % U_T (>60 % dip in U_T) for 5 cycles <70 % U_T (>30 % dip in U_T) for 25 cycles <5 % U_T (>95 % dip in U_T) for 5 sec	Mains power quality should be that of a typical commercial or hospital environment. If the user of the TotalAlert 360 control system requires continued operation during power mains interruptions, it is recommended that the system be installed on an emergency power service.
Power frequency (50/60 Hz) magnetic field IEC 61000-4-8	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.
NOTE: U_T is the a.c. mains voltage prior to application of the test level.			

1.0 General Information

EN 61000-6-2 (Cont.)

Guidance and manufacturer's declaration - electromagnetic immunity			
The TotalAlert 360 control system is intended for use in the electromagnetic environment specified below. The customer or the user of the TotalAlert 360 control system should assure that it is used in such an environment.			
Immunity test	IEC 60601 test level	Compliance level	Electromagnetic environment - guidance
Conducted RF IEC 61000-4-6	3 Vrms 150 kHz to 80 MHz	3 Vrms	Portable and mobile RF communications equipment should be used no closer to any part of the TotalAlert 360 control system, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. Recommended separation distance $d = 1,2\sqrt{P}$ $d = 1,2\sqrt{P}$ 80 MHz to 800 MHz $d = 2,3\sqrt{P}$ 800 MHz to 2,5 GHz where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in metres (m).
Radiated RF IEC 61000-4-3	3 V/m 80 MHz to 2,5 GHz	3 V/m	Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey,[a] should be less than the compliance level in each frequency range.[b] Interference may occur in the vicinity of equipment marked with the following symbol: 
NOTE 1 At 80 MHz and 800 MHz, the higher frequency range applies.			
NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.			
[a] Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the TotalAlert 360 control system is used exceeds the applicable RF compliance level above, the TotalAlert 360 control system should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the TotalAlert 360 control system. [b] Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.			

2.0 Installation

2.1 Inspection Upon Receiving

The condition of the **LifeLine®** Claw Medical Vacuum 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. **BeaconMedæs** ships all systems F.O.B. factory; therefore, damage is the responsibility of the carrier, and all claims must be made with them. Claw systems may remain in their shipping containers until ready for installation. If **LifeLine®** Claw systems 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 unit 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 vacuum package can be moved with either a forklift or dollies. Keep all packing in place during installation to minimize damage. Walk along the route the unit must travel and note dimensions of doorways and low ceilings.

Most Single Point Connection systems can be separated to fit through 36" doorways (Pentaplex and Hexaplex control skid bases measure 40.5"). If separating bases, carefully label all removed electrical connections for easier re-assembly at the final destination.

Modular systems are shipped as separate units to facilitate a variety of installations. Most modular and tank mount units are designed to fit through a standard 36" doorway, though some receiver modules may need to be tipped slightly (15 Hp through 25 Hp skid bases measure 43"). Some interconnecting piping and wiring between modules may be necessary on modular systems only.

2.3 Location

The **LifeLine®** Claw Medical Vacuum system should be installed indoors in a clean, well-ventilated environment. Areas of excessive dust, dirt or other air-borne particulate should be avoided.

Place units to ensure high visibility of indicators and gauges and for performing maintenance on the system. Refer to your installation diagram. If you do not have one, please contact **BeaconMedæs Technical Support** at 888-4-MEDGAS.

Certain considerations should be given to the placement of the system. Install the package in a location that is flat, level, and will support its weight. Clearance between the unit and adjacent walls should be no less than 24" to ensure sufficient airflow for cooling. There should be a minimum of three feet of clearance in front of the control panel for safe operation and maintenance. A vertical distance of 24" is required above the modules for ventilation and maintenance.

No special foundation is required. However, all units must be securely bolted using all mounting holes provided. If a raised concrete pad is used, the module bases must not overhang the concrete base. A method to drain away moisture is necessary.

Adequate ventilation is required. The pumps are air-cooled. Therefore, ambient temperature should be between 40˚F and 105˚F (if the maximum ambient exceeds 105˚F, contact factory for special instructions). The system should be located as close as possible to the point of usage to prevent excessive loss of operating vacuum due to pressure drop.

When selecting the location for the system,

2.0 Installation

consider the requirements for service, such as cleaning, changing filters, and changing oil.

2.4 Locations Above Sea Level

All vacuum pumps above sea level have reduced flow and should be de-rated. After determining the correct flow needed for the medical vacuum system, multiply this number by the adjustment factor located in Table 2.4.1. After determining the new flow required, use this number to size the medical vacuum system.

Table 2.4.1 Altitude Adjustment Factor

Altitude Adjustment Factor		
Altitude (ft)	**Normal Barometric Pressure (inches HG)**	**Multiplier Used for Required SCFM**
0	29.92	1.00
500	29.39	1.02
1000	28.86	1.04
1500	28.33	1.06
2000	27.82	1.08
2500	27.32	1.10
3000	26.82	1.12
3500	26.33	1.14
4000	25.84	1.16
>4000	**Contact Factory**	

2.5 Electrical Requirements

WARNING:

BE SURE THAT ALL POWER IS TURNED OFF PRIOR TO PERFORMING ANY WORK ON THE ELECTRICAL PANEL!

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

Do not operate vacuum pump on a voltage other than the voltage specified on the control panel nameplate.

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

Refer to the wiring diagram(s) that came with the vacuum pump system for pertinent wiring connections.

Electrical power for the medical system must be supplied from the emergency life support circuit.

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 be able to handle peak motor amp load of all operating units. Refer to the vacuum pump system full load amperes on the wiring diagram.

Check all electrical connections within the vacuum system that may have loosened during shipment.

Qualified electricians only should make power connections to the control panel and any interconnecting wiring. The control panel has openings for electrical and alarm/data/USB connections. **Do not drill additional holes in the control panel as this may void the system warranty.** See Figure 2.1 for opening locations.

2.0 Installation

Figure 2.5.1 Electrical/Alarm/Data/USB Openings

Ensure that the emergency generation system electrical supply is consistent with the vacuum system's requirements.

The electrical controls for the system were wired at the factory and were fully tested.

Three-phase power supplied from emergency generator(s) must match that of the normal supply to allow for correct direction of the motor rotation at all times.

NOTE: It may be necessary to switch two of the leads when performing start-up, if the pump rotation is in the wrong direction.

2.6 Intake Piping

Before connecting any piping, the plastic thread protector installed in the connection port must be removed. We recommend that the main vacuum line to the receiver should not be reduced below that provided on the receiver. Long piping runs may need to be increased in size to minimize pressure drop. Improper line sizing may result in a loss of capacity. Ideally, piping should be constructed using long radius elbows and a minimum number of turns.

All secondary lines should be taken from the top or side of the main line to prevent any accumulated moisture from draining towards the pumps. All lines should slope away from the pumps. Any low points in the piping should be equipped with pipe drains to remove accumulated moisture.

All intake vacuum lines must be piped in accordance with NFPA 99. All pipe must be either seamless copper tubing or other corrosion-resistant metallic tubing, as detailed in NFPA 99.

2.7 Exhaust Piping

The exhaust line must be piped outside of the building in accordance with NFPA 99. To ensure that no restriction of airflow will occur, size the piping according to Table 2.7.1. All pipe must be either seamless copper tubing or other corrosion-resistant metallic tubing as detailed in NFPA 99. A flexible connector must be installed on each exhaust port of the vacuum pump before connecting to the main exhaust line leading outdoors. Additionally, a drip leg must be installed at each exhaust port connection to allow for the draining of any accumulated moisture (Refer to the installation schematics for more details). The outside pipe must be turned down and screened to prevent contamination.

2.0 Installation

WARNING:

THE VACUUM EXHAUST VENT MUST BE LOCATED AWAY FROM MEDICAL AIR INTAKES, DOORS, AND OPENINGS IN THE BUILDINGS TO MINIMIZE POSSIBLE CONTAMINATION TO THE FACILITY, IN ACCORDANCE WITH NFPA 99.

Table 2.7.1 Exhaust Pipe Length

System Exhaust Pipe Length (ft) - See Notes												
LifeLine Units	**25**	**50**	**75**	**100**	**150**	**200**	**250**	**300**	**350**	**400**	**450**	**500**
Duplex 2 Hp	1.50	1.50	1.50	1.50	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.50
Duplex 3 Hp	1.50	1.50	1.50	2.00	2.00	2.00	2.00	2.50	2.50	2.50	2.50	2.50
Duplex 4 Hp	2.00	2.00	2.00	2.00	2.50	2.50	2.50	2.50	2.50	2.50	3.00	3.00
Duplex 5.4 Hp	2.00	2.00	2.00	2.50	2.50	2.50	2.50	3.00	3.00	3.00	3.00	3.00
Duplex 6.4 Hp	2.50	2.50	2.50	2.50	2.50	3.00	3.00	3.00	3.50	3.50	3.50	3.50
Duplex 7.5 Hp	2.50	2.50	2.50	3.00	3.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00
Duplex 8.7 Hp	2.50	2.50	3.00	3.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Duplex 10 Hp	3.00	3.00	3.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	5.00
Duplex 15 Hp	3.00	4.00	4.00	4.00	4.00	4.00	5.00	5.00	5.00	5.00	5.00	5.00
Triplex 5.4 Hp	2.50	2.50	2.50	2.50	3.00	3.00	3.00	3.00	4.00	4.00	4.00	4.00
Triplex 6.4 Hp	2.50	2.50	3.00	3.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Triplex 7.5 Hp	3.00	3.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00	5.00	5.00	5.00
Triplex 8.7 Hp	3.00	3.00	3.00	4.00	4.00	4.00	4.00	5.00	5.00	5.00	5.00	5.00
Triplex 10 Hp	3.00	3.00	4.00	4.00	4.00	4.00	5.00	5.00	5.00	5.00	5.00	5.00
Triplex 15 Hp	4.00	4.00	4.00	5.00	5.00	5.00	5.00	6.00	6.00	6.00	6.00	6.00
Quadruplex 5.4 Hp	3.00	3.00	3.00	3.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Quadruplex 6.4 Hp	3.00	3.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00	5.00	5.00	5.00
Quadruplex 7.5 Hp	4.00	4.00	4.00	4.00	4.00	4.00	5.00	5.00	5.00	5.00	5.00	5.00
Quadruplex 8.7 Hp	4.00	4.00	4.00	4.00	4.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Quadruplex 10 Hp	4.00	4.00	4.00	4.00	5.00	5.00	5.00	5.00	5.00	6.00	6.00	6.00
Quadruplex 15 Hp	5.00	5.00	5.00	5.00	5.00	6.00	6.00	6.00	6.00	6.00	8.00	8.00
Pentaplex 15 Hp	5.00	5.00	5.00	5.00	6.00	6.00	6.00	8.00	8.00	8.00	8.00	8.00
Hexaplex 15 Hp	5.00	5.00	6.00	6.00	6.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00

Notes:

1. All pipe sizes are based on the following: copper pipe (Type L), 14.7 psia.
2. The minimum pipe size must be maintained for the total length of the exhaust pipe. Use next larger size pipe in the event the minimum size is not available.
3. When determining the total pipe length, add all the straight lengths of pipe together in addition to the number of elbows times the effective pipe length for that pipe size. (See the table and example below.)

2.0 Installation

Table 2.7.2 Pipe Length for 90˚ Elbow

Effective Pipe Length Equivalent to each 90 degree Elbow									
Pipe Size (in.)	1.50	2.00	2.50	3.00	3.50	4.00	5.00	6.00	8.00
Eff. Pipe Length (ft)	4.0	4.9	6.4	7.9	9.4	10.0	11.9	13.2	14.5

Example:

Select the pipe size for a Duplex 7.5 HP with 60 feet of straight pipe and six elbows:

A) Select the pipe size of 3" diameter for 60 feet of straight pipe.

B) Determine the eff. Pipe length for an elbow of 3" dia. (EPL= 7.9 ft / elbow).

C) Calculate the SYSTEM PIPE LENGTH {SPL (3.0" D) = 60 + (6 x 7.9) = 107.4 ft}

D) Check this SYSTEM PIPE LENGTH to see if it exceeds the minimum pipe size. In this case it does, select the next larger pipe size from the table (D = 4").

E) To double-check the pipe size, recalculate the SPL with the new diameter. SPL (D = 4") = 60 + (6 x 10.0) = 120 ft. This is in the allowable range.

3.0 Start Up

3.1 Prestart-up

The contractor should notify **BeaconMedæs** 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 an authorized technician from **BeaconMedæs** start-up the system can void the manufacturer's warranties.

WARNING:

Prior to putting the LifeLine® Claw Medical Vacuum 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 Medical Vacuum meets the minimum requirements for Medical Vacuum as specified in NFPA 99.

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

WARNING:

Have more than one person on hand during prestart-up and start-up procedures to ensure 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/actions and maintenance. The temperature of the area containing the modules should be approximately 70°F (21.1°C) with a minimum ambient temperature of 40°F (4.4°C) and a maximum ambient temperature of 105°F (40°C).

- Check the intake piping for proper size and connection to the vacuum modules.
- Check all piping system joints that might have come loose during shipment and installation to ensure they are tight.
- Check the air receiver, controls, and pumps for damage.
- Check the drain valve on the air receiver.
- Check all valves for full open and full close travel. Ensure that the system's valves are positioned for proper operation. (Refer to labeling on valve handles)
- **Remove all packing material from the unit.**
- Check the electrical connections to the control cabinet.
- Verify electrical service. Before starting the system, check to see that voltage, amperage, and wire size are appropriate.

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

WARNING:

To prevent electrical shock, ensure that ALL electrical power to the system is OFF, including the disconnect switches on the control panel. The facility's supply circuit breaker should also be locked out.

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

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

3.0 Start Up

- Check the electrical cabinet for any broken components.
- 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 Start-up

CAUTION: Complete the prestart-up procedure before continuing with the initial start-up procedure.

WARNING:

To prevent electrical shock, ensure that ALL electrical power to the system is OFF, including the disconnect switches. The facility's supply circuit breaker should also be locked out.

3.2.1 Lubrication

The pump gears are oil lubricated, but there is no lubricant or sealing fluid inside the pumping chamber.

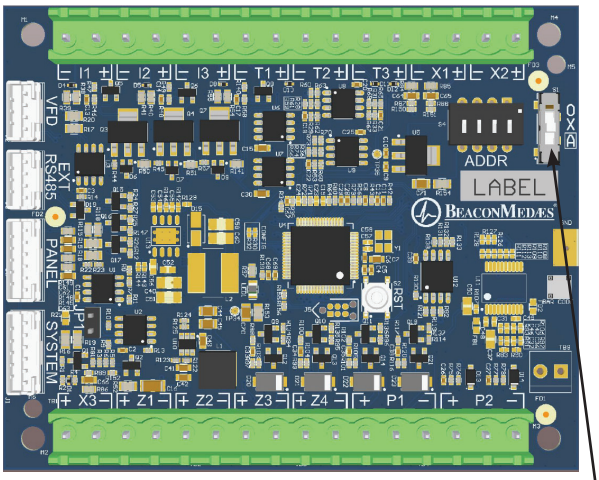
All LifeLine® Claw vacuum pumps are shipped with the required amount of oil for start-up. All models are shipped with the required oil already in the pumps.

3.2.2 Unit Rotation

Inside the control panel, make sure that all unit printed circuit boards are set to the manual override "Off" position. This is indicated by the middle position "X" on the three-position sliding switch as shown in Figure 3.2.2.1. Refer to the wiring diagram for your system to confirm which boards are unit controller boards.

Check all voltages supplied to the **LifeLine®** system to ensure they are the required value and phases needed by the control panel.

Apply power to the system and turn the disconnect switches to "On".



Manual Override Switch

O - On Manual
X - Off
A - Automatic

Figure 3.2.2.1 Unit PCB Override Switch

Prior to actual operation, the pumps must be checked for correct rotation.

Inside the control cabinet, switch one of the unit printed circuit boards from the manual override "Off" position to the bottom position, the default "Automatic" mode. Navigate to the Units screen by pressing on either of the unit status boxes on the main screen, see Figure 3.2.2.3 Make sure the unit mode on the display is "Off", see Figure 3.2.2.2.

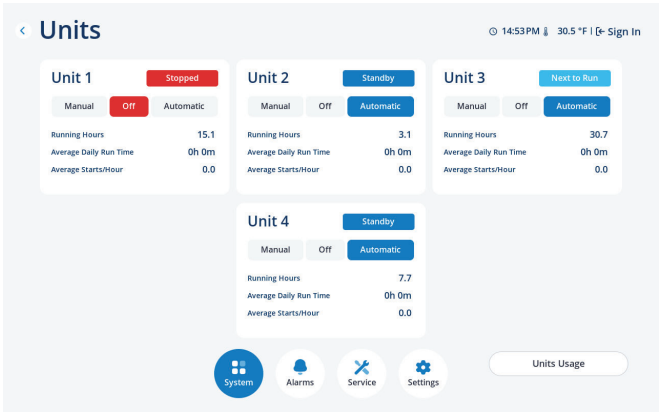


Figure 3.2.2.2 Unit Screen - Off Position

3.0 Start Up

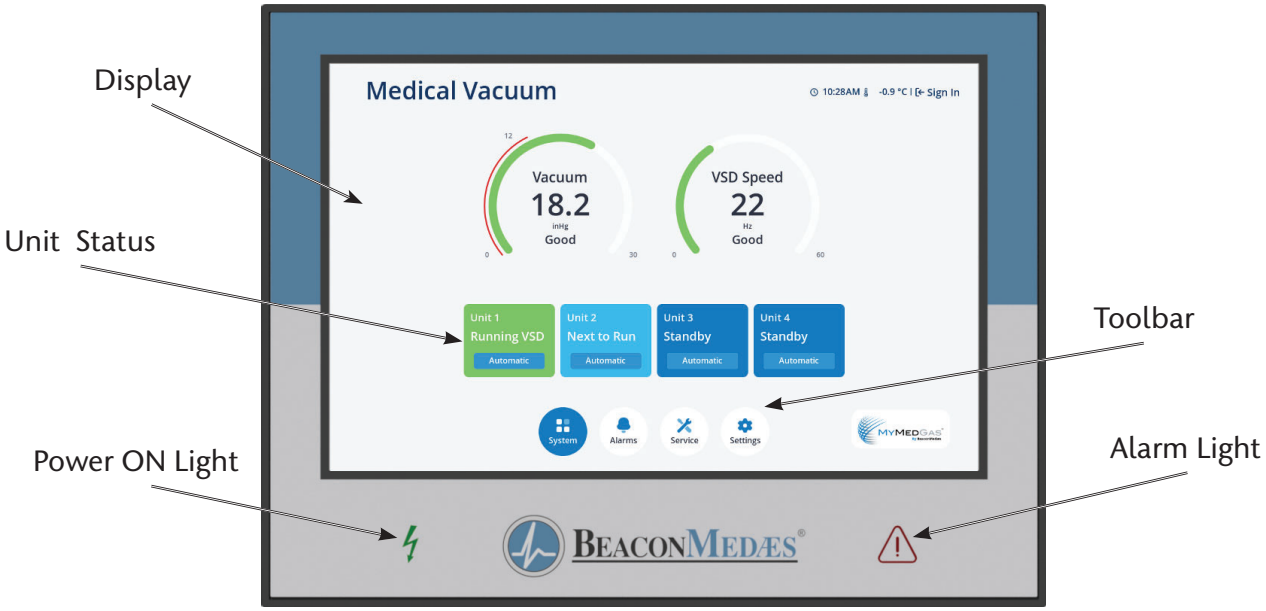


Figure 3.2.2.3 Touchscreen Controls

Direct On Line or Wye Delta Starting

Check for correct direction of rotation of each pump by pressing the "Rotate" button on the touchscreen display (found in the Units Rotation section of the Service screen) and observing rotation. See Figure 3.2.2.4. The unit mode for each compressor must be in the Off Position for the Rotation to function.

By observing the cooling fan of the motor, you can determine the rotation of the pump. After pressing the "Rotation" button on the touchscreen, there is a 3 second delay before the pump will start for a brief amount of time. Pump rotation should be counterclockwise when looking at the rear of the motor. Directional arrows are located on each pump.

If the pumps are rotating in the wrong direction, rotation can be reversed by switching any two main power leads to the panel. Correct rotation should be confirmed in the previous manner.

Repeat the process of switching the Unit printed circuit boards from the manual override "Off" position to the default "Automatic" position and testing rotation.

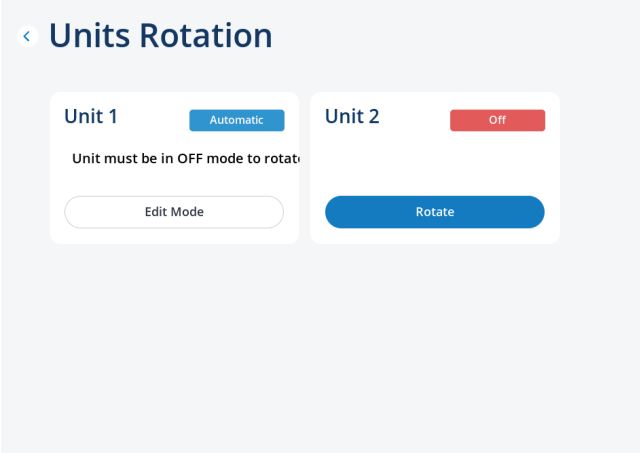


Figure 3.2.2.4 Units Rotation Screen

Variable Speed Drive

Prior to actual operation, the pumps must be checked for correct rotation in both "Manual" and "Automatic" position. In the "Manual" position, the unit starts Across the Line. In the "Automatic" position, the unit starts with the Variable Speed Drive. It is possible for the pump to turn in one direction when started in the "Manual" position, and then turn the other direction when started in the "Automatic" position. This must be checked using the following two steps.

3.0 Start Up

Step 1: Running Unit without VSD

Check for correct direction of rotation of each pump by pressing the "Rotation" button on the touchscreen display (found in the Units Rotation section of the Service screen) and observing rotation. See Figure 3.2.2.4. The unit mode must be in the "Off" Position for the Rotation to function.

By observing the cooling fan of the motor, you can determine the rotation of the pump. Pump rotation should be counterclockwise when looking at the rear of the motor. Directional arrows are located on each pump.

If the pumps are rotating in the wrong direction, rotation can be reversed by switching any two main power leads to the panel. Correct rotation should be confirmed in the previous manner.

Step 2: Running Unit with VSD

Check for correct direction of rotation of each pump by pressing the "Automatic" button on the touchscreen display and observing rotation. See Figure 3.3.1.

By observing the cooling fan of the motor, you can determine the rotation of the pump. Pump rotation should be counterclockwise when looking at the rear of the motor. Directional arrows are located on each pump.

If the pumps are rotating in the wrong direction, rotation can be reversed by switching any two main power leads between the VSD and the motor starter. Correct rotation should be confirmed in the previous manner.

WARNING:

Do not allow the vacuum pump to run backwards.

3.3 Initial Operation

Start each unit by pressing "Automatic" on the touchscreen. See Figure 3.3.1.

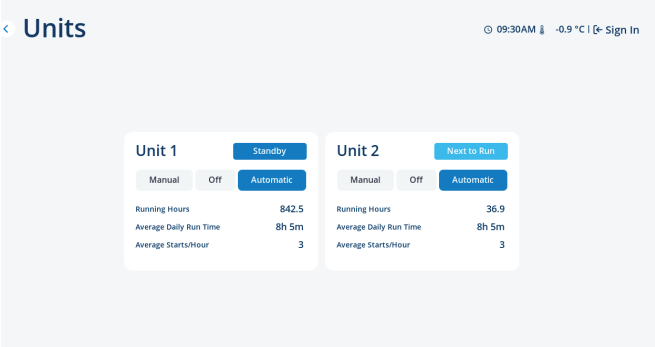


Figure 3.3.1 Unit Screen - Automatic Mode

WARNING:

Pumps that have reached operating temperature may have a high surface temperature on the top of the exhaust muffler.

DO NOT TOUCH!

Run the pump for two minutes in the correct rotation. Stop the pump and check that the gear box is at the correct oil level, as shown in the sight glass (See Figure 6.1.1). See Section 6.4 for the oil type and quantity. **DO NOT OPEN THE FILLER PORT WHILE THE PUMP IS RUNNING.**

After testing each pump, if everything appears normal, put each unit into the "Automatic" mode and allow each pump to run until vacuum builds. Check for any leaks in the piping. Repair leaks, if needed.

4.0 General Operation

WARNING:

NEVER RUN THE PUMP WITHOUT LUBRICATING OIL!

4.1 Electrical Control Panel

The LifeLine multiplex control system is U.L. labeled. The control system has a touch screen control, single variable speed drive (VSD Control only), automatic lead/lag sequencing, external operators with circuit breaker disconnects, full voltage motor starters and VSD contactors (VSD Control only), overload protection, 24V control circuit, and automatic-off-manual selector for each vacuum pump. Automatic alternation of all vacuum pumps is based on first-on/first-off principle with provisions for simultaneous operation if required. Automatic activation of reserve unit, if required, will activate an audible alarm as well as a visual alarm on the control panel. The control panel displays service alert, run hours for each vacuum pump, system status, system vacuum level, and high discharge air temperature. A complete alarm and service history is available on the control panel. (see Appendix A for more details)

During normal operation, all pumps should be in the "Automatic" position so that the control system can effectively run the system. The control system monitors the system vacuum level, starts and stops the pumps depending on changing vacuum level conditions and minimum run time values, and automatically alternates the lead position between units.

On the **initial** system start-up, when the system vacuum level is below the set point of the vacuum transducer, unit 1 will start immediately. Another unit starts after a programmed time delay. The time delay prevents high inrush current after a power failure or emergency power switch over. During this initial system start-up, the lag alarm may come on at this point and is normal. It can be reset once the system reaches its normal operating vacuum and the lead pump times out and stops. See Figure 4.1.1.

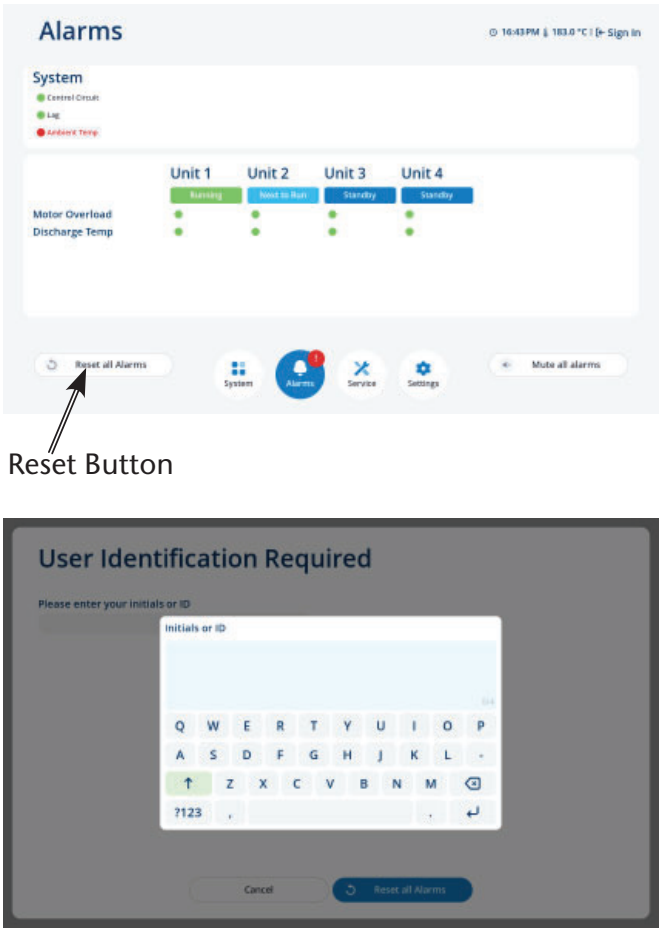


Figure 4.1.1 Main Screen - Reset Button and User Identification (DOL shown)

The control system sequences the pumps in number order (1, 2, 3, etc.). The control system only considers available units in the sequence. The number of available units is the number of pumps set to "Automatic" on-screen. The system will not count pumps set to "Manual" or "Off". Example: A triplex system has Units 1 and 3 set to "Automatic" and Unit 2 set to "Off". The control system will start/stop the pumps based on having only 2 units, and the sequence will be: 1, 3, 1, etc.

The control system will automatically start/stop the units at pre-defined system vacuum values. The start/stop values vary depending on the number of available units and the min/max system vacuum settings. The last available (lag) pump will come

4.0 General Operation

on at the min system vacuum level. The last pump running will turn off at the max system vacuum level if the minimum run time has been met. If not, the pump will continue to run until the minimum run time is achieved. Refer to the appropriate wiring diagram for the default vacuum settings.

This control system operates according to a "first on/first off" principle instead of the more traditional "last on/first off" principle. With the "first on/first off" sequencing technique, starts and stops on the pump are minimized. The "first on/first off" principle behaves as follows:

The control will signal the lead pump to start when system vacuum falls below the set point. Once the lead pump has started, the next available pump will read "Next to Run." If the one pump can carry the load, then the system vacuum will rise to 22 inHg. At this point, the control will turn off the lead pump if the minimum run time has been met. When the system vacuum drops again, the control will automatically sequence the lead role to the "Next to Run" pump and will start it.

If one pump cannot carry the load, the system vacuum will continue to fall until it triggers the "Next to Run" pump to start. Once the second pump has started, the next available unit will read "Next to Run." This will continue until the system vacuum stops falling or all available units have turned on. When the pumps can carry the load, the system vacuum will rise towards 22 inHg. The lead pump will be the first to stop. When the lead pump stops, the system will automatically sequence the lead role to the next available unit. If the system vacuum continues to rise, the new lead pump will be the next to turn off. If the system vacuum drops again, the "Next to Run" pump will be the next to start.

If during operation, the lag pump is required to come on, the control will turn on the "Lag Alarm" (see Section 4.3).

For maintenance or other reasons, pumps can operate in "Manual" position. The pump(s) in the "Manual" mode will run continuously.

4.1.1 Run Timer

Direct On Line or Wye Delta Starting
All LifeLine vacuum systems incorporate run timers to minimize the starts and stops on the vacuum pumps. After the pump has stopped, its runtime will automatically adjust based on how long the lead pump is off and the maximum run time set by the user.

Variable Speed Drive
After a pump has started, its runtime will depend on the vacuum level of the system. If the vacuum level exceeds the set point by 0.5 inHg, the pump will stop after 5 minutes. If the vacuum level remains within +/- 0.5 inHg of the set point, the pump will run for the maximum run time set by the user.

4.2 Tank Drains

The standard tank drain consists of a manually operated ball valve.

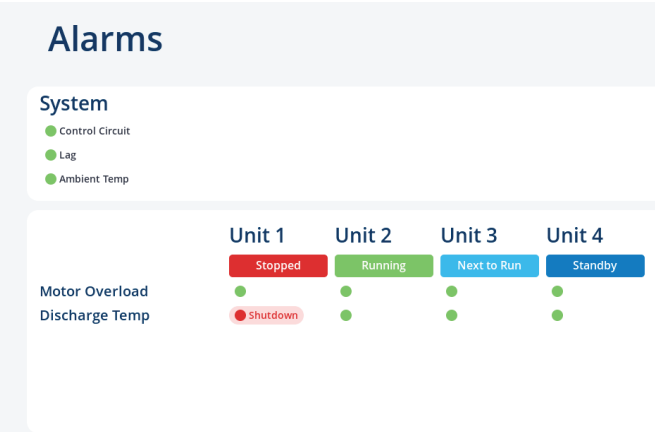
To drain the liquid from the tank, open the tank bypass valve and close the tank isolation valves. Then open the vent and drain valves. When draining is complete, close the vent and drain valves first, then open the tank isolation valves and close the tank bypass valve.

4.3 Emergency Shutdown / Alarms

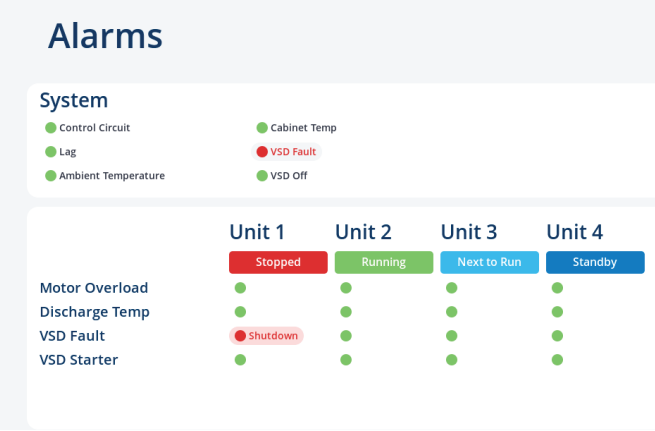
The following conditions may arise during operation. Alarm conditions will be labelled "Alarm" and shutdown conditions will be labelled "Shutdown".

4.0 General Operation

4.3.1 Unit Shutdown / Alarms



Unit Alarm/Shutdown - DOL System



Unit Shutdown - VSD System

Figure 4.3.1.1 Alarms Screen - Unit Alarm and Shutdown

Motor Overload Shutdown - This shutdown will activate if the motor current draw exceeds the set limit. This will shut down the pump in question and will not re-start until the reset button on the motor starter inside the main control cabinet is reset and "Reset all Alarms" is pressed on the control panel display. It is possible that the VSD will also have to be reset to clear this alarm condition. See "Motor breakers trip constantly" in the Troubleshooting Section 5.0.

Discharge Temperature Shutdown - This shutdown will activate if the outlet air temperature exceeds the set limit. This will shut down the pump in question and will not re-start until "Reset all Alarms" is pressed on the control panel. Before allowing the unit to re-start, the condition should be checked (see "Pump overheats" in the Troubleshooting Section 5.0). Even after resetting the alarm and putting the pump in "Automatic" mode, the unit may not re-start, depending on system sequencing and system vacuum.

Discharge Temperature Alarm - This alarm will activate if the outlet air temperature exceeds the set point. This will not shut down the pump in question but instead is a warning that a shutdown is likely to occur. The condition should be checked immediately (see "Pump overheats" in the Troubleshooting Section 5.0) to avoid a compressor shutdown.

VSD Fault Shutdown (VSD Systems only) - This shutdown will activate if a VSD Fault occurs while running on a particular unit. The unit will shutdown and not restart. Before resetting, investigate the cause of the shutdown to make sure there is no damage to the unit. To reset, push the "Reset all Alarms" button on the alarms screen. See Appendix B1 or B2 for more information.

VSD Starter Shutdown (VSD Systems only) - This shutdown will activate if the VSD starter fails to start the VSD. It will shut down the pump in question and it will not re-start until the reset button on the VSD starter is reset (See "VSD breakers trip constantly" in the Trouble Shooting

4.0 General Operation

Section 5.0). Press the alarm silence button on the alarms screen to silence the alarm. The Shutdown indicator will remain red until vsd starter is reset.

4.3.2 System Alarms

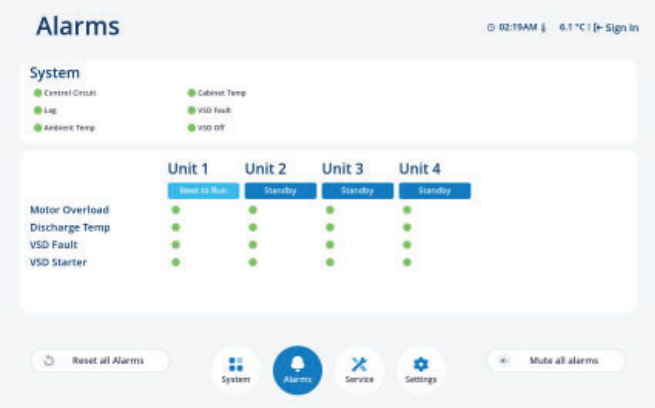


Figure 4.3.2.1 Alarms Screen (VSD shown)

Control Circuit Alarm - This alarm will activate if communication between any of the boards in the control circuit is disrupted. This will not shut down the pump in question but instead is a notification that there is a loss of communication between printed circuit boards within the control panel. See Appendix A on Control System for troubleshooting.

Lag Alarm - This alarm will activate if the last available unit activates bringing the total number of available units remaining to zero. This alarm will activate if the last available pump unit comes on. (See Section 4.1 for more information) To silence the alarm, press the "Mute all alarms" button. In the event the lag alarm is persistent, check to see if any leaks or valves are open upstream or reduce the system load.

Ambient Temperature Alarm - This alarm will activate when the temperature in the room exceeds the set point. The touchscreen will show an active alarm and record it in the event log. The alarm remains latched until the alarm condition is reset by the operator.

Cabinet Temperature Alarm (VSD Systems only) This alarm will activate when the temperature inside the control cabinet exceeds the set point. Check the side panel filters to make sure these are not clogged. The touchscreen will show an active alarm and record it in the event log. The alarm remains latched until the alarm condition is reset by the operator.

VSD Fault Alarm (VSD Systems only) - This alarm will activate if a VSD Fault occurs due to a malfunction of the VSD inverter. Before resetting the alarm, investigate the cause of the alarm to make sure there is no damage to the VSD inverter. See Section B1.3 or B2.3 for VSD Inverter Trouble Shooting. To reset, press the "Reset all Alarms" button on the alarms page to enable the VSD to operate.

VSD Off Alarm (VSD Systems only) - This alarm will activate if the VSD inverter shuts down and becomes unavailable for operation. Before resetting the alarm, investigate the cause of the alarm to make sure there is no damage to the VSD inverter. See Section B1.3 or B2.3 for VSD Inverter Trouble Shooting and for instructions to restart the inverter. To reset, press the "Reset all Alarms" button on the alarms page to enable the VSD to operate.

4.3.3 Service Warnings

Service Due Alarm - Service intervals and type of service are preprogrammed into the control system. The service icon on the toolbar will get a red "!" symbol when one of these services are required. See Table 6.1 Maintenance Schedules.

4.4 Backup Vacuum Switch Set Point Adjustments

The backup switch is set at the factory to the operating point(s) as stated on the wiring diagram supplied with the unit. It is good practice to cycle the switch to determine actual operating points before proceeding with readjustment. Refer to Figure 4.4.1 for location of adjustment.

4.0 General Operation

CAUTION:

- ALWAYS change vacuum setting gradually.
- ALWAYS check switch setting before making any adjustments.
- DO NOT force adjustment sleeve when it becomes difficult to turn.
- ALWAYS isolate the vacuum transducer before making any adjustments to the backup vacuum switch.

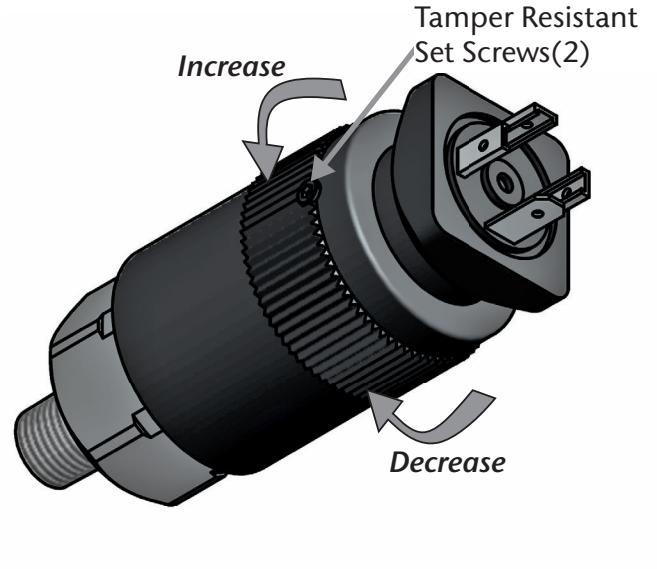


Figure 4.4.1 Backup Vacuum Switch

Adjusting Instructions

1. To make an adjustment, loosen the tamper resistant set screws (2) on the adjustment sleeve.

2. Secure the hex body with an open-end wrench. Hand turn the adjustment sleeve: counter-clockwise to increase and clockwise to decrease the set point. The backup vacuum switch should always be set with falling vacuum level starting at a vacuum level higher than the setpoint.

3. Using the vacuum gauge determine the actuation point of the switch.

4. If the actuation point is above the desired value, turn the adjustment sleeve clockwise to decrease the actuation point, and if it is below, turn the adjustment sleeve counter-clockwise to increase it.

5. For exact vacuum setting, cycle vacuum switch and make fine adjustments by repeating steps 2 through 4 (trial and error process) until the desired setting is obtained.

6. Secure the tamper resistant set screws (2) on the adjustment sleeve.

CAUTION: Do not over tighten set screws.

5.0 Troubleshooting

Problem	Possible Causes	Solution
Power failure	Main power disconnected	Turn on main power
		Change power supply phase on incoming power
	Power failure	Restore power
	Main fuse blown	Replace fuse
	Fuse blown in control circuit	Replace fuse
Failure to start	Overload tripped on starter	Reset & check for system overload
	High temperature sensor activated	Allow unit to cool; reset alarm & check for over temperature condition
	Vacuum sensor open	Adjust or replace sensor
	Loose or faulty connection	Check & tighten all wire connections
Unit lacks sufficient vacuum or lag alarm has occurred	Clogged/Dirty Filers	Clean filters
	Vacuum relief valves need adjusting	Re-calibrate relief valve (6.4-15 Hp only)
	Restrictions in piping	Check for dirty/clogged inlet filter
	Leaks in piping, tubing	Correct leaks
	Insufficient pump speed (RPM)	Check voltage and amperage to motor
		Inspect motor and coupling halves
		Check that the pump shaft turns freely
	Line losses too high	Piping diameter too small- replace with larger diameter
	Unit is operating at an elevated altitude	Contact the factory for assistance. Performance may be reduced when operating above sea level
	Transducer fault with lag alarm	Replace Transducer
Motor breakers trip constantly	Defective motor	Test motor and replace if necessary
	Overload incorrectly adjusted or defective	Adjust or replace overload

5.0 Troubleshooting

Problem	Possible Causes	Solution
Motor breaker trips constantly (continued)	Low motor voltage	Check at motor terminals Contact electric service provider
	Ambient temperature too high	Reduce ambient temperature
VSD breakers trip constantly	Defective motor	Test motor and replace if necessary
	VSD overload adjusted incorrectly	Adjust overload
	Low motor voltage	Check at motor terminals Contact electric service provider
	Ambient temperature too high	Reduce ambient temperature
	VSD defective	Replace VSD
Pump overheats	Cooling ducts blocked	Clean cooling ducts
	Cooling fan broken	Replace fan
	High ambient temperature	Ventilate or cool room
	Vacuum too high	Adjust vacuum settings or relief valve
	Inlet restricted	Remove restriction
	Exhaust restricted	Remove restriction
	The gearcase may be low/ empty of oil, has contaminated oil or was filled with an incorrect type of oil.	If the oil level is found to be low, immediately shut off the pump, drain the remaining oil from the gearcase and replenish with new fresh oil. If an incorrect oil type or contamination is found, contact the factory for assistance. Refer to Section 5.1 for the correct oil type.
Unit runs rough and cannot be rotated manually	Worn coupling	Remove motor & inspect coupling element Replace, if necessary
	Worn bearings	Contact factory for assistance
High vacuum level	Vacuum relief valves need adjusting	Contact factory for assistance
	Vacuum setting out of adjustment	Adjust vacuum setting on main display
Excessive noise level	The coupling rubbers may be worn	See “Worn coupling” above
	Internal pump damage	Contact factory for assistance

6.0 Maintenance

6.1 General Maintenance

WARNING:

ISOLATE POWER BEFORE STARTING ANY MAINTENANCE PROCEDURES, TO PREVENT ELECTRICAL SHOCK OR ACCIDENTAL STARTING OF EQUIPMENT.

WARNING:

Pumps that have reached normal operating temperature may have a high surface temperature.

Do not perform any maintenance until after a sufficient cool down period.

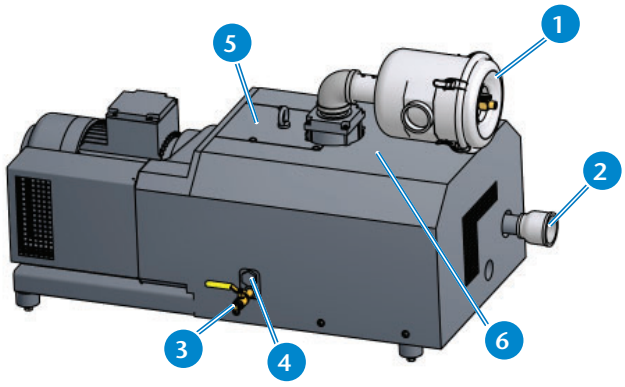
Never perform any maintenance functions while the unit is in operation.

Table 6.1.1 Maintenance Schedule

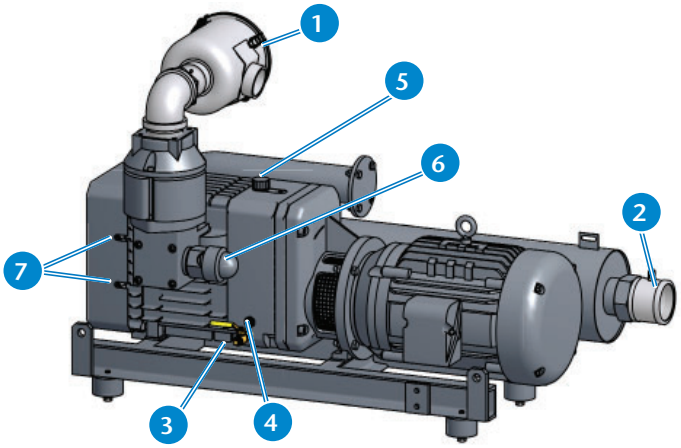
Item	Frequency	Action
Exhaust drip leg	Daily/Adjust as needed	Check for accumulated moisture
Inlet filters and drain flasks	Check Monthly Replace Annually or as needed	Inspect Replace the inlet filter elements and drain flasks
VSD Control Panel Filter (VSD Only)	Check Monthly Clean Annually or as needed	Inspect Remove filters and wash, dry, and reinstall
Oil Level	Check weekly	Top off only when unit is not running
Oil	5,000 hours or Annually	Change oil
Motor bearings* 2 - 15 HP units	Annually	17 grams of grease per fitting
Pump bearings* 2 - 10 HP & 15 HP MM1502 units 15 HP MI1502 units	Not required 6 months	Not required for these models Fill until grease flows from relief port
Coupling	2 years	Remove motor in order to inspect coupling elements for wear. Replace as needed

* Refer to the sections 6.5 and 6.6 for grease specifications.

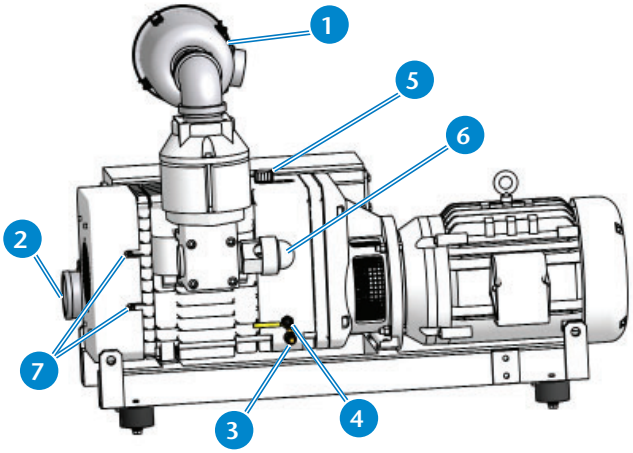
6.0 Maintenance



2 - 10 Hp & 15 Hp MM1502
Standard and O_2Assured



15 Hp MI1502 Standard



15 Hp MI1502 O_2Assured

Figure 6.1.1 Vacuum Pumps

Pump Maintenance Components	
1	Inlet Filter (Suction)
2	Discharge
3	Oil Drain Valve
4	Oil Sight Glass
5	Vent Valve / Oil Fill Port
6	Vacuum Relief Valve
7	Back-Side Bearing Grease Fittings

6.2 Pumps

Maintain the pump regularly to achieve the best operating results. Maintenance intervals will depend on the pump's use and ambient conditions. Each pump in the LifeLine system has an oil-lubricated gear box but there is no lubricant in the pumping chamber.

Do not run pumps without oil in the gear box.

6.3 Oil Type

a) **Standard Claw** - See Section 7.1 for listing of oil change kits.

b) **O_2Assured Claw** - Use only **BeaconMedæs** O_2Assured oil. Failure to use the proper lubricant may void the warranty. **BeaconMedæs** O_2Assured oil is inert in the presence of oxygen that may be in your vacuum system. See Section 7.2 for listing of oil change kits.

Contact **BeaconMedæs** Tech Support for additional information.

NOTE: If changing brands of oil, it is important to completely drain out all oil from the pump.

6.0 Maintenance

6.4 Gear Box Lubrication

CAUTION: Oil and used oil must be disposed of corresponding with the relevant health, safety and environmental laws.

Check the oil level regularly by observing the built-in sight glass (4). Each pump requires the proper oil to operate correctly (see Section 6.3 for the correct oil types). The oil should be changed every 5,000 hours of operation or annually, whichever comes first. The oil will need to be changed more frequently when operating at ambient temperatures above 105°F. An oil analysis kit is available to check oil quality and help determine best service interval for the operating conditions. See Oil Analysis Kit in Sections 7.1 and 7.2. Contact **BeaconMedæs** Tech Support for additional information.

The following table describes the oil quantity capacity per pump. See the pump nameplate for the pump model number.

Table 6.4.1 Oil Quantity per Pump

Pump Model	Oil Quantity (liters)	
	Standard	O_2Assured
MM1104	.85	.85
MM1144	.85	.85
MM1102	.85	.85
MM1142	.85	.85
MM1202	1.0	1.0
MM1252	1.0	1.0
MM1322	1.0	1.0
MM1402	1.0	1.0
MI1502	.6	.6
MM1502	1.2	N/A

6.5 Bearing Lubrication

CAUTION: Shut down the vacuum pump and lock & tag out the electrical controls for that pump prior to greasing the pump bearings.

Standard Claw

The back side bearings of the 15 HP MI1502 vacuum units need to be greased every 6 months. Use a grease gun to fill until grease flows from relief port (see 2 greasing points (7) (Ref. Fig 6.1). The greasing interval should be cut in half when operating at high ambient temperatures. See Section 7.1 for listing of grease service kits for Standard Claw Systems.

O_2Assured Claw

The back side bearings of the 15 HP MI1502 vacuum units need to be greased every 6 months. Each bearing requires 50 grams of grease.

Remove fan cover on the end of the pump opposite the motor. Follow this procedure for each bearing:

1. Remove the bearing cap.
2. Clean all old grease from the cap and face of the bearing.
3. Use a clean cloth and wear latex gloves, so that no contaminates are introduced into the bearing.
4. Pack 6.5 grams of grease into the bearing (using your finger).
5. Pack the balance of the grease (43.5 grams) into the cap.
6. Reinstall the bearing cap.
7. Reinstall the fan cover.

The greasing interval should be cut in half when operating at high ambient temperatures.

Use only BeaconMedæs O_2Assured grease. **Failure to use the proper grease may void the warranty. BeaconMedæs** O_2Assured grease is inert in the presence of oxygen that may be in your vacuum system.

See Section 7.2 for listing of grease service kits for O_2Assured Claw Systems.

6.0 Maintenance

6.6 Motor Lubrication

If greasing the motor becomes necessary, wipe the fittings completely clean and use clean equipment. More bearing failures are caused by dirt introduced by greasing than from insufficient grease. Be careful not to over-grease the motor. Slowly apply the recommended amount of grease, taking 1 minute or so to apply. Motors are pre-greased, normally with Polyrex EM (Exxon Mobil). Mixing dissimilar grease is not recommended.

The following table describes the motors that may require greasing. See the pump nameplate for the pump model number.

Table 6.6.1 Motor Lubrication

Pump Model	Greasable Motor Bearings	
	Standard	O_2Assured
MM1104	Yes	Yes
MM1144	Yes	Yes
MM1102	Yes	Yes
MM1142	Yes	Yes
MM1202	No	No
MM1252	No	No
MM1322	No	No
MM1402	No	No
MI1502	Yes	Yes
MM1502	No	N/A

6.7 Exhaust Drip Leg Valve

Each pump should have a drip leg at the exhaust port on the pump. This valve should be checked daily at first, then depending on the moisture accumulated, could be checked less frequently.

6.8 Inlet Filters

WARNING:

Filter elements and drain flasks are biohazard materials and need to be handled with proper care.

WARNING:

Proper Personal Protective Equipment (PPE) must be worn when servicing this equipment.

The capacity of the vacuum pump can be reduced if the air inlet filters (M) are not maintained correctly. The inlet filter cartridges should initially be cleaned monthly and changed yearly depending on the degree of contamination.

A PPE kit is available through BeaconMedæs. The kit includes a XL disposable coverall, N100 disposable respirator, wrap-around safety glasses, and two heavy-duty 30-gallon biohazard waste bags. The P/N for the kit is 4107 4018 65.

In addition to the PPE kit, below are the recommended gloves to be worn when servicing this equipment:

Grainger P/N: 2VLZ8

- Description: 9-1/2" Powder Free Unlined Nitrile Disposable Gloves, Black,Size L, 100PK

Grainger P/N: 2VLZ9

- Description: 9-1/2" Powder Free Unlined Nitrile Disposable Gloves, Black, Size XL, 100PK

It is recommended to replace the drain flask with every filter element change. The drain flask is available through BeaconMedæs. The P/N for the flask is 4107 6558 95.

The drain flask is also suitable for steam sterilization up to 273 °F (134 °C) using hospital equipment and procedures.

To replace the filter and drain flask:

1. Turn off the pump being serviced and lock open the appropriate disconnect switches.

6.0 Maintenance

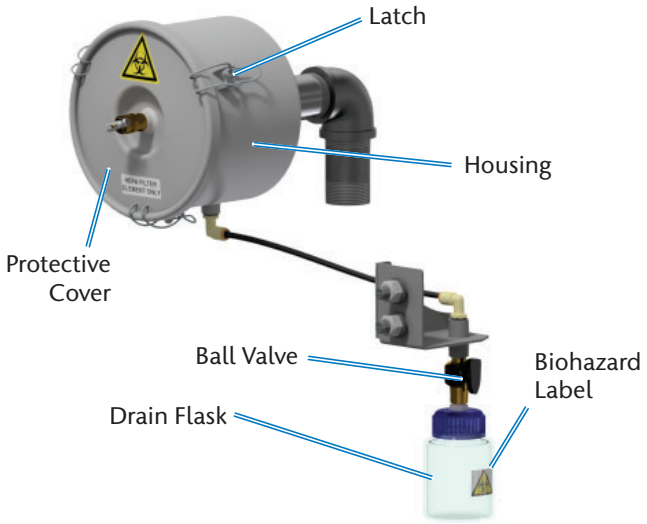


Figure 6.8.1 Intake Filter

2. Close intake isolation valve.
3. Close the ball valve attached to the drain flask, unscrew the drain flask, and dispose of it using the hospital procedure for biohazard waste.
4. Open the ball valve to relieve the vacuum in the filter assembly and ease in removing the filter housing.
5. Remove the protective cover by loosening the latches.
6. Remove the element.
7. Clean inside of housing
8. Dispose of gloves. Put on a new pair of gloves before proceeding further.
9. Insert a new element (note orientation of the element).
10. Replace protective cover and tighten latches.
11. Place the new biohazard label on the new drain flask.
12. Place a sealing washer over the fitting on the drain flask cap
13. Reinstall the drain flask by screwing it onto the ball valve.
14. Open intake isolation valve.
15. Turn on the compressor. Close butterfly valves on both sides of filter being serviced.
16. Dispose of all contaminated PPE.

6.9 Coupling Inserts

Remove the motor and inspect the condition of the coupling insert. Replace as needed.

Contact BeaconMedæs Tech Support for additional information.

6.10 Monthly Inspections

A general inspection should be performed on a regular basis (monthly) for safety items. Items to inspect include all wiring, flex hoses, and other items. If a damaged item is viewed, call your local **BeaconMedæs** service technician for a thorough inspection and report of findings.

6.11 Every Six Months

A thorough inspection of the vacuum pump cooling air intake and discharge grating should be performed at least every six months or more frequently if conditions require. If a dust/dirt buildup is visible, clean the grating to remove the buildup. Excess dust/dirt buildup in these areas will prevent air from cooling the vacuum pump, affecting peformance of the vacuum system.

6.12 Oil Leak

If upon inspection of the vacuum system, a noticeable amount of oil is seen on the base of the system or on the floor around the system, immediate action is required to prevent the possibility of injury. Using an oil absorbent or like product, absorb the oil on the base frame or floor to remove the potential of slipping. Call your local **BeaconMedæs** service technician for a thorough inspection of the vacuum pumps.The capacity of the vacuum pump can be reduced if the air inlet filters (M) are not maintained correctly. The inlet filter cartridges should initially be cleaned monthly and changed yearly depending on the degree of contamination.

6.0 Maintenance

6.13 Cleaning

Use clean, dry or damp microfiber cloth or soft lint-free cloth to remove any smudges on the display. Do not apply excessive pressure while cleaning. Never use paper towels or tissue paper, which contain wood fibers that may cause scratches.

7.0 Replacement / Maintenance Parts

7.1 Service Kits for Standard Claw Systems

KIT NUMBER	DESCRIPTION	QTY	WHERE USED	CONTENTS
6-Month Basic Service Kit for 15 Hp MI1502 Standard Claw Systems				
4107 4001 14	KIT - Claw Vacuum Pump Bearing Grease	1 per pump	15 Hp MI1502 B-Side Bearings	(1) High melting point grease (400g tube)
1-Year Basic Service Kit for Standard Claw Systems (HEPA Filters Effective August, 2021)				
4107 4001 15	KIT - Claw Vacuum Basic Size A	1 per pump	2 - 5.4 Hp	Filter element
4107 4021 20	KIT - Claw Vacuum Basic Size A	1 per pump	2 - 5.4 Hp	HEPA Filter element
4107 4001 16	KIT - Claw Vacuum Basic Size B	1 per pump	6.4 - 15 Hp	HEPA Filter element
5,000 Hour Oil or Annual Change Kits for Standard Claw Systems				
4107 4001 17	KIT - Claw Vacuum Oil Change Size A	1 per pump	2 - 5.4 Hp	(1) Vent Valve (1 Qt) Synchronizing Gear Operating Fluid
4107 4001 18	KIT - Claw Vacuum Oil Change Size B	1 per pump	6.4 - 15 Hp	(1) Vent Valve (1 Qt) Synchronizing Gear Operating Fluid
Oil Analysis Kit for Standard Claw Systems				
4107 4001 26	KIT - Oil Analysis Kit for Standard Claw Systems	1 per pump	All systems	(1) Oil sample container (1) Instruction form
Replacement Parts				
4107 6541 85	Coupling Insert	1 per pump	2 Hp (MM1104), 3 Hp (MM1144), 4 Hp (MM1102), 5 Hp (MM1142)	(1) Coupling insert
4107 6541 86	Coupling Insert	1 per pump	6.4 Hp (MM1202), 7.5 Hp (MM1252), 8.7 Hp (MM1322), 10* Hp (MM1402), 15 Hp (MM1502)	(1) Coupling insert
4107 6541 87	Coupling Insert	1 per pump	10* Hp (MM1320)	(1) Coupling insert
4107 6541 88	Coupling Insert (Complete)	1 per pump	15 Hp (MI1502)	(1) Complete coupling
4107 6558 95	Drain Flask	1 per pump	All systems	(1) Drain flask assembly

7.0 Replacement / Maintenance Parts

* Note: There are two models of 10 Hp Claw pumps: MM1320 and MM1402 and two models of 15 Hp pumps: MI1502 and MM1502. See pump nameplate to identify pump model.

7.2 Service Kits for O2Assured Claw Systems

KIT NUMBER	DESCRIPTION	QTY	WHERE USED	CONTENTS
6-Month Basic Service Kit for 15 Hp MI1502 O2Assured Claw Systems				
4107 4001 25	KIT - Claw Vacuum Pump Bearing Grease O2Assured	1 per pump	15 Hp MI1502 B-Side Bearings	(1) High melting point grease (400g tube)
1-Year Basic Service Kit for O2Assured Claw Systems (HEPA Filters Effective August, 2021)				
4107 4001 19	KIT - Claw Vacuum Basic Size A O2Assured	1 per pump	2 - 5.4 Hp	Filter element
4107 4021 20	KIT - Claw Vacuum Basic Size A O2Assured	1 per pump	2 - 5.4 Hp	HEPA Filter element
4107 4001 16	KIT - Claw Vacuum Basic Size B O2Assured	1 per pump	6.4 - 15 Hp	HEPA Filter element
5,000 Hour Oil or Annual Change Kits for O2Assured Claw Systems				
4107 4001 21	KIT - Claw Vacuum Oil Change Size A O2Assured	1 per pump	2 - 5.4 Hp	(1) Vent Valve (2 Pt) Synchronizing Gear Operating Fluid
4107 4001 22	KIT - Claw Vacuum Oil Change Size B O2Assured	1 per pump	6.4 - 15 Hp	(1) Vent Valve (2 Pt) Synchronizing Gear Operating Fluid
Oil Analysis Kit for O2 Assured Claw Systems				
4107 4001 27	KIT - Claw Vacuum Oil Analysis O2 Assured	1 per pump	All systems	(1) Oil sample container (1) Instruction form
Replacement Parts				
4107 6541 85	Coupling Insert	1 per pump	2 Hp (MM1104), 3 Hp (MM1144), 4 Hp (MM1102), 5 Hp (MM1142	(1) Coupling insert
4107 6541 86	Coupling Insert	1 per pump	6.4 Hp (MM1202), 7.5 Hp (MM1252), 8.7 Hp (MM1322), 10* Hp (MM1402), 15 Hp (MM1502)	(1) Coupling insert
4107 6541 87	Coupling Insert	1 per pump	10* Hp (MM1320)	(1) Coupling insert

7.0 Replacement / Maintenance Parts

Replacement Parts (Cont.)

KIT NUMBER	DESCRIPTION	QTY	WHERE USED	CONTENTS
4107 6541 88	Coupling Insert (Complete)	1 per pump	15 Hp (MI1502)	(1) Complete coupling
4107 6558 95	Drain Flask	1 per pump	All systems	(1) Drain flask assembly

* Note: There are two models of 10 Hp Claw pumps: MM1320 and MM1402 and two models of 15 Hp pumps: MI1502 and MM1502. See pump nameplate to identify pump model.

7.3 Retrofit Kits for HEPA Filters

KIT NUMBER	DESCRIPTION	QTY	WHERE USED	CONTENTS
KIT - Retrofit HEPA Filter Claw Vertical, SPC & Modular				
4107 4021 21	KIT - Retrofit HEPA Filter Claw Vertical, SPC & Modular	1 per pump	2-5.4Hp DX TX QX	(1) Filter assembly (1) Pipe nipple (1) Drain flask assembly (1) 1/4” Bleed Valve
4107 4021 22	KIT - Retrofit HEPA Filter Claw Vertical, SPC & Modular	1 per pump	6.4-7.5Hp DX TX QX	(1) Filter assembly (1) Drain flask assembly (1) 1/4” Bleed Valve
4107 4021 23	KIT - Retrofit HEPA Filter Claw Vertical, SPC & Modular	1 per pump	8.7Hp DX TX QX	(1) Filter assembly (2) Pipe nipples (1) 2” Pipe Union (1) Drain flask assembly (1) 1/4” Bleed Valve
4107 4021 24	KIT - Retrofit HEPA Filter Claw Vertical, SPC & Modular	1 per pump	10Hp DX TX QX	(1) Filter assembly (1) Drain flask assembly (1) 1/4” Bleed Valve
4107 4021 25	KIT - Retrofit HEPA Filter Claw Vertical, SPC & Modular	1 per pump	15Hp DX TX QX PX HX	(1) Filter assembly (1) Drain flask assembly (1) 1/4” Bleed Valve
Retrofit HEPA Filter Claw SPC & Modular Extension Bracket				
4107 4021 26	Retrofit HEPA Filter Claw SPC & Modular Extension Bracket	1 per tower	All systems	(1) Bracket

7.4 PPE Kit for Filter Service

KIT NUMBER	DESCRIPTION	QTY	WHERE USED	CONTENTS
4107 4018 65	KIT - Filter Service PPE	1	As needed	(1) Coverall (1) N100 Respirator (1) Safety glasses (2) Biohazard bags

8.0 Maintenance Record

Model Number _____

Serial Number _____

Installation Date _____

Date of Service								
Hours								
Load								
Ambient Temp.								
Vacuum Level								
Inlet Filters								
Inlet Check Valve								
Gear Box Oil Change								
Pump Bearings								
Motor Bearings								
Coupling Inserts								
Discharge Screens								
Relief Valves								
Misc.								
Serviced By								

8.0 Maintenance Record

Model Number _____

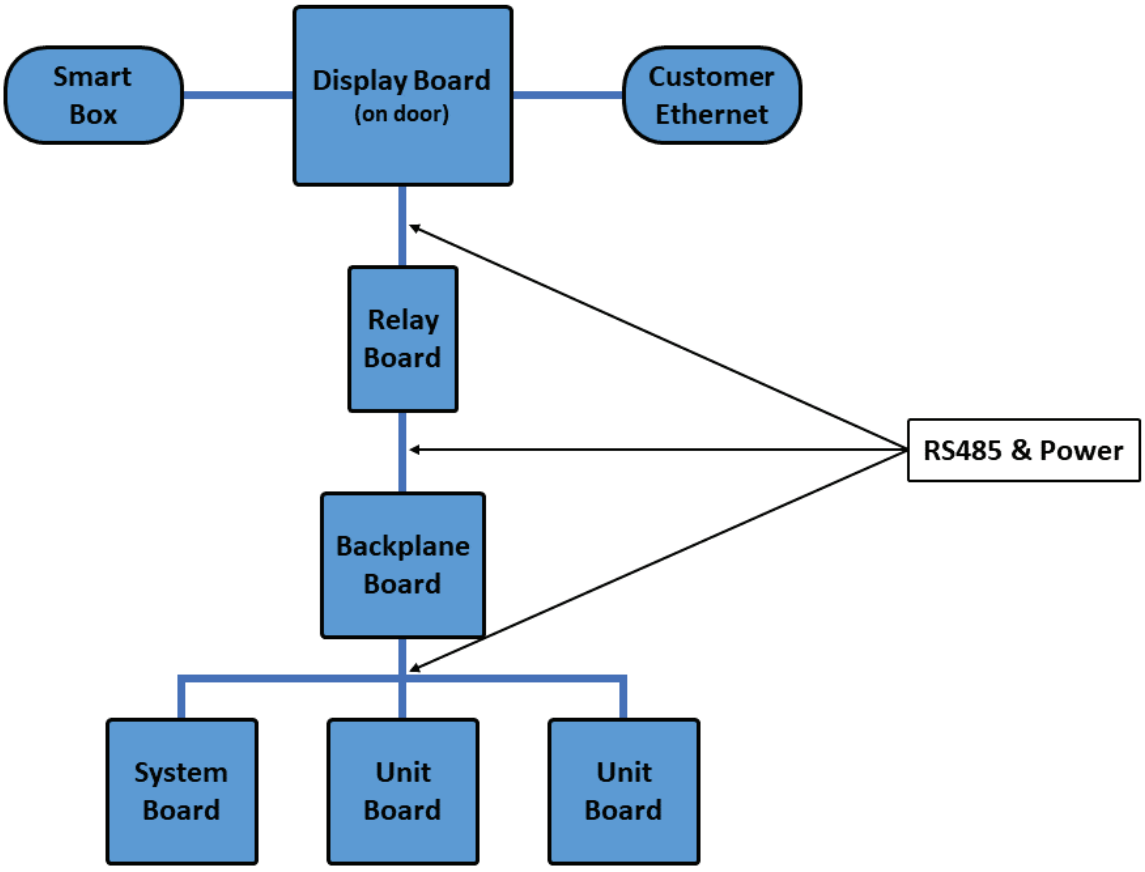
Serial Number _____

Installation Date _____

Date of Service								
Hours								
Load								
Ambient Temp.								
Vacuum Level								
Inlet Filters								
Inlet Check Valve								
Gear Box Oil Change								
Pump Bearings								
Motor Bearings								
Coupling Inserts								
Discharge Screens								
Relief Valves								
Misc.								
Serviced By								

Appendix A: TotalAlert 360 Control System

Figure A.1 Touchscreen Controls



All Boards Other than Display Board Mounted on Back Panel

Figure A.2 Duplex Medical Vacuum Configuration - Printed Circuit Boards

Appendix A: TotalAlert 360 Control System

A.1 Board Configurations

The source control system is comprised of five (5) different printed circuit boards (PCBs) with interconnecting wiring (RS485) for internal communications between the boards. See Figure A.2. NOTE: The system and unit controller boards are the same printed circuit board with different settings distinguishing them.

1. Display Board for 10.1" Touch Screen Display
2. Relay Board
3. Backplane Board
4. Control Board for System or Unit

In a standard medical vacuum duplex system, the PCB configuration consists of the following quantities and types of boards:

- (1) Display Board
- (1) Relay Board
- (1) Backplane Board
- (1) System Control Board
- (2) Unit Control Boards

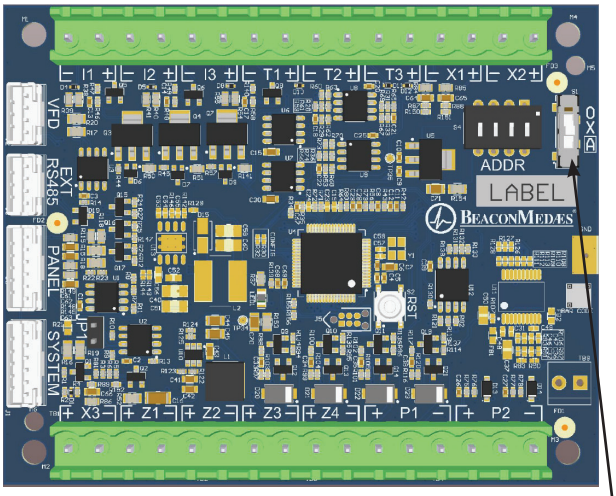
In a standard medical vacuum quadruplex system, the PCB configuration consists of the following quantities and types of boards:

- (1) Display Board
- (1) Relay Board
- (2) Backplane Board
- (1) System Control Board
- (4) Unit Control Boards

A.2 Manual Override

During the system startup, the manual override switch, located on the unit board, is utilized to ensure the unit is in the off position. The manual override switch on the unit board is a safety measure as well, for emergency situations to ensure the pump unit produces medical vacuum.

In an emergency where the control system is not operating effectively, the manual override switch can be moved from the Automatic position to the Manual position. See Figure A.2.1. Moving to this position forces the pump to run continuously.



Manual Override Switch

O - On Manual
X - Off
A - Automatic

Unit Board with Manual Override Switch

Figure A.2.1 Manual Override

If the switch is in Manual or Off position on the unit board, the touchscreen controls no longer control the vacuum pump. Moving the switch back to the Automatic position puts the unit under the control of the TotalAlert 360 control system.

Appendix A: TotalAlert 360 Control System

CAUTION: The "Manual Override" mode of operation should only be used for emergencies such as a loss of the display touchscreen and should not be used for normal operation.

A.3 10.1" Display Controller

A.3.1 Basic Software Architecture

The primary purpose of the display board is to drive the 10.1" LCD display. Its other functions include the following:

1. Communicate through the relay board and backplane board via RS485 bus to relay commands from the touch screen to the system and unit boards.
2. Display messages from the system and unit boards.
3. Interface to the 10.1" Display touch screen to interpret the user interaction.
4. Evaluate alarm signals.
5. Accept new firmware via the USB connection when connected to a system programmer configured with genuine **BEACONMEDÆS** software for reprogramming.

A.3.2 User Interface for Source Systems

Figure A.3.2.1 Main Screen (VSD shown)

The user interface is displayed on a 10.1" 1280 x 800 pixel display as shown in Figure A.3.2.1. The interface is designed such that any information can be accessed with a minimal amount of touches by the user.

The 10.1" screen is divided into two main areas – the top portion above the toolbar which changes depending on the icon selected on the toolbar and bottom portion which contains the toolbar (Figure A.3.2.2) and is available on most screens.

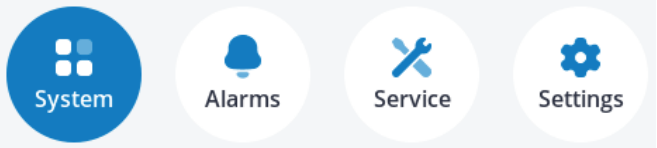


Figure A.3.2.2 Screen Toolbar

A.3.3 System (Main) Screen

The system (main) screen (Figure A.3.2.1) shows the pertinent system measurements as well as unit sequence information.

The pertinent system measurements include: Vacuum Level and VSD Level (for VSD systems). Pressing a pertinent system data gauge shows Trend information for that value.See Figure A.3.4.1.

The Unit Button (Figure A.3.3.1) shows unit, status, and mode.

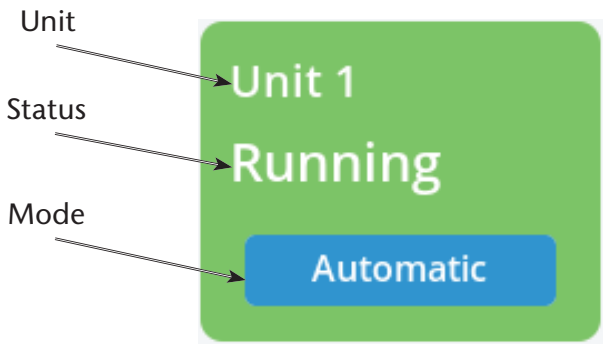


Figure A.3.3.1 Unit Button

Appendix A: TotalAlert 360 Control System

Mode Label	Mode Color	Status Label	Button Color
Automatic	Blue	Running	Green
		Running VSD	Green
		Next to Run	Lt. Blue
		Standby	Blue
Manual	Orange	Running	Orange
		Standby	Yellow
Off	Red	Stopped	Red
Override ON	Red	Running	Orange
Override OFF	Red	Stopped	Red
Emergency COM	Red	No Comms	Red
Expandable	Gray	Unavailable	White

Table A.3.3.1 Unit Mode & Status Configurations

Table A.3.3.1 shows the possible combinations of mode and status for a given unit. In regards to the lag alarm condition, a unit is only considered available when the mode is Automatic and the status is either Next to Run or Standby. All other combinations result in the unit being considered unavailable.

- In Automatic, the unit will start/stop depending on the vacuum level and unit sequencing.
- In Manual, the unit will start/stop based on vacuum readings from the backup vacuum switch.
- In Off, the unit is stopped and will not run.
- In Override ON, the unit will run continuously.
- In Override OFF, the unit is stopped and will not run.
- In Emergency COM, communication between the controls and the unit has been disrupted. If a connection to the backup vacuum switch is intact, the unit will start/stop based on vacuum readings from the backup vacuum switch. Otherwise, the unit will not run.
- In Expandable, the unit does not exist but can be added to the system.

A.3.4 Trend Screen

Figure A.3.4.1 Trend Screen

The trend screen (Figure A.3.4.1) shows the measured value over a specific time period:

- The default time period when opening the window is the last 60 minutes. For a given period, the maximum amount of data stored will only be for the most recent time period and the older data will be removed from view and memory.
- Another time period is selected by pressing the buttons above the trend chart. These periods are 60 minutes (600 data points – 0.1 min resolution), 6 hours (600 data points – 0.6 min resolution), 24 hours (600 data points – 2.4 min resolution) and 6 days (600 data points – 14.4 min resolution).
- There is an export button available underneath the gauge. When the export button is pressed, the data will be stored on the display board until it is transferred to a computer (If the system turns off, the export file will be lost). This transfer will require an USB-A to USB-A cable. Only one file can be stored on the display board at a time. If exporting multiple files, transfer each file before exporting the next file.

Appendix A: TotalAlert 360 Control System

A.3.5 Unit Screen

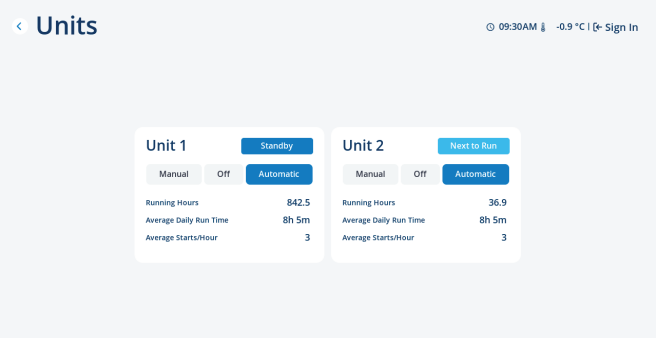


Figure A.3.5.1 Unit Screen

The unit screen (Figure A.3.5.1) shows the operation mode and status of each unit along with running hours, average daily run time, and average starts per hour.

The unit modes Automatic, Manual, and Off can be selected from the display. The override modes are set using the switch on the unit controller boards (Figure A.2.1), but will be shown on the display. If in an override mode, no other selection can be made using the display. See Section A.3.3 for further information on unit modes.

A.3.6 Units Usage

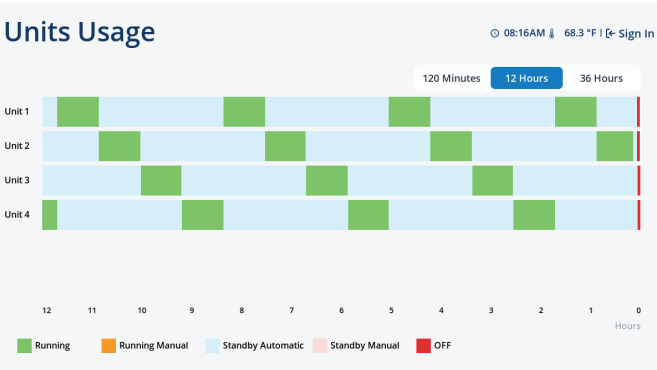


Figure A.3.6.1 Units Usage

The Units Usage screen (Figure A.3.6.1) can be accessed by selecting the button to the right of the toolbar on the Units screen. Once on the Units Usage screen, the user can view three different time intervals (120 minutes, 12 hours, and 36 hours) by using the buttons at the top right of the chart. The chart shows the running status of each unit during the selected time interval.

A.3.7 Alarms Screen

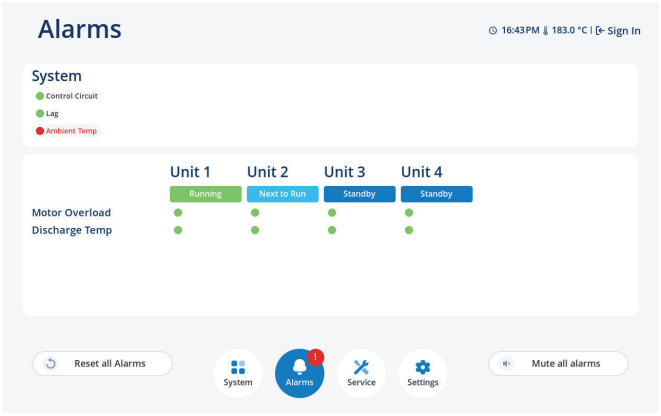


Figure A.3.7.1 Alarms Screen

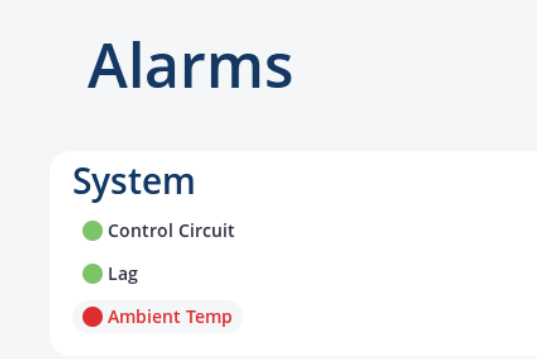


Figure A.3.7.2 System Alarm

Appendix A: TotalAlert 360 Control System

Figure A.3.7.3 Unit Alarm

Figure A.3.7.4 Unit Shutdown

The alarms screen (Figure A.3.7.1) shows all of the system alarm and shutdown information. An alarm is classified as an event of significance that does not shut the system down. These alarms are latched and are not cleared until a user presses the reset button on the alarms screen and enters their initials. This reset button will reset all alarms for that given system. A shutdown is classified as an event of significance that shuts the unit down. Shutdown events are latched and are not cleared until the condition is corrected and a user presses the reset button on the alarms screen and enters their initials.

- Green condition indicates a normal status for that condition.
- Red condition indicates an abnormal status for that condition. The icon will be labelled "Alarm" or "Shutdown" as applicable.
- The horn silence button is at the bottom right of the screen.
- if the user is signed into the system, the initials associated with that account will automatically be entered in the event log when resetting an alarm. TC for technician, AD for admin, and any custom initials set up for established users. If not signed into the system, users will be prompted to enter their initials.

A.3.8 Service Screen

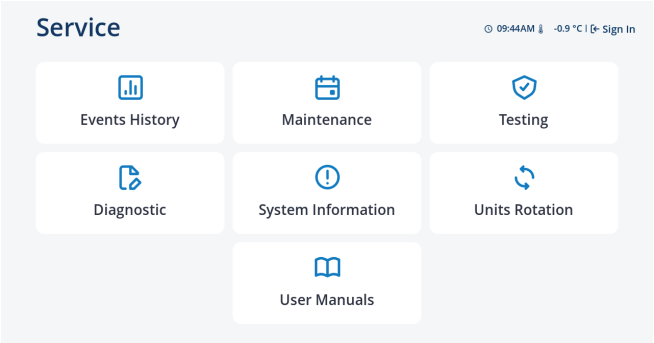


Figure A.3.8.1 Service Screen

Figure A.3.8.2 Diagnostic Screen

The service screen (Figure A.3.8.1) allows the selection of various sub screens:

- Events History – Displays a log of all recorded events. Data can be exported.
- Maintenance – Additional screens depicting suggested and required maintenance items with resettable timers. When maintenance is due, both the maintenance button and the service icon on the tool bar will have a red (!) symbol. See Section A.3.10 for more information.
- Testing – Allows the user to test all alarm events. See Section A.3.11 for more information.
- Diagnostic – Two tabs depicting the I/O status of the connecting unit controller board. The

Appendix A: TotalAlert 360 Control System

first tab (Figure A.3.8.2) lists the digital inputs (X1-X3 as 0 or 1), the analog readings (T1-T3, I1-I3, and P1-P2 with A/D values), the 24VDC powered digital outputs (Z1-Z4 as 0 or 1), as well as the statuses of "Fan Enable (Off/On)", "Backup Switch (Open/Closed)", and "Override Switch (On/Off/No)". The values on the first tab can be displayed in their raw state as described above or as converted values changed into their corresponding units of measurement (Note: Values from disconnected I/Os may also convert, but these converted values are incorrect and should be ignored). The second tab lists alarm contacts as "Open" or "Closed". "Open" contacts are in alarm state.

- System information – Displays the system serial and model numbers, wiring diagram number, system warranty level, ship date, startup date and person, as well as service contact number. Also contains software version.

- Units Rotation – Allows the user to run the unit for a short period to check rotation. Arrows located on the belt guard show the correct rotation direction (counter clockwise when facing the compressor pulley). Unit mode must be Off to test rotation.

- User Manuals – Contains a QR code that directs to the user manual for the system.

- Cabinet Temperature (VSD Systems only) –The temperature inside the control cabinet will be displayed on the main Service screen.

A.3.9 Events History Screen

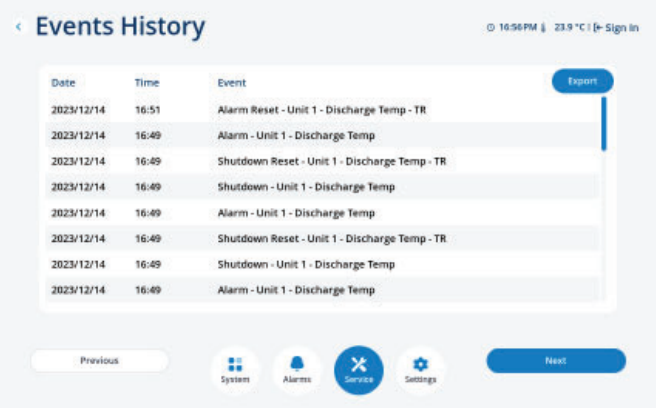


Figure A.3.9.1 Events History Screen

The Events History screen (Figure A.3.9.1) shows all of the system and unit event history excluding service maintenance history.

- Events are shown in descending date/time order. Located at the bottom of the screen to either side of the toolbar are buttons for navigating between pages. The maximum number of events is 200.

- There is an export button available at the top right of the table. When the export button is pressed, the data will be stored on the display board until it is transferred to a computer. This transfer will require an USB-A to USB-A cable. Only one file can be stored on the display board at a time. If exporting multiple files, transfer each file before exporting the next file.

Appendix A: TotalAlert 360 Control System

A.3.10 Maintenance Screens

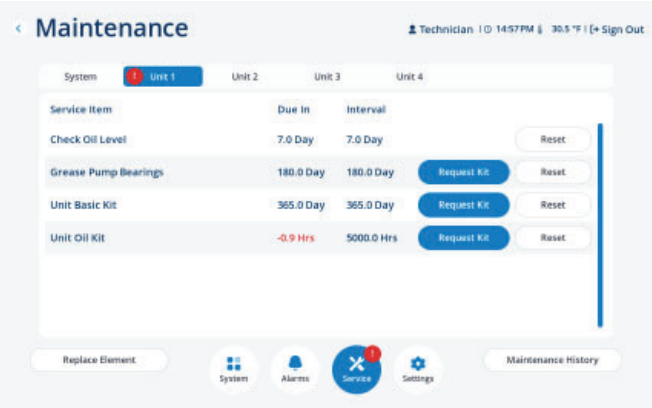


Figure A.3.10.1 Unit Maintenance Screen

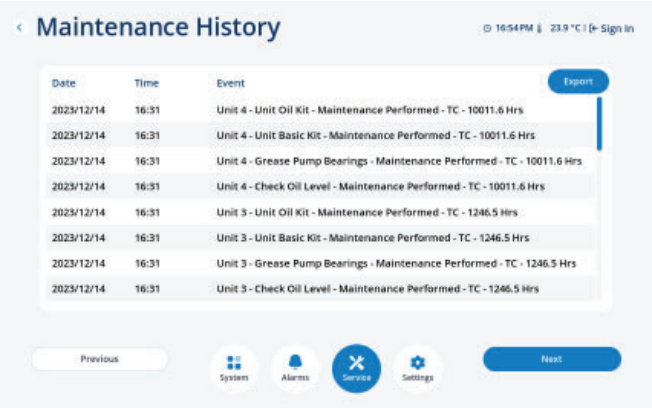


Figure A.3.10.2 Maintenance History Screen

The maintenance screens (Figures A.3.10.1&2) are accessed via the service screen:

- Multiple screens depicting maintenance items with resettable timers. If an item is past due the "Due In" column value will turn red and the service icon and appropriate tab will have a red (!) symbol.
- The first (default) tab shows the system maintenance. The other tabs across the top of the screen allow the user to access unit maintenance pages. When the user resets a timer, the action is logged in the service history.
- By selecting the Request Kit button, the user will be taken to a page with a QR code to access the kit information.
- After a service activity is performed, press the Reset button next to the appropriate service item and enter the users initials. If signed in, the users initials will be entered automatically.
- The Replace Element button to the left of the toolbar will reset all of the maintenance timers for the active page. The user must be signed in to use this function.
- Maintenance history is accessed by pressing the button to the right of the toolbar on the Maintenance screen. Once on the Maintenance History screen, the user will have the ability to navigate between pages using buttons on either side of the toolbar. Additionally, the user can either clear the history (with technician level access) or export the data using buttons at the top right of the table. When the export button is pressed, the data will be stored on the display board until it is transferred to a computer (If the system turns off, the export file will be lost). This transfer will require a USB-A to USB-A cable. Only one file can be stored on the display board at a time. If exporting multiple files, transfer each file before exporting the next file.

A.3.11 Testing Alarms

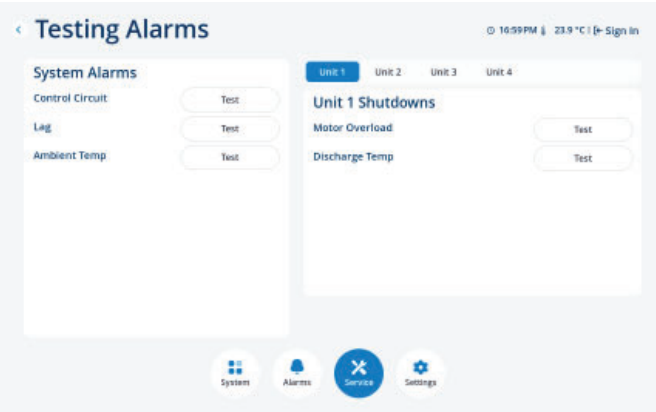


Figure A.3.11.1 Testing Alarms Screen

Appendix A: TotalAlert 360 Control System

In the Service section of the Main screen and Unit screens, the operator can test each alarm and shutdown event. When an alarm/shutdown event is selected to test, the actual alarm/shutdown is latched. At this point, the system responds as if an actual alarm/shutdown has occurred.

CAUTION: If testing a shutdown event, the pump being tested will shut down. Notify the appropriate hospital personnel **BEFORE** testing any alarms.

For an alarm/shutdown event, the following will occur:

- Unit shuts down (shutdown event only).
- The horn will initiate.
- Alarms screen will show the alarm/shutdown condition.
- An alarm/shutdown signal will be sent to the Master alarms.
- The operator must respond and reset the alarm/shutdown signal by pressing the "Reset all Alarms" button on the Alarms screen.
- A history item will be created that shows the "Test" alarm/shutdown event and a subsequent event for the correction of the "Test" item.

CAUTION: When testing a Shutdown condition, the pump shuts down and must be restarted after the test. Press Automatic on the Unit main screen.

A.3.12 Settings Screen

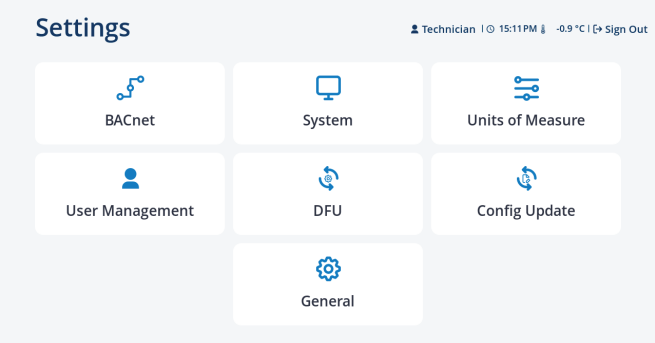


Figure A.3.12.1 Settings Screen

The settings screen (Figure A.3.12.1) allows the selection of various sub screens that pertain to system configuration data. All value/adjustment changes are password protected.

- BACnet – Displays BACnet connection information and settings. See Section A.5 for more information.
- System – Allows the adjustment of system vacuum operating range.
- Units of Measure – Allows changing units of measurement displayed by the system.
- General – Allows adjustment of horn reinitialization timer, system language, and date and time as well as activation of the backlight timer.

The below option is only available when signed in as a technician or admin.

- User Management – Allows user to create and manage user profiles.

The below options are only available when signed in as a technician.

- DFU – Reboots system in DFU mode.
- Config Update – Allows user to update system configuration.

Appendix A: TotalAlert 360 Control System

A.4 User Access

Figure A.4.1 Sign In Screen

The TotalAlert 360 control system can store up to five user profiles. There are three permission levels to which a profile can be assigned: technician, admin, and user. There will be one technician and one admin profile per system and up to three user profiles. The technician profile has the highest level of access followed by the admin and lastly the user. To sign in, select the "Sign In" button at the top right of the main screen. See Figure A.4.1. On this page, use the drop down to select the desired profile. It may be necessary to scroll down to find the intended profile. Then enter the correct password to sign into the selected profile.

A.4.1 Password Items

Some system settings require the user to be signed in to change. Certain settings are only available when the user is signed in as either an admin or technician. An Admin level profile will have the ability to change the Admin level settings as well as all User level settings. A Technician level profile will have the ability to change the Technician level settings as well as all Admin and User level settings.

User Level Settings:

- Adjust system vacuum operating levels - Adjust the system operating vacuum high and low levels within the min and max ranges.
- Set horn reinitialization timer - Turn the horn reinitialization timer on/off and set the timer. The horn will reinitiate at the set amount of time after being silenced.
- Test horn - Test the local alarm horn.
- Change display language - Change the language on the display.
- Change units of measure - Change the system units of measurement.
- Set date/time - Set the year, month, day and time on the display.
- Set BACnet settings - Configure settings for connecting to the BACnet system. See Section A.5 for more information.
- Turn backlight timer on/off - Turn on/off the backlight timer. Screen will dim after 15 minutes of no user input. Just touch the screen to return brightness to normal setting.
- Reset maintenance events - Reset the "Due In" timer on maintenance items.

Admin Level Settings

- All User level settings
- Create or delete user profiles - Create or delete User level profiles for adding additional users.

Technician Level Settings

- All User and Admin level settings
- Below Setpoint Timeout (VSD only) - Set the time a unit will run below the vacuum setpoint on VSD at 100% before it switches to DOL and brings another unit online.
- Set maximum unit run time - Set the maximum run time for a unit before the system will cycle to the next available unit.
- Set vacuum reading offset - This offset will change the on-screen vacuum reading by the

Appendix A: TotalAlert 360 Control System

selected value. This feature is used to align the vacuum reading on the display with the gauge on the receiver. Possible values are +/-0.2, 0.4, or 0.6 inHg.

- Change number of units installed - Used to add units on an expandable system.
- Change maintenance item intervals
- Adjust vacuum min and max levels - Change set points for when units start and stop while running in Automatic mode.
- Reset events history log - Clear the events history log.
- Reset maintenance history log - Clear the maintenance history log.
- Reset user password - Reset the password for User or Admin profiles.

A.5 BACnet

Figure A.5.1 BACnet Settings

This system is BACnet compatible. The user can connect to the system through the ethernet port on the top of the control cabinet. When signed in, the user can modify the following settings:

- Device Name
- Device ID
- IPv4
- Subnet Mask
- Gateway
- Port
- Foreign LifeTime
- Foreign IPv4
- Foreign Port

A.6 MyMedGas

A.6.1 Logging Daily Rounds

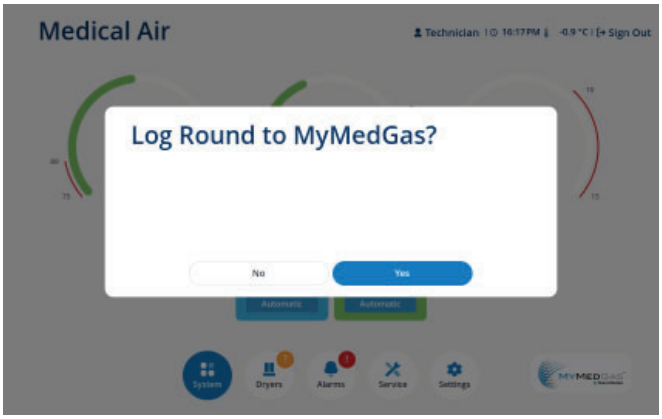


Figure A.6.1.1 Log Daily Round

The MyMedGas button at the bottom right of the main screen can be used to log a daily round to the MyMedGas system. This cellular communication is done via the SmartBox unit in the control cabinet.

A.6.2 MyMedGas Further Information

For further information, refer to the manual for MyMedGas.

Appendix B1: Variable Speed Drive Inverter (F700)

B1.1 VSD (Variable Speed Drive) Operation Panel

The VSD inverter has an operational panel to control and monitor the speed of the pump in VSD mode as well as adjusting parameters and alarm indications of the unit.

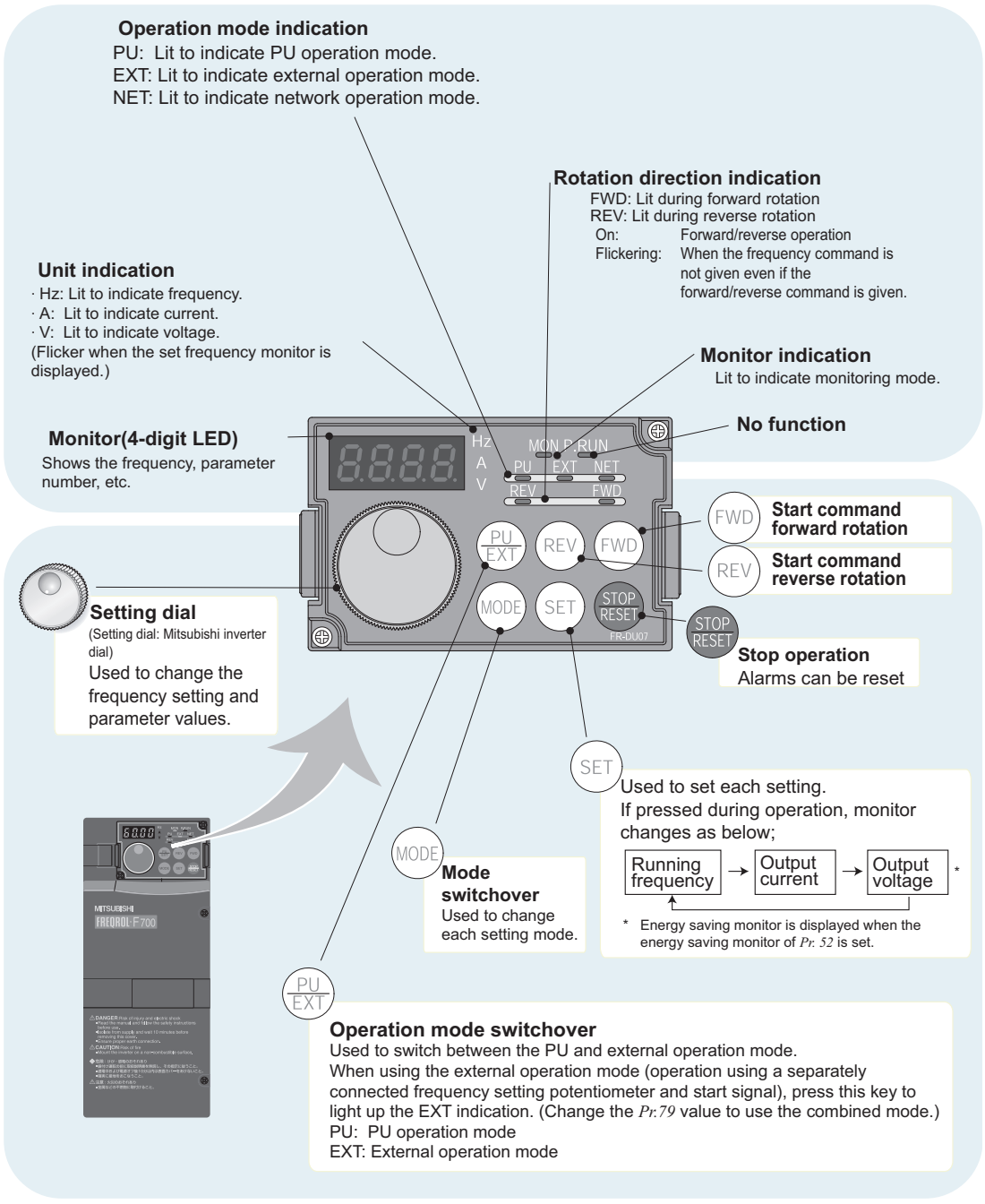


Figure B1.1.1 Operational Panel (F700)

Appendix B1: Variable Speed Drive Inverter (F700)

B1.1.1 Monitoring of Output Current and Output Voltage

The monitor display of output frequency, output current and output voltage can be changed by pushing "SET" button during monitor mode. The default is set to display output frequency. To change the default, press "SET" button to display either A (amps) or V (voltage). Press and hold the "SET" button for 1 second to activate the selected display as the default.

B1.2 Specifications

B1.2.1 Display and Parameter Settings

All parameter settings can be displayed from the display monitor. For a complete list of parameters, description and settings, see Parameter List in Section B1.2.2. Parameter settings are write protected to maintain factory settings.

Display Parameter Number & Setting

1. Press the "MODE" button to activate parameter setting mode.
2. Turn the setting dial to the parameter number to be displayed.
3. Press the "SET" button to display the value of the parameter.
4. Press the "MODE" button twice to return to the monitor display

Appendix B1: Variable Speed Drive Inverter (F700)

B1.2.2 Parameter List

Function	Parameters	Name	Setting Range	Minimum Setting Increments	Initial Value	Factory Setting
Basic Functions	0	Torque boost	0 to 30%	0.1%	6/4/3/2/ 1.5/1%	0% +
	1	Maximum frequency	0 to 120Hz	0.01Hz	120/60Hz	60Hz
	2	Minimum frequency	0 to 120Hz	0.01Hz	0Hz	25Hz
	3	Base frequency	0 to 400Hz	0.01Hz	60Hz	
	4	Multi-speed setting (high speed)	0 to 400Hz	0.01Hz	60Hz	
	5	Multi-speed setting (middle speed)	0 to 400Hz	0.01Hz	30Hz	
	6	Multi-speed setting (low speed)	0 to 400Hz	0.01Hz	10Hz	
	7	Acceleration time	0 to 3600/ 360s	0.1/0.01s	5s/15s	10s +
	8	Deceleration time	0 to 3600/ 360s	0.1/0.01s	10s/30s	
	9	Electronic thermal O/L relay	0 to 500/0 to 3600A	0.01/0.1A	Rated inverter output current	**
DC injection brake	10	DC injection brake operation frequency	0 to 120Hz, 9999	0.01Hz	3Hz	
	11	DC injection brake operation time	0 to 10s, 8888	0.1s	0.5s	
	12	DC injection brake operation voltage	0 to 30%	0.1%	4/2/1%	
----	13	Starting frequency	0 to 60Hz	0.01Hz	0.5Hz	
----	14	Load pattern selection	0, 1	1	1	0 +
Jog operation	15	Jog frequency	0 to 400Hz	0.01Hz	5Hz	
	16	Jog acceleration/deceleration time	0 to 3600/360s	0.1/0.01s	0.5s	
----	17	MRS input selection	0, 2	1	0	2 +
----	18	High speed maximum frequency	120 to 400Hz	0.01Hz	120/60Hz	60 +
----	19	Base frequency voltage	0 to 1000V, 8888, 9999	0.1V	9999	
Acceleration/ deceleration times	20	Acceleration/deceleration reference frequency	1 to 400Hz	0.01Hz	60Hz	
	21	Acceleration/deceleration time increments	0, 1	1	0	

+ Indicates setting changed from initial value

** See O/L chart on print

Appendix B1: Variable Speed Drive Inverter (F700)

B1.2.2 Parameter List (continued)

Function	Parameters	Name	Setting Range	Minimum Setting Increments	Initial Value	Factory Setting
Stall prevention	22	Stall prevention operation level	0 to 120%, 9999	0.1%	110%	120 +
	23	Stall prevention operation level compensation factor at double speed	0 to 150%, 9999	0.1%	9999	
Multi-speed setting	24 to 27	Multi-speed setting (4 speed to 7 speed)	0 to 400Hz, 9999	0.01Hz	9999	
----	28	Multi-speed input compensation selection	0, 1	1	0	
----	29	Acceleration/deceleration pattern selection	0, 1, 2, 3	1	0	
----	30	Regenerative function selection	0, 2/0, 1, 2	1	0	
Frequency jump	31	Frequency jump 1A	0 to 400Hz, 9999	0.01Hz	9999	
	32	Frequency jump 1B	0 to 400Hz, 9999	0.01Hz	9999	
	33	Frequency jump 2A	0 to 400Hz, 9999	0.01Hz	9999	
	34	Frequency jump 2B	0 to 400Hz, 9999	0.01Hz	9999	
	35	Frequency jump 3A	0 to 400Hz, 9999	0.01Hz	9999	
	36	Frequency jump 3B	0 to 400Hz, 9999	0.01Hz	9999	
----	37	Speed display	0, 1 to 9998	1	0	
Frequency detection	41	Up-to-frequency sensitivity	0 to 100%	0.1%	10%	
	42	Output frequency detection	0 to 400Hz	0.01Hz	6Hz	
	43	Output frequency detection for reverse rotation	0 to 400Hz, 9999	0.01Hz	9999	

+ Indicates setting changed from initial value

Appendix B1: Variable Speed Drive Inverter (F700)

B1.2.2 Parameter List (continued)

Function	Parameters	Name	Setting Range	Minimum Setting Increments	Initial Value	Factory Setting
Second fluctuations	44	Second acceleration/ deceleration time	0 to 3600/360s	0.1/0.01s	5s	
	45	Second deceleration time	0 to 3600/360s, 9999	0.1/0.01s	9999	
	46	Second torque boost	0 to 30%, 9999	0.1%	9999	
	47	Second V/F (base frequency)	0 to 400Hz, 9999	0.01Hz	9999	
	48	Second stall prevention operation current	0 to 120%	0.1%	110%	
	49	Second stall prevention operationfrequency	0 to 400Hz, 9999	0.01Hz	0Hz	
	50	Second output frequency detection	0 to 400Hz	0.01Hz	30Hz	
	51	Second electronic thermal O/L relay	0 to 500A, 9999/0 to 3600A, 9999	0.01/0.1A	9999	
Monitor functions	52	DU/PU main display data selection	0, 5, 6, 8 to 14, 17, 20, 23 to 25, 50 to 57, 100	1	0	
	54	CA terminal function selection	1 to 3, 5, 6, 8 to 14, 17, 21, 24, 50, 52, 53	1	1	
	55	Frequency monitoring reference	0 to 400Hz	0.01Hz	60Hz	133.3
	56	Current monitoring reference	0 to 500A/0 to 3600A	0.01/0.1A	Rated inverter output current	
Automatic restart functions	57	Restart coasting time	0, 0.1 to 5s, 9999/ 0, 0.1 to 30s, 9999	0.1s	9999	
	58	Restart cushion time	0 to 60s	0.1s	1s	
----	59	Remote function selection	0, 1, 2, 3	1	0	
----	60	Energy saving control selection	0, 4, 9	1	0	
----	65	Retry selection	0 to 5	1	0	
----	66	Stall prevention operation reduction starting frequency	0 to 400Hz	0.01Hz	60Hz	
Retry	67	Number of retries at alarm occurrence	0 to 10, 101 to 110	1	0	
	68	Retry waiting time	0 to 10s	0.1s	1s	
	69	Retry count display erase	0	1	0	

Appendix B1: Variable Speed Drive Inverter (F700)

B1.2.2 Parameter List (continued)

Function	Parameters	Name	Setting Range	Minimum Setting Increments	Initial Value	Factory Setting
----	70	Special regenerative brake duty	0 to 10%	0.1%	0%	
----	71	Applied motor	0, 1, 2, 20	1	0	
----	72	PWM frequency selection	0 to 15/0 to 6, 25	1	2	
----	73	Analog input selection	0 to 7, 10 to 17	1	1	5 +
----	74	Input filter time constant	0 to 8	1	1	
----	75	Reset selection/disconnected PU detection/PU stop selection	0 to 3, 14 to 17, 100 to 103, 114 to 117	1	14	
----	76	Alarm code output selection	0, 1, 2	1	0	
----	77	Parameter write selection	0, 1, 2	1	0	2 +
----	78	Reverse rotation prevention selection	0, 1, 2	1	0	
----	79	Operation mode selection	0, 1, 2, 3, 4, 6, 7	1	0	2 +
Simple magnetic flux vector control	80	Motor capacity(simple magnetic flux vector control)	0.4 to 55kW, 9999/ 0 to 3600kW, 9999	0.01/0.1kW	9999	
	90	Motor constant (R1)	0 to 50 , 9999/ 0 to 400m , 9999	0.001 / 0.01m	9999	
Adjustable 5 points VF	100	V/F1(first frequency)	0 to 400Hz, 9999	0.01Hz	9999	
	101	V/F1(first frequency voltage)	0 to 1000V	0.1V	0V	
	102	V/F2(second frequency)	0 to 400Hz, 9999	0.01Hz	9999	
	103	V/F2(second frequency voltage)	0 to 1000V	0.1V	0V	
	104	V/F3(third frequency)	0 to 400Hz, 9999	0.01Hz	9999	
	105	V/F3(third frequency voltage)	0 to 1000V	0.1V	0V	
	106	V/F4(fourth frequency)	0 to 400Hz, 9999	0.01Hz	9999	
	107	V/F4(fourth frequency voltage)	0 to 1000V	0.1V	0V	
	108	V/F5(fifth frequency)	0 to 400Hz, 9999	0.01Hz	9999	
	109	V/F5(fifth frequency voltage)	0 to 1000V	0.1V	0V	

+ Indicates setting changed from initial value

Appendix B1: Variable Speed Drive Inverter (F700)

B1.2.2 Parameter List (continued)

Function	Parameters	Name	Setting Range	Minimum Setting Increments	Initial Value	Factory Setting
PU connector communication	117	PU communication station number	0 to 31	1	0	
	118	PU communication speed	48, 96, 192, 384	1	192	
	119	PU communication stop bit length	0, 1, 10, 11	1	1	
	120	PU communication parity check	0, 1, 2	1	2	
	121	Number of PU communication retries	0 to 10, 9999	1	1	
	122	PU communication check time interval	0, 0.1 to 999.8s, 9999	0.1s	9999	
	123	PU communication waiting time setting	0 to 150ms, 9999	1	9999	
	124	PU communication CR/LF presence/ absence selection	0, 1, 2	1	1	
----	125	Terminal 2 frequency setting gain frequency	0 to 400Hz	0.01Hz	60Hz	
----	126	Terminal 4 frequency setting gain frequency	0 to 400Hz	0.01Hz	60Hz	
PID operation	127	PID control automatic switchover frequency	0 to 400Hz, 9999	0.01Hz	9999	25 +
	128	PID action selection	10, 11, 20, 21, 50, 51, 60, 61	1	0	80 +
	129	PID proportional band	0.1 to 1000%, 9999	0.1%	100%	300 +
	130	PID integral time	0.1 to 3600s, 9999	0.1s	1s	0.10 +
	131	PID upper limit	0 to 100%, 9999	0.1%	9999	
	132	PID lower limit	0 to 100%, 9999	0.1%	9999	
	133	PID action set point	0 to 100%, 9999	0.01%	9999	
	134	PID differential time	0.01 to 10.00s, 9999	0.01s	9999	
Commercial power supply-inverter switch-over	135	Electronic bypass sequence selection	0, 1	1	0	
	136	MC switchover interlock time	0 to 100s	0.1s	1s	
	137	Start waiting time	0 to 100s	0.1s	0.5s	
	138	Bypass selection at an alarm	0, 1	1	0	
	139	Automatic switchover frequency from inverter to bypass operation	0 to 60Hz, 9999	0.01Hz	9999	

+ Indicates setting changed from initial value

Appendix B1: Variable Speed Drive Inverter (F700)

B1.2.2 Parameter List (continued)

Function	Parameters	Name	Setting Range	Minimum Setting Increments	Initial Value	Factory Setting
Backlash measures	140	Backlash acceleration stopping frequency	0 to 400Hz	0.01Hz	1Hz	
	141	Backlash acceleration stopping time	0 to 360s	0.1s	0.5s	
	142	Backlash deceleration stopping frequency	0 to 400Hz	0.01Hz	1Hz	
	143	Backlash deceleration stopping time	0 to 360s	0.1s	0.5s	
----	144	Speed setting switchover	0, 2, 4, 6, 8, 10, 102, 104, 106, 108, 110	1	4	
----	145	PU display language selection	0 to 7	1	1	
----	148	Stall prevention level at 0V input	0 to 120%	0.1%	110%	
----	149	Stall prevention level at 10V input	0 to 120%	0.1%	120%	
----	150	Output current detection level	0 to 120%	0.1%	110%	
----	151	Output current detection signal delay time	0 to 10s	0.1s	0s	
----	152	Zero current detection level	0 to 150%	0.1%	5%	
----	153	Zero current detection time	0 to 1s	0.01s	0.5s	
----	154	Voltage reduction selection during stall prevention operation	0, 1	1	1	
----	155	RT signal function validity condition selection	0, 10	1	0	
----	156	Stall prevention operation selection	0 to 31, 100, 101	1	0	
----	157	OL signal output timer	0 to 25s, 9999	0.1s	0s	
----	158	AM terminal function selection	1 to 3, 5, 6, 8 to 14, 17, 21, 24, 50, 52, 53	1	1	
----	159	Automatic switchover frequency range from bypass to inverter operation	0 to 10Hz, 9999	0.01Hz	9999	
----	160	User group read selection	0, 1, 9999	1	0	
----	161	Frequency setting/key lock operation selection	0, 1, 10, 11	1	0	

Appendix B1: Variable Speed Drive Inverter (F700)

B1.2.2 Parameter List (continued)

Function	Parameters	Name	Setting Range	Minimum Setting Increments	Initial Value	Factory Setting
Automatic restart functions	162	Automatic restart after instantaneous power failure selection	0, 1, 10, 11	1	0	
	163	First cushion time for restart	0 to 20s	0.1s	0s	
	164	First cushion voltage for restart	0 to 100%	0.1%	0%	
	165	Stall prevention operation level for restart	0 to 120%	0.1%	110%	
Current detection	166	Output current detection signal retention time	0 to 10s, 9999	0.1s	0.1s	
	167	Output current detection operation selection	0, 1	1	0	1
----	168	Parameter for manufacturer setting. Do not set.				
----	169					
Cumulative monitor clear	170	Watt-hour meter clear	0, 10, 9999	1	9999	
	171	Operation hour meter clear	0, 9999	1	9999	
User group	172	User group registered display/ batch clear	9999, (0 to 16)	1	0	
	173	User group registration	0 to 999, 9999	1	9999	
	174	User group clear	0 to 999, 9999	1	9999	

Appendix B1: Variable Speed Drive Inverter (F700)

B1.2.2 Parameter List (continued)

Function	Parameters	Name	Setting Range	Minimum Setting Increments	Initial Value	Factory Setting
Input terminal function assignment	178	STF terminal function selection	0 to 8, 10 to 14, 16, 24, 25, 60, 62, 64 to 67, 9999	1	6	
	179	STR terminal function selection	0 to 8, 10 to 14, 16, 24, 25, 61, 62, 64 to 67, 9999	1	61	
	180	RL terminal function selection	0 to 8, 10 to 14, 16, 24, 25, 62, 64 to 67, 9999	1	0	
	181	RM terminal function selection		1	1	
	182	RH terminal function selection		1	2	
	183	RT terminal function selection		1	3	14 +
	184	AU terminal function selection	0 to 8, 10 to 14, 16, 24, 25, 62 to 67, 9999	1	4	50
	185	JOG terminal function selection	0 to 8, 10 to 14, 16, 24, 25, 62, 64 to 67, 9999	1	5	
	186	CS terminal function selection		1	6	
	187	MRS terminal function selection		1	24	
	188	STOP terminal function selection		1	25	
	189	RES terminal function selection		1	62	
Output terminal function assignment	190	RUN terminal function selection	0 to 5, 7, 8, 10 to 19, 25, 26, 45 to 47, 64, 70 to 78, 90 to 96, 98, 99, 100 to 105, 107, 108, 110 to 116, 125, 126, 145 to 147, 164, 170, 190 to 196, 198, 199, 9999	1	0	
	191	SU terminal function selection		1	1	
	192	IPF terminal function selection		1	2	
	193	OL terminal function selection		1	3	
	194	FU terminal function selection		1	4	
	195	ABC1 terminal function selection	0 to 5, 7, 8, 10 to 19, 25, 26, 45 to 47, 64, 70 to 78, 90, 91, 94 to 96, 98, 99, 100 to 105, 107, 108, 110 to 116, 125, 126, 145 to 147, 164, 170, 190, 191, 194 to 196, 198, 199, 9999	1	99	
	196	ABC2 terminal function selection		1	9999	0 +
Multi-speed setting	232 to 239	Multi-speed setting (8 speed to 15 speed)	0 to 400Hz, 9999	0.01Hz	9999	

+ Indicates setting changed from initial value

Appendix B1: Variable Speed Drive Inverter (F700)

B1.2.2 Parameter List (continued)

Function	Parameters	Name	Setting Range	Minimum Setting Increments	Initial Value	Factory Setting
----	240	Soft-PWM operation selection	0, 1	1	1	
----	241	Analog input display unit switchover	0, 1	1	0	
----	242	Terminal 1 added compensation amount (terminal 2)	0 to 100%	0.1%	100%	
----	243	Terminal 1 added compensation amount (terminal 4)	0 to 100%	0.1%	75%	
----	244	Cooling fan operation selection	0, 1	1	1	
Slip compensation	245	Rated slip	0 to 50%, 9999	0.01%	9999	
	246	Slip compensation time constant	0.01 to 10s	0.01s	0.5s	
	247	Constant-power range slip compensation selection	0, 9999	1	9999	
----	250	Stop selection	0 to 100s, 1000 to 1100s, 8888, 9999	0.1s	9999	
----	251	Output phase failure protection selection	0, 1	1	1	
Frequency compensation function	252	Override bias	0 to 200%	0.1%	50%	
	253	Override gain	0 to 200%	0.1%	150%	
Life check	255	Life alarm status display	(0 to 15)	1	0	
	256	Inrush current limit circuit life display	(0 to 100%)	1%	100%	
	257	Control circuit capacitor life display	(0 to 100%)	1%	100%	
	258	Main circuit capacitor life display	(0 to 100%)	1%	100%	
	259	Main circuit capacitor life measuring	0, 1	1	0	
----	260	PWM frequency automatic switchover	0, 1	1	1	

Appendix B1: Variable Speed Drive Inverter (F700)

B1.2.2 Parameter List (continued)

Function	Parameters	Name	Setting Range	Minimum Setting Increments	Initial Value	Factory Setting
Power failure stop	261	Power failure stop selection	0, 1, 2	1	0	2 +
	262	Subtracted frequency at deceleration start	0 to 20Hz	0.01Hz	3Hz	
	263	Subtraction starting frequency	0 to 120Hz, 9999	0.01Hz	60Hz	
	264	Power-failure deceleration time 1	0 to 3600/ 360s	0.1/0.01s	5s	
	265	Power-failure deceleration time 2	0 to 3600/ 360s, 9999	0.1/0.01s	9999	
	266	Power failure deceleration time switchover frequency	0 to 400Hz	0.01Hz	60Hz	
----	267	Terminal 4 input selection	0, 1, 2	1	0	1 +
----	268	Monitor decimal digits selection	0, 1, 9999	1	9999	
----	269	Parameter for manufacturer setting. Do not set.				
----	299	Rotation direction detection selection at restarting	0, 1, 9999	1	9999	
Digital input	300	BCD input bias	Parameter for digital input option (FR-A7AX)			
	301	BCD input gain				
	302	BIN input bias				
	303	BIN input gain				
	304	Digital input and analog input compensation enable/disable selection				
	305	Read timing operation selection				
Analog output	306	Analog output signal selection	Extension analog output/digital output option Parameter for (FR-A7AY)			
	307	Setting for zero analog output				
	308	Setting for maximum analog output				
	309	Analog output signal voltage/ current switchover				
	310	Analog meter voltage output selection				
	311	Setting for zero analog meter voltage output				
	312	Setting for maximum analog meter voltage output				

+ Indicates setting changed from initial value

Appendix B1: Variable Speed Drive Inverter (F700)

B1.2.2 Parameter List (continued)

Function	Parameters	Name	Setting Range	Minimum Setting Increments	Initial Value	Factory Setting
Digital output	313	DO0 output selection	Parameter for extension analog output/digital output option (FR-A7AY)			
	314	DO1 output selection				
	315	DO2 output selection				
	316	DO3 output selection				
	317	DO4 output selection				
	318	DO5 output selection				
	319	DO6 output selection				
Relay output	320	RA1 output selection	Parameter for relay output option (FR-A7AR)			
	321	RA2 output selection				
	322	RA3 output selection				
Analog output	323	AM0 0V adjustment	Parameter for extension analog output/digital output option (FR-A7AY)			
	324	AM1 0mA adjustment				
----	329	Digital input unit selection	Parameter for digital input option (FR-A7AY)			

Appendix B1: Variable Speed Drive Inverter (F700)

B1.2.2 Parameter List (continued)

Function	Parameters	Name	Setting Range	Minimum Setting Increments	Initial Value	Factory Setting
RS-485 communication	331	RS-485 communication station number	0 to 31(0 to 247)	1	0	1
	332	RS-485 communication speed	3, 6, 12, 24, 48, 96, 192, 384	1	96	
	333	RS-485 communication stop bit length	0, 1, 10, 11	1	1	
	334	RS-485 communication parity check selection	0, 1, 2	1	2	
	335	RS-485 communication retry count	0 to 10, 9999	1	1	
	336	RS-485 communication check time interval	0 to 999.8s, 9999	0.1s	0s	
	337	RS-485 communication waiting time setting	0 to 150ms, 9999	1	9999	
	338	Communication operation command source	0, 1	1	0	
	339	Communication speed command source	0, 1, 2	1	0	
	340	Communication startup mode selection	0, 1, 2, 10, 12	1	0	12
	341	RS-485 communication CR/LF selection	0, 1, 2	1	1	
	342	Communication EEPROM write selection	0, 1	1	0	1
	343	Communication error count	----	1	0	
DeviceNet	345	DeviceNet address	Parameter for DeviceNet communication option (FR-A7ND)			
	346	DeviceNet baud rate				
CC-Link PROFIBUS-DP	349	Communication reset selection	Parameter for CC-Link and PROFIBUS-DP communication option (FR-A7NC, FR-A7NP)			

Appendix B1: Variable Speed Drive Inverter (F700)

B1.2.2 Parameter List (continued)

Function	Parameters	Name	Setting Range	Minimum Setting Increments	Initial Value	Factory Setting
LONWORKS	387	Initial communication delay time	Parameter for LONWORKS communication option (FR-A7NL)			
	388	Send time interval at hart beat				
	389	Minimum sending time at hart beat				
	390	% setting reference frequency				
	391	Receive time interval at hart beat				
	392	Event driven detection width				
Remote output	495	Remote output selection	0, 1	1	0	
	496	Remote output data 1	0 to 4095	1	0	
	497	Remote output data 2	0 to 4095	1	0	
Communication error	500	Communication error execution waiting time	Parameter for communication option			
	501	Communication error occurrence count display				
	502	Stop mode selection at communication error				
Maintenance	503	Maintenance timer	0 (1 to 9998)	1	0	
	504	Maintenance timer alarm output set time	0 to 9998, 9999	1	9999	
CC-Link	542	Communication station number (CC-Link)	Parameter for CC-Link communication option (FR-A7NC)			
	543	Baud rate (CC-Link)				
	544	CC-Link extended setting				
Communication	549	Protocol selection	0, 1	1	1	
	550	NET mode operation command source selection	0, 1, 9999	1	9999	
	551	PU mode operation command sourceselection	1, 2	1	2	
Current average monitor	555	Current average time	0.1 to 1.0s	0.1s	1s	
	556	Data output mask time	0.0 to 20.0s	0.1s	0s	
	557	Current average value monitor signaloutput reference current	0 to 500A/0 to 3600A	0.01/0.1A	Rated inverter current	

Appendix B1: Variable Speed Drive Inverter (F700)

B1.2.2 Parameter List (continued)

Function	Parameters	Name	Setting Range	Minimum Setting Increments	Initial Value	Factory Setting
----	563	Energization time carrying-over times	(0 to 65535)	1	0	
----	564	Operating time carrying-over times	(0 to 65535)	1	0	
Multiple rating	570	Multiple rating setting	0, 1	1	0	
----	571	Holding time at a start	0.0 to 10.0s, 9999	0.1s	9999	
----	573	4mA input check selection	1, 9999	1	9999	
PID control	575	Output interruption detection time	0 to 3600s, 9999	0.1s	1s	
	576	Output interruption detection level	0 to 400Hz	0.01Hz	0Hz	
	577	Output interruption cancel level	900 to 1100%	0.1%	1000%	
Pump function	578	Auxiliary motor operation selection	0 to 3	1	0	
	579	Motor connection function selection	0 to 3	1	0	
	580	MC switching interlock time	0 to 100s	0.1s	1s	
	581	Start waiting time	0 to 100s	0.1s	1s	
	582	Auxiliary motor connection-timedeceleration time	0 to 3600s, 9999	0.1s	1s	
	583	Auxiliary motor disconnection-time acceleration time	0 to 3600s, 9999	0.1s	1s	
	584	Auxiliary motor 1 starting frequency	0 to 400Hz	0.01Hz	60Hz	
	585	Auxiliary motor 2 starting frequency	0 to 400Hz	0.01Hz	60Hz	
	586	Auxiliary motor 3 starting frequency	0 to 400Hz	0.01Hz	60Hz	
	587	Auxiliary motor 1 stopping frequency	0 to 400Hz	0.01Hz	0Hz	
	588	Auxiliary motor 2 stopping frequency	0 to 400Hz	0.01Hz	0Hz	
	589	Auxiliary motor 3 stopping frequency	0 to 400Hz	0.01Hz	0Hz	
	590	Auxiliary motor start detection time	0 to 3600s	0.1s	5s	
	591	Auxiliary motor stop detection time	0 to 3600s	0.1s	5s	

Appendix B1: Variable Speed Drive Inverter (F700)

B1.2.2 Parameter List (continued)

Function	Parameters	Name	Setting Range	Minimum Setting Increments	Initial Value	Factory Setting
----	611	Acceleration time at a restart	0 to 3600s, 9999	0.1s	5/15s	
----	867	AM output filter	0 to 5s	0.01s	0.01s	
----	869	Current output filter	0 to 5s	0.01s	0.02s	
----	872	Input phase failure protection selection	0, 1	1	0	
Regeneration avoidance function	882	Regeneration avoidance operation selection	0, 1, 2	1	0	
	883	Regeneration avoidance operation level	300 to 800V	0.1V	DC380V/ 760V	
	884	Regeneration avoidance at deceleration detection sensitivity	0 to 5	1	0	
	885	Regeneration avoidance compensation frequency limit value	0 to 10Hz, 9999	0.01Hz	6Hz	
	886	Regeneration avoidance voltage gain	0 to 200%	0.1%	100%	
Free parameter	888	Free parameter 1	0 to 9999	1	9999	
	889	Free parameter 2	0 to 9999	1	9999	
Energy saving monitor	891	Cumulative power monitor digit shifted times	0 to 4, 9999	1	9999	
	892	Load factor	30 to 150%	0.1%	100%	
	893	Energy saving monitor reference (motor capacity)	0.1 to 55kW/ 0 to 3600kW	0.01/0.1kW	SLD/LD value of Applied motor Capacity	
	894	Control selection during commercial power-supply operation	0, 1, 2, 3	1	0	
	895	Power saving rate reference value	0, 1, 9999	1	9999	
	896	Power unit cost	0 to 500, 9999	0.01	9999	
	897	Power saving monitor average time	0, 1 to 1000h, 9999	1	9999	
	898	Power saving cumulative monitor clear	0, 1, 10, 9999	1	9999	
	899	Operation time rate (estimated value)	0 to 100%, 9999	0.1%	9999	

Appendix B1: Variable Speed Drive Inverter (F700)

B1.2.2 Parameter List (continued)

Function	Parameters	Name	Setting Range	Minimum Setting Increments	Initial Value	Factory Setting
Calibration parameters	C0 (900)	CA terminal calibration	----	----	----	
	C1 (901)	AM terminal calibration	----	----	----	
	C2 (902)	Terminal 2 frequency setting bias frequency	0 to 400Hz	0.01Hz	0Hz	
	C3 (902)	Terminal 2 frequency setting bias	0 to 300%	0.1%	0%	
	125 (903)	Terminal 2 frequency setting gain frequency	0 to 400Hz	0.01Hz	60Hz	
	C4 (903)	Terminal 2 frequency setting gain	0 to 300%	0.1%	100%	
	C5 (904)	Terminal 4 frequency setting bias frequency	0 to 400Hz	0.01Hz	0Hz	
	C6 (904)	Terminal 4 frequency setting bias	0 to 300%	0.1%	20%	0 +
	126 (905)	Terminal 4 frequency setting gain frequency	0 to 400Hz	0.01Hz	60Hz	
	C7 (905)	Terminal 4 frequency setting gain	0 to 300%	0.1%	100%	
Analog output current calibration	C8 (930)	Current output bias signal	0 to 100%	0.1%	0%	
	C9 (930)	Current output bias current	0 to 100%	0.1%	0%	
	C10 (931)	Current output gain signal	0 to 100%	0.1%	100%	
	C11 (931)	Current output gain current	0 to 100%	0.1%	100%	
----	989	Parameter copy alarm release	10, 100	1	10/100	
PU	990	PU buzzer control	0, 1	1	1	
	991	PU contrast adjustment	0 to 63	1	58	
Clear parameter	Pr.CL	Parameter clear	0, 1	1	0	
	ALLC	All parameter clear	0, 1	1	0	
	Er.CL	Alarm history clear	0, 1	1	0	
	PCPY	Parameter copy	0, 1, 2, 3	1	0	

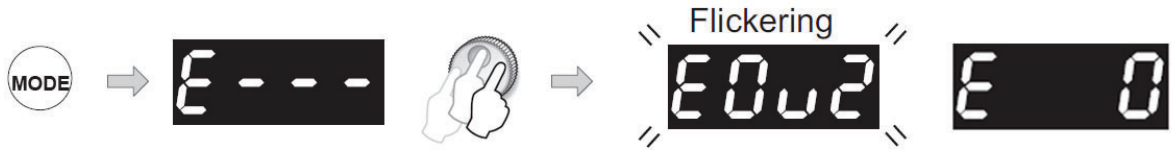
+ Indicates setting changed from initial value

Appendix B1: Variable Speed Drive Inverter (F700)

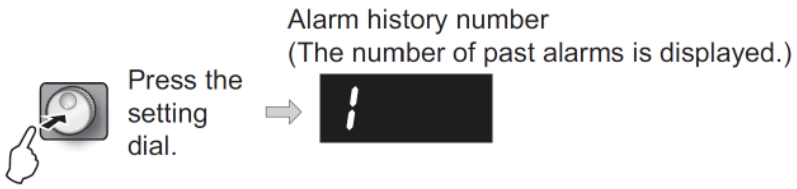
B1.3 Alarms

B1.3.1 Check Alarm History

A list of the past 8 alarms can be displayed from the display monitor (for a complete list of alarm indications, see Alarm Indications Section B1.3.4).



1. Press the “MODE” button twice to display the alarm history mode.
2. Turn the setting dial to list all error indications. When no alarm history exists “E0” is displayed (refer to Table B1.3.4.1 for list of alarm displays).
3. Press the setting dial to display the alarm history number (past 8 alarms).



4. Press the “MODE” button once to return to the monitor display.

B1.3.2 Check Alarm Output Conditions

The output frequency, output current, output voltage and energization time (total elapsed time until alarm occurred) can be checked on each alarm indication.

NOTE: Not all alarms will display the conditions listed above.

1. Complete steps 1& 2 in Section B1.3.1.
2. After selecting the error indication, press the “SET” button to display the output frequency. See Figure B1.3.2.1.
3. Press “SET” button to display the output current.
4. Press “SET” button display the output voltage.
5. Press “SET” button to display the energization time.
6. Press “SET” button to return to the alarm display.
7. Press the “MODE” button once to return to the monitor display.

Appendix B1: Variable Speed Drive Inverter (F700)

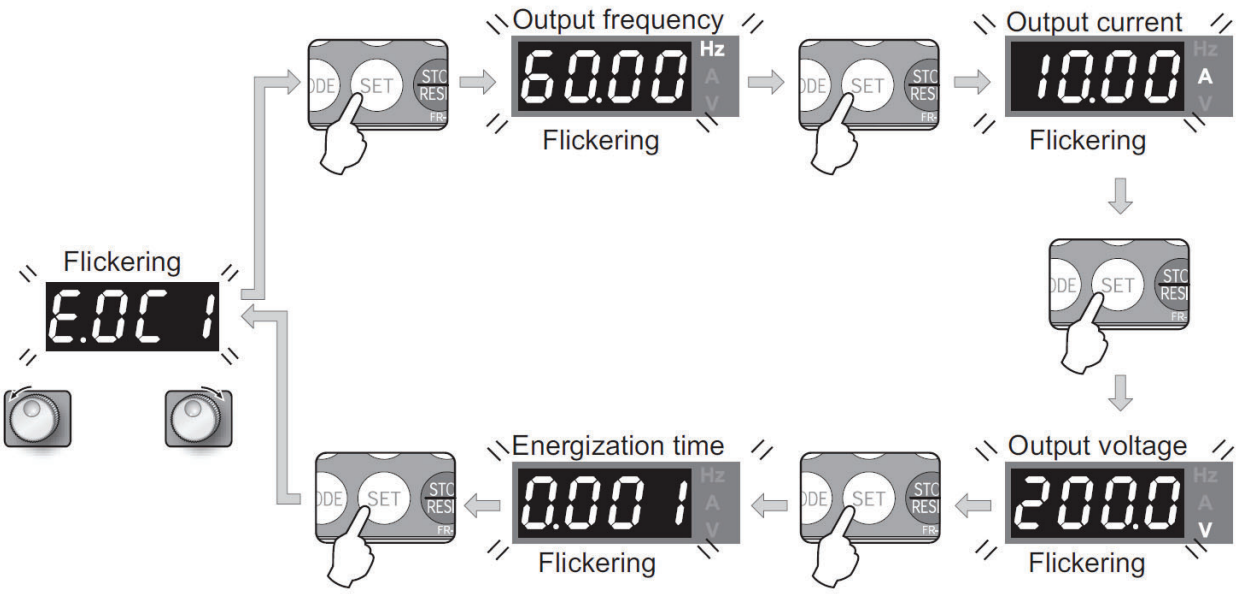
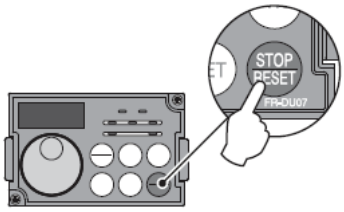


Figure B1.3.2.1 Alarm Output Conditions (F700)

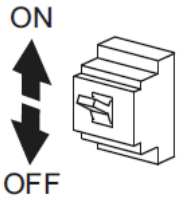
B1.3.3 Maintenance

The inverter can be reset by performing any of the following operations. Note that the internal thermal integrated value of the electronic thermal relay function and the number of retries are cleared (erased) by resetting the inverter. It takes about 1 second for reset.

Operation 1: Using the operation panel, press "STOP/RESET" to reset the inverter. (Enabled only when the inverter protective function is activated) (major fault)



Operation 2: Switch power off once, then switch it on again.



Appendix B1: Variable Speed Drive Inverter (F700)

B1.3.4 Troubleshooting (Alarm Indications)

When an alarm occurs in the inverter, the protective function is activated bringing the inverter to an alarm stop and the monitor display automatically changes to any of the following alarm indications (see Table B1.3.4.1).

When the protective function is activated, take the corresponding corrective action (refer to factory), then reset the inverter and resume operation. (See Reset VSD Section B1.3.3)

Operation Panel Indication			Name
Error message	E - - -	E---	Alarm history
	HOLd	HOLD	Operation panel lock
	Er 1 to Er 4	Er1 to 4	Parameter write error
	rE 1 to rE4	rE1 to 4	Copy operation error
	Err.	Err.	Error
Warnings	OL	OL	Stall prevention (overcurrent)
	oL	oL	Stall prevention (overvoltage)
	rb	RB	Regenerative brake prealarm
	TH	TH	Electronic thermal relay function prealarm
	PS	PS	PU stop
	MT	MT	Maintenance signal output
	CP	CP	Parameter copy
Minor fault	Fn	FN	Fan fault
Major fault	E.OC 1	E.OC1	Overcurrent shut-off during acceleration
	E.OC2	E.OC2	Overcurrent shut-off during constant speed
	E.OC3	E.OC3	Overcurrent shut-off during deceleration or stop
	E.Ou 1	E.OV1	Regenerative overvoltage shut-off during acceleration
	E.Ou2	E.OV2	Regenerative overvoltage shut-off during constant speed
	E.Ou3	E.OV3	Regenerative overvoltage shut-off during deceleration or stop
	E.THT	E.THT	Inverter overload shut-off (electronic thermal relay function)
	E.THM	E.THM	Motor overload shut-off (electronic thermal relay function)
	E.FIn	E.FIN	Fin overheat
	E.IPF	E.IPF	Instantaneous power failure
	E. bE	E.BE	Brake transistor alarm detection/internal circuit error
	E.UVT	E.UVT	Undervoltage
	E.ILF	E.ILF*	Input phase failure
	E.OLT	E.OLT	Stall prevention

Operation Panel Indication			Name
Major fault	E. GF	E.GF	Output side ground fault overcurrent
	E. LF	E.LF	Output phase failure
	E.OHT	E.OHT	External thermal relay operation *2
	E.PTC	E.PTC*	PTC thermistor operation
	E.OPT	E.OPT	Option alarm
	E.OP1	E.OP1	Communication option alarm
	E. 1	E. 1	Option alarm
	E. PE	E.PE	Parameter storage device alarm
	E.PUE	E.PUE	PU disconnection
	E.rET	E.RET	Retry count excess
	E.PE2	E.PE2*	Parameter storage device alarm
	E. 6 / E. 7 / E.CPU	E. 6 / E. 7 / E.CPU	CPU error
	E.CTE	E.CTE	Operation panel power supply short circuit, RS-485 terminal power supply short circuit
	E.P24	E.P24	24VDC power output short circuit
	E.CdO	E.CDO*	Output current detection value exceeded
	E.IOH	E.IOH*	Inrush current limit circuit alarm
	E.SER	E.SER*	Communication error (inverter)
	E.AIE	E.AIE*	Analog input error
	E. 13	E.13	Internal circuit error

* If an error occurs when using the FR-PU04/FR-PU07, "Fault 14" is displayed on the FR-PU04/FR-PU07.

Table B1.3.4.1 List of Alarm Displays (F700)

Appendix B1: Variable Speed Drive Inverter (F700)

B1.3.5 Troubleshooting Checklist

NOTE: If the cause is still unknown after every check, contact **BeaconMedæs Tech Support** at 888-4-MEDGAS.

Motor does not rotate as commanded

1) Check the value of torque boost setting (Pr. 0).

2) Check the main circuit.
   - Check that a proper power supply voltage is applied (operation panel display is provided).
   - Check that the motor is connected properly.
   - Check that the jumper across P/+-P1 is connected.

3) Check the input signals.
   - Check that the start signal is input.
   - Check that both the forward and reverse rotation start signals are not input simultaneously.
   - Check that the frequency setting signal is not zero. (When the frequency command is 0Hz and the start command is entered, FWD or REV LED on the operation panel flickers.)
   - Check that the output stop signal (MRS) or reset signal (RES) is not on.
   - Check that the CS signal is not OFF with automatic restart after instantaneous power failure function is selected (Pr. 57 ≠ "9999").
   - Check that the sink or source jumper connector is fitted securely.

4) Check the parameter settings.
   - Check that the reverse rotation prevention selection (Pr. 78) is not selected.
   - Check that the Operation mode selection (Pr. 79) setting is correct.
   - Check that the bias and gain (calibration parameter C2 to C7) settings are correct.
   - Check that the starting frequency setting (Pr. 13) is not greater than the running frequency.
   - Check that frequency settings of each running frequency (such as multi-speed operation) are not zero.
   - Check that especially the maximum frequency setting (Pr. 1) is not zero.
   - Check that the jog frequency setting (Pr. 15) is not lower than the starting frequency setting (Pr. 13) value.

5) Inspection of load.
   - Check that the load is not too heavy.
   - Check that the shaft is not locked.

Appendix B1: Variable Speed Drive Inverter (F700)

B1.3.5 Troubleshooting Checklist (continued)

Motor generates abnormal noise

1) No carrier frequency noises (metallic noises) are generated.
   - Soft-PWM control to change the motor tone into an unoffending complex tone is factory-set to valid by the PWM frequency selection (Pr.72). Adjust PWM frequency selection (Pr.72) to change the motor tone. (When operating the inverter with the carrier frequency of 3kHz or more set in Pr. 72, the carrier frequency will automatically decrease if the output current of the inverter exceeds the value in parenthesis of the rated output current. This may cause the motor noise to increase. But it is not a fault.)
2) Check for any mechanical looseness.
3) Contact the motor manufacturer.

Motor generates heat abnormally

1) Is the fan for the motor is running? (Check for accumulated dust.)
2) Check that the load is not too heavy. Lighten the load.
3) Check that the inverter output voltages (U, V, W) balanced.
4) Check that the torque boost setting (Pr.0) is correct.

Motor rotates in opposite direction

1) Check that the phase sequence of output terminals U, V and W is correct.
2) Check that the start signals (forward rotation, reverse rotation) are connected properly.

Speed greatly differs from the setting

1) Check that the frequency setting signal is correct. (Measure the input signal level.)
2) Check that the Pr. 1, Pr. 2, Calibration parameter C2 to C7 settings are correct.
3) Check that the input signal lines are not affected by external noise. (Use shielded cables)
4) Check that the load is not too heavy.
5) Check that the Pr. 31 to Pr. 36 (frequency jump) settings are correct.

Acceleration/deceleration is not smooth

1) Check that the acceleration and deceleration time settings are not too short.
2) Check that the load is not too heavy.

Appendix B1: Variable Speed Drive Inverter (F700)

B1.3.5 Troubleshooting Checklist (continued)

Motor current is large

1) Check that the load is not too heavy.
2) Check that the torque boost setting (Pr. 0) is correct.
3) Check that the base frequency setting (Pr. 3) is correct.
4) Check that the load pattern selection setting (Pr. 14) is appropriate.
5) Check that the base frequency voltage setting (Pr. 19) is correct.

Speed does not increase

1) Check that the maximum frequency setting (Pr. 1) is correct. (If you want to run the motor at 120Hz or more, set Pr. 18 High speed maximum frequency. Refer to Instruction Manual.)
2) Check that the load is not too heavy. (In agitators, etc., load may become heavier in winter.)
3) Check that the brake resistor is not connected to terminals P/+-P1 accidentally.

Speed varies during operation

1) Inspection of load
   - Check that the load is not varying.
2) Check the input signal
   - Check that the frequency setting signal is not varying.
   - Check that the frequency setting signal is not affected by noise.
   - Check for a malfunction due to undesirable currents when the transistor output unit is connected.
3) Others
   - Check that the wiring length is not too long for V/F control.

Operation panel (FR-DU07) display is not operating

Check that the operation panel is connected to the inverter securely.

Parameter write cannot be performed

1) Make sure that operation is not being performed (signal STF or STR is not ON).
2) Make sure that you are not attempting to set the parameter in the external operation mode.
3) Check Pr. 77 Parameter write selection.
4) Check Pr. 161 Frequency setting/key lock operation selection.

Appendix B1: Variable Speed Drive Inverter (F700)

B1.4 Correspondences Between Digital and Actual Characters

There are the following correspondences between the actual alphanumeric characters and the digital characters displayed on the operation panel.

Actual	Digital
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	

Actual	Digital
A	
B	
C	
D	
E	
F	
G	
H	
I	
J	
L	

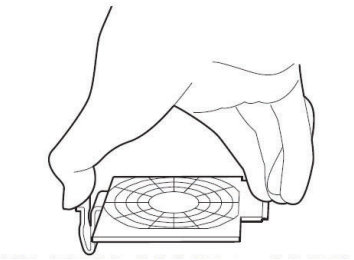
Actual	Digital
M	
N	
O	
o	
P	
S	
T	
U	
V	
r	
-	

Appendix B1: Variable Speed Drive Inverter (F700)

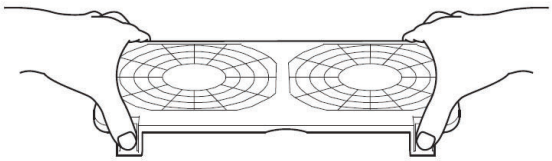
B1.5 Cooling Fan Replacement

Removal

1. Push the hooks from above and remove the fan cover.



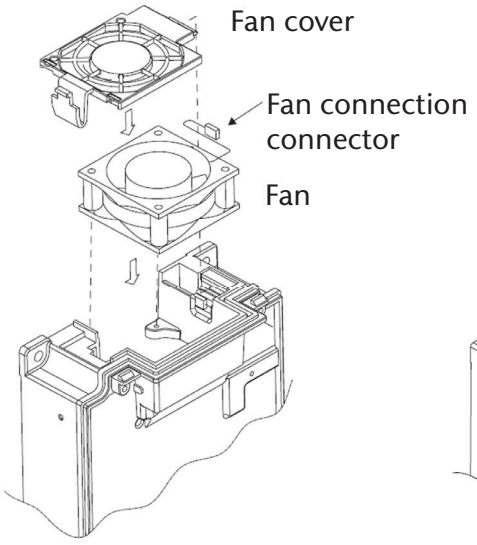
FR-F720-00250
FR-F740-00126



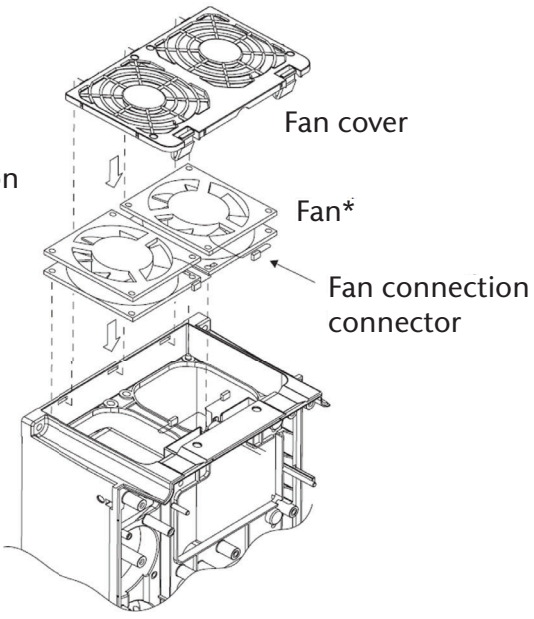
FR-F720-00340 to 00490
FR-F740-00170 to 00250

2. Disconnect the fan connectors.

3. Remove the fan.



FR-F720-00250
FR-F740-00126



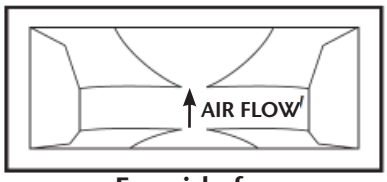
FR-F720-00340 to 00490
FR-F740-00170 to 00250

Appendix B1: Variable Speed Drive Inverter (F700)

B1.5 Cooling Fan Replacement (continued)

Reinstallation

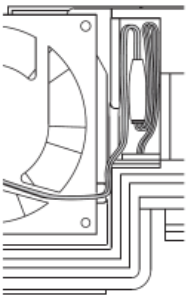
1. After confirming the orientation of the fan, reinstall the fan so that the arrow on the left of "AIR FLOW" faces up.



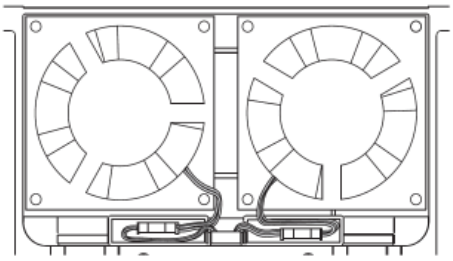
<Fan side face>

CAUTION: Installing the fan in the opposite air flow direction can cause the inverter life to be shorter.

2. Reconnect the fan connectors. When wiring, use care to avoid the cables being caught by the fan.



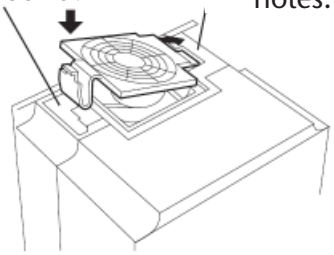
FR-F720-00250
FR-F740-00126



FR-F720-00340 to 00490
FR-F740-00170 to 00250

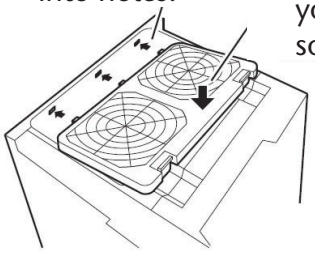
3. Reinstall the fan cover.

2. Insert hooks until you hear a click sound.
1. Insert hooks into holes.



FR-F720-00250
FR-F740-00126

1. Insert hooks into holes.
2. Insert hooks until you hear a click sound.



FR-F720-00340 to 00490
FR-F740-00170 to 00250

Appendix B1: Variable Speed Drive Inverter (F700)

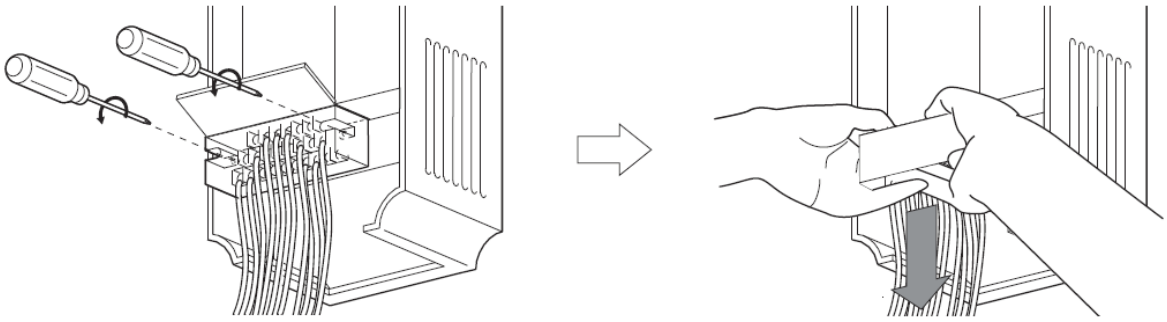
B1.6 Inverter Replacement

WARNING:

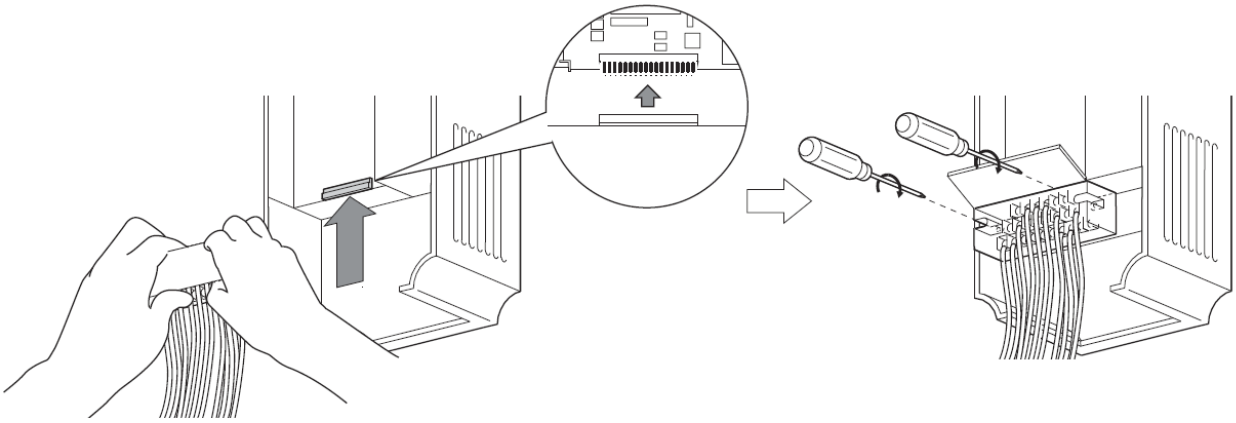
Before starting inverter replacement, switch power off, wait for at least 10 minutes, and then check the voltage with a tester and such to ensure safety.

The inverter can be replaced with the control circuit wiring kept connected. Before replacement, remove the wiring cover of the inverter.

1. Loosen the two installation screws in both ends of the control circuit terminal block. (These screws cannot be removed.) Pull down the terminal block from behind the control circuit terminals.



2. Using care not to bend the pins of the inverter's control circuit connector, reinstall the control circuit terminal block and fix it with the mounting screws.



Appendix B1: Variable Speed Drive Inverter (F700)

B1.7 Parts List

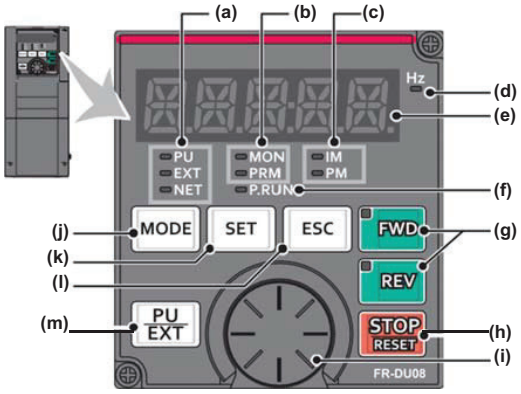
For information regarding replacement parts, see the spare parts list. For additional parts or information, please contact **BeaconMedæs** Tech Support at 888-4-MEDGAS. Please provide the serial number of your system.

Appendix B2: Variable Speed Drive Inverter (F800)

B2.1 VSD (Variable Speed Drive) Operation Panel

The VSD inverter has an operational panel to control and monitor the speed of the pump in VSD mode as well as adjusting parameters and alarm indications of the unit.

Figure B2.1.1 Operational Panel (F800)



No.	Component	Name	Description
(a)	PU EXT NET	Operation mode indicator	PU: ON to indicate the PU operation mode. EXT: ON to indicate the External operation mode. (ON at power-ON in the initial setting.) NET: ON to indicate the Network operation mode. PU and EXT: ON to indicate the External/PU combined operation mode 1 or 2.
(b)	MON PRM	Operation panel status indicator	MON: ON to indicate the monitoring mode. Quickly flickers twice intermittently while the protective function is activated. Slowly flickers in the display-off mode. PRM: ON to indicate the parameter setting mode.
(c)	IM PM	Control motor indicator	IM: ON to indicate the induction motor control. PM: ON to indicate the PM motor control. The indicator flickers when test operation is selected.
(d)	Hz	Frequency unit indicator	ON to indicate frequency. (Flickers when the set frequency is displayed in the monitor.)
(e)		Monitor (5-digit LED)	Shows the frequency, parameter number, etc. (Using **Pr.52, Pr.774 to Pr.776**, the monitored item can be changed.)
(f)	P.RUN	PLC function indicator	ON to indicate that the sequence program can be executed.
(g)	FWD REV	FWD key, REV key	FWD key: Starts forward rotation. The LED is on during forward operation. REV key: Starts reverse rotation. The LED is on during reverse operation. The LED flickers under the following conditions. • When the frequency command is not given even if the forward/reverse command is given. • When the frequency command is the starting frequency or lower. • When the MRS signal is being input.
(h)	STOP RESET	STOP/RESET key	Stops the operation commands. Resets the inverter when the protection function is activated.
(i)		Setting dial	The setting dial of the Mitsubishi inverters. The setting dial is used to change the frequency and parameter settings. Press the setting dial to perform the following operations: • To display a set frequency in the monitoring mode (the setting can be changed using **Pr.992**.) • To display the present setting during calibration • To display a fault history number in the faults history mode
(j)	MODE	MODE key	Switches to different modes. Switches to the easy setting mode by pressing simultaneously with PU EXT. Holding this key for 2 seconds locks the operation. The key lock is invalid when **Pr.161**="0 (initial setting)". (Refer to page 166.)
(k)	SET	SET key	Enters each setting. If pressed during operation, the monitored item changes. When the initial setting is set: Output frequency → Output current → Output voltage (Using **Pr.52** and **Pr.774-Pr.776**, the monitored item can be changed.)
(l)	ESC	ESC key	Goes back to the previous display. Holding this key for a longer time changes the mode back to the monitor mode.
(m)	PU EXT	PU/EXT key	Switches between the PU operation mode, the PUJOG operation mode, and the External operation mode. Switches to the easy setting mode by pressing simultaneously with MODE. Cancels the PU stop also.

Appendix B2: Variable Speed Drive Inverter (F800)

B2.1.1 Monitoring of Output Current and Output Voltage

The monitor display of output frequency, output current and output voltage can be changed by pushing "SET" button during monitor mode. The default is set to display output frequency. To change the default, press "SET" button to display either A (amps) or V (voltage). Press and hold the "SET" button for 1 second to activate the selected display as the default.

B2.2 Specifications

B2.2.1 Display and Parameter Settings

All parameter settings can be displayed from the display monitor. For a complete list of parameters, description and settings, see Parameter List in Section B2.2.2. Parameter settings are write protected to maintain factory settings.

Display Parameter Number & Setting

1. Press the "MODE" button to activate parameter setting mode.
2. Turn the setting dial to the parameter number to be displayed.
3. Press the "SET" button to display the value of the parameter.
4. Press the "MODE" button twice to return to the monitor display

Appendix B2: Variable Speed Drive Inverter (F800)

B2.2.2 Parameter List

Function	Parameters	Name	Setting Range	Minimum Setting Increments	Initial Value	Factory Setting
Basic Functions	0	Torque boost	0 to 30%	0.1%	6/4/3/2/ 1.5/1%	0% +
	1	Maximum frequency	0 to 120Hz	0.01Hz	120/60Hz	60Hz
	2	Minimum frequency	0 to 120Hz	0.01Hz	0Hz	25Hz
	3	Base frequency	0 to 400Hz	0.01Hz	60Hz	
	4	Multi-speed setting (high speed)	0 to 400Hz	0.01Hz	60Hz	
	5	Multi-speed setting (middle speed)	0 to 400Hz	0.01Hz	30Hz	
	6	Multi-speed setting (low speed)	0 to 400Hz	0.01Hz	10Hz	
	7	Acceleration time	0 to 3600/ 360s	0.1/0.01s	5s/15s	10s +
	8	Deceleration time	0 to 3600/ 360s	0.1/0.01s	10s/30s	
	9	Electronic thermal O/L relay	0 to 500/0 to 3600A	0.01/0.1A	Rated inverter output current	**
DC injection brake	10	DC injection brake operation frequency	0 to 120Hz, 9999	0.01Hz	3Hz	
	11	DC injection brake operation time	0 to 10s, 8888	0.1s	0.5s	
	12	DC injection brake operation voltage	0 to 30%	0.1%	4/2/1%	
----	13	Starting frequency	0 to 60Hz	0.01Hz	0.5Hz	
----	14	Load pattern selection	0, 1	1	1	0 +
Jog operation	15	Jog frequency	0 to 400Hz	0.01Hz	5Hz	
	16	Jog acceleration/deceleration time	0 to 3600/360s	0.1/0.01s	0.5s	
----	17	MRS input selection	0, 2	1	0	2 +
----	18	High speed maximum frequency	120 to 400Hz	0.01Hz	120/60Hz	60 +
----	19	Base frequency voltage	0 to 1000V, 8888, 9999	0.1V	9999	
Acceleration/ deceleration times	20	Acceleration/deceleration reference frequency	1 to 400Hz	0.01Hz	60Hz	
	21	Acceleration/deceleration time increments	0, 1	1	0	

+ Indicates setting changed from initial value

** See O/L chart on print

Appendix B2: Variable Speed Drive Inverter (F800)

B2.2.2 Parameter List (continued)

Function	Parameters	Name	Setting Range	Minimum Setting Increments	Initial Value	Factory Setting
Stall prevention	22	Stall prevention operation level	0 to 120%, 9999	0.1%	110%	120 +
	23	Stall prevention operation level compensation factor at double speed	0 to 150%, 9999	0.1%	9999	
Multi-speed setting	24 to 27	Multi-speed setting (4 speed to 7 speed)	0 to 400Hz, 9999	0.01Hz	9999	
----	28	Multi-speed input compensation selection	0, 1	1	0	
----	29	Acceleration/deceleration pattern selection	0, 1, 2, 3	1	0	
----	30	Regenerative function selection	0, 2/0, 1, 2	1	0	
Frequency jump	31	Frequency jump 1A	0 to 400Hz, 9999	0.01Hz	9999	
	32	Frequency jump 1B	0 to 400Hz, 9999	0.01Hz	9999	
	33	Frequency jump 2A	0 to 400Hz, 9999	0.01Hz	9999	
	34	Frequency jump 2B	0 to 400Hz, 9999	0.01Hz	9999	
	35	Frequency jump 3A	0 to 400Hz, 9999	0.01Hz	9999	
	36	Frequency jump 3B	0 to 400Hz, 9999	0.01Hz	9999	
----	37	Speed display	0, 1 to 9998	1	0	
Frequency detection	41	Up-to-frequency sensitivity	0 to 100%	0.1%	10%	
	42	Output frequency detection	0 to 400Hz	0.01Hz	6Hz	
	43	Output frequency detection for reverse rotation	0 to 400Hz, 9999	0.01Hz	9999	

+ Indicates setting changed from initial value

Appendix B2: Variable Speed Drive Inverter (F800)

B2.2.2 Parameter List (continued)

Function	Parameters	Name	Setting Range	Minimum Setting Increments	Initial Value	Factory Setting
Second fluctuations	44	Second acceleration/ deceleration time	0 to 3600/360s	0.1/0.01s	5s	
	45	Second deceleration time	0 to 3600/360s, 9999	0.1/0.01s	9999	
	46	Second torque boost	0 to 30%, 9999	0.1%	9999	
	47	Second V/F (base frequency)	0 to 400Hz, 9999	0.01Hz	9999	
	48	Second stall prevention operation current	0 to 120%	0.1%	110%	
	49	Second stall prevention operationfrequency	0 to 400Hz, 9999	0.01Hz	0Hz	
	50	Second output frequency detection	0 to 400Hz	0.01Hz	30Hz	
	51	Second electronic thermal O/L relay	0 to 500A, 9999/0 to 3600A, 9999	0.01/0.1A	9999	
Monitor functions	52	DU/PU main display data selection	0, 5, 6, 8 to 14, 17, 20, 23 to 25, 50 to 57, 100	1	0	
	54	CA terminal function selection	1 to 3, 5, 6, 8 to 14, 17, 21, 24, 50, 52, 53	1	1	
	55	Frequency monitoring reference	0 to 400Hz	0.01Hz	60Hz	133.3
	56	Current monitoring reference	0 to 500A/0 to 3600A	0.01/0.1A	Rated inverter output current	
Automatic restart functions	57	Restart coasting time	0, 0.1 to 5s, 9999/ 0, 0.1 to 30s, 9999	0.1s	9999	
	58	Restart cushion time	0 to 60s	0.1s	1s	
----	59	Remote function selection	0, 1, 2, 3	1	0	
----	60	Energy saving control selection	0, 4, 9	1	0	
----	65	Retry selection	0 to 5	1	0	
----	66	Stall prevention operation reduction starting frequency	0 to 400Hz	0.01Hz	60Hz	
Retry	67	Number of retries at alarm occurrence	0 to 10, 101 to 110	1	0	
	68	Retry waiting time	0 to 10s	0.1s	1s	
	69	Retry count display erase	0	1	0	

Appendix B2: Variable Speed Drive Inverter (F800)

B2.2.2 Parameter List (continued)

Function	Parameters	Name	Setting Range	Minimum Setting Increments	Initial Value	Factory Setting
----	70	Special regenerative brake duty	0 to 10%	0.1%	0%	
----	71	Applied motor	0, 1, 2, 20	1	0	
----	72	PWM frequency selection	0 to 15/0 to 6, 25	1	2	
----	73	Analog input selection	0 to 7, 10 to 17	1	1	5 +
----	74	Input filter time constant	0 to 8	1	1	
----	75	Reset selection/disconnected PU detection/PU stop selection	0 to 3, 14 to 17, 100 to 103, 114 to 117	1	14	
----	76	Alarm code output selection	0, 1, 2	1	0	
----	77	Parameter write selection	0, 1, 2	1	0	2 +
----	78	Reverse rotation prevention selection	0, 1, 2	1	0	
----	79	Operation mode selection	0, 1, 2, 3, 4, 6, 7	1	0	2 +
Simple magnetic flux vector control	80	Motor capacity(simple magnetic flux vector control)	0.4 to 55kW, 9999/ 0 to 3600kW, 9999	0.01/0.1kW	9999	
	90	Motor constant (R1)	0 to 50 , 9999/ 0 to 400m , 9999	0.001 / 0.01m	9999	
Adjustable 5 points VF	100	V/F1(first frequency)	0 to 400Hz, 9999	0.01Hz	9999	
	101	V/F1(first frequency voltage)	0 to 1000V	0.1V	0V	
	102	V/F2(second frequency)	0 to 400Hz, 9999	0.01Hz	9999	
	103	V/F2(second frequency voltage)	0 to 1000V	0.1V	0V	
	104	V/F3(third frequency)	0 to 400Hz, 9999	0.01Hz	9999	
	105	V/F3(third frequency voltage)	0 to 1000V	0.1V	0V	
	106	V/F4(fourth frequency)	0 to 400Hz, 9999	0.01Hz	9999	
	107	V/F4(fourth frequency voltage)	0 to 1000V	0.1V	0V	
	108	V/F5(fifth frequency)	0 to 400Hz, 9999	0.01Hz	9999	
	109	V/F5(fifth frequency voltage)	0 to 1000V	0.1V	0V	

+ Indicates setting changed from initial value

Appendix B2: Variable Speed Drive Inverter (F800)

B2.2.2 Parameter List (continued)

Function	Parameters	Name	Setting Range	Minimum Setting Increments	Initial Value	Factory Setting
PU connector communication	117	PU communication station number	0 to 31	1	0	
	118	PU communication speed	48, 96, 192, 384	1	192	
	119	PU communication stop bit length	0, 1, 10, 11	1	1	
	120	PU communication parity check	0, 1, 2	1	2	
	121	Number of PU communication retries	0 to 10, 9999	1	1	
	122	PU communication check time interval	0, 0.1 to 999.8s, 9999	0.1s	9999	
	123	PU communication waiting time setting	0 to 150ms, 9999	1	9999	
	124	PU communication CR/LF presence/ absence selection	0, 1, 2	1	1	
----	125	Terminal 2 frequency setting gain frequency	0 to 400Hz	0.01Hz	60Hz	
----	126	Terminal 4 frequency setting gain frequency	0 to 400Hz	0.01Hz	60Hz	
PID operation	127	PID control automatic switchover frequency	0 to 400Hz, 9999	0.01Hz	9999	25 +
	128	PID action selection	10, 11, 20, 21, 50, 51, 60, 61	1	0	80 +
	129	PID proportional band	0.1 to 1000%, 9999	0.1%	100%	300 +
	130	PID integral time	0.1 to 3600s, 9999	0.1s	1s	0.10 +
	131	PID upper limit	0 to 100%, 9999	0.1%	9999	
	132	PID lower limit	0 to 100%, 9999	0.1%	9999	
	133	PID action set point	0 to 100%, 9999	0.01%	9999	
	134	PID differential time	0.01 to 10.00s, 9999	0.01s	9999	
Commercial power supply-inverter switch-over	135	Electronic bypass sequence selection	0, 1	1	0	
	136	MC switchover interlock time	0 to 100s	0.1s	1s	
	137	Start waiting time	0 to 100s	0.1s	0.5s	
	138	Bypass selection at an alarm	0, 1	1	0	
	139	Automatic switchover frequency from inverter to bypass operation	0 to 60Hz, 9999	0.01Hz	9999	

+ Indicates setting changed from initial value

Appendix B2: Variable Speed Drive Inverter (F800)

B2.2.2 Parameter List (continued)

Function	Parameters	Name	Setting Range	Minimum Setting Increments	Initial Value	Factory Setting
Backlash measures	140	Backlash acceleration stopping frequency	0 to 400Hz	0.01Hz	1Hz	
	141	Backlash acceleration stopping time	0 to 360s	0.1s	0.5s	
	142	Backlash deceleration stopping frequency	0 to 400Hz	0.01Hz	1Hz	
	143	Backlash deceleration stopping time	0 to 360s	0.1s	0.5s	
----	144	Speed setting switchover	0, 2, 4, 6, 8, 10, 102, 104, 106, 108, 110	1	4	
----	145	PU display language selection	0 to 7	1	1	
----	148	Stall prevention level at 0V input	0 to 120%	0.1%	110%	
----	149	Stall prevention level at 10V input	0 to 120%	0.1%	120%	
----	150	Output current detection level	0 to 120%	0.1%	110%	
----	151	Output current detection signal delay time	0 to 10s	0.1s	0s	
----	152	Zero current detection level	0 to 150%	0.1%	5%	
----	153	Zero current detection time	0 to 1s	0.01s	0.5s	
----	154	Voltage reduction selection during stall prevention operation	0, 1	1	1	
----	155	RT signal function validity condition selection	0, 10	1	0	
----	156	Stall prevention operation selection	0 to 31, 100, 101	1	0	
----	157	OL signal output timer	0 to 25s, 9999	0.1s	0s	
----	158	AM terminal function selection	1 to 3, 5, 6, 8 to 14, 17, 21, 24, 50, 52, 53	1	1	
----	159	Automatic switchover frequency range from bypass to inverter operation	0 to 10Hz, 9999	0.01Hz	9999	
----	160	User group read selection	0, 1, 9999	1	0	
----	161	Frequency setting/key lock operation selection	0, 1, 10, 11	1	0	

Appendix B2: Variable Speed Drive Inverter (F800)

B2.2.2 Parameter List (continued)

Function	Parameters	Name	Setting Range	Minimum Setting Increments	Initial Value	Factory Setting
Automatic restart functions	162	Automatic restart after instantaneous power failure selection	0, 1, 10, 11	1	0	
	163	First cushion time for restart	0 to 20s	0.1s	0s	
	164	First cushion voltage for restart	0 to 100%	0.1%	0%	
	165	Stall prevention operation level for restart	0 to 120%	0.1%	110%	
Current detection	166	Output current detection signal retention time	0 to 10s, 9999	0.1s	0.1s	
	167	Output current detection operation selection	0, 1	1	0	1
----	168	Parameter for manufacturer setting. Do not set.				
----	169					
Cumulative monitor clear	170	Watt-hour meter clear	0, 10, 9999	1	9999	
	171	Operation hour meter clear	0, 9999	1	9999	
User group	172	User group registered display/ batch clear	9999, (0 to 16)	1	0	
	173	User group registration	0 to 999, 9999	1	9999	
	174	User group clear	0 to 999, 9999	1	9999	

Appendix B2: Variable Speed Drive Inverter (F800)

B2.2.2 Parameter List (continued)

Function	Parameters	Name	Setting Range	Minimum Setting Increments	Initial Value	Factory Setting
Input terminal function assignment	178	STF terminal function selection	0 to 8, 10 to 14, 16, 24, 25, 60, 62, 64 to 67, 9999	1	6	
	179	STR terminal function selection	0 to 8, 10 to 14, 16, 24, 25, 61, 62, 64 to 67, 9999	1	61	
	180	RL terminal function selection	0 to 8, 10 to 14, 16, 24, 25, 62, 64 to 67, 9999	1	0	
	181	RM terminal function selection		1	1	
	182	RH terminal function selection		1	2	
	183	RT terminal function selection		1	3	14 +
	184	AU terminal function selection	0 to 8, 10 to 14, 16, 24, 25, 62 to 67, 9999	1	4	50
	185	JOG terminal function selection	0 to 8, 10 to 14, 16, 24, 25, 62, 64 to 67, 9999	1	5	
	186	CS terminal function selection		1	6	
	187	MRS terminal function selection		1	24	
	188	STOP terminal function selection		1	25	
	189	RES terminal function selection		1	62	
Output terminal function assignment	190	RUN terminal function selection	0 to 5, 7, 8, 10 to 19, 25, 26, 45 to 47, 64, 70 to 78, 90 to 96, 98, 99, 100 to 105, 107, 108, 110 to 116, 125, 126, 145 to 147, 164, 170, 190 to 196, 198, 199, 9999	1	0	
	191	SU terminal function selection		1	1	
	192	IPF terminal function selection		1	2	
	193	OL terminal function selection		1	3	
	194	FU terminal function selection		1	4	
	195	ABC1 terminal function selection	0 to 5, 7, 8, 10 to 19, 25, 26, 45 to 47, 64, 70 to 78, 90, 91, 94 to 96, 98, 99, 100 to 105, 107, 108, 110 to 116, 125, 126, 145 to 147, 164, 170, 190, 191, 194 to 196, 198, 199, 9999	1	99	
	196	ABC2 terminal function selection		1	9999	0 +
Multi-speed setting	232 to 239	Multi-speed setting (8 speed to 15 speed)	0 to 400Hz, 9999	0.01Hz	9999	

+ Indicates setting changed from initial value

Appendix B2: Variable Speed Drive Inverter (F800)

B2.2.2 Parameter List (continued)

Function	Parameters	Name	Setting Range	Minimum Setting Increments	Initial Value	Factory Setting
----	240	Soft-PWM operation selection	0, 1	1	1	
----	241	Analog input display unit switchover	0, 1	1	0	
----	242	Terminal 1 added compensation amount (terminal 2)	0 to 100%	0.1%	100%	
----	243	Terminal 1 added compensation amount (terminal 4)	0 to 100%	0.1%	75%	
----	244	Cooling fan operation selection	0, 1	1	1	
Slip compensation	245	Rated slip	0 to 50%, 9999	0.01%	9999	
	246	Slip compensation time constant	0.01 to 10s	0.01s	0.5s	
	247	Constant-power range slip compensation selection	0, 9999	1	9999	
----	250	Stop selection	0 to 100s, 1000 to 1100s, 8888, 9999	0.1s	9999	
----	251	Output phase failure protection selection	0, 1	1	1	
Frequency compensation function	252	Override bias	0 to 200%	0.1%	50%	
	253	Override gain	0 to 200%	0.1%	150%	
Life check	255	Life alarm status display	(0 to 15)	1	0	
	256	Inrush current limit circuit life display	(0 to 100%)	1%	100%	
	257	Control circuit capacitor life display	(0 to 100%)	1%	100%	
	258	Main circuit capacitor life display	(0 to 100%)	1%	100%	
	259	Main circuit capacitor life measuring	0, 1	1	0	
----	260	PWM frequency automatic switchover	0, 1	1	1	

Appendix B2: Variable Speed Drive Inverter (F800)

B2.2.2 Parameter List (continued)

Function	Parameters	Name	Setting Range	Minimum Setting Increments	Initial Value	Factory Setting
Power failure stop	261	Power failure stop selection	0, 1, 2	1	0	2 +
	262	Subtracted frequency at deceleration start	0 to 20Hz	0.01Hz	3Hz	
	263	Subtraction starting frequency	0 to 120Hz, 9999	0.01Hz	60Hz	
	264	Power-failure deceleration time 1	0 to 3600/ 360s	0.1/0.01s	5s	
	265	Power-failure deceleration time 2	0 to 3600/ 360s, 9999	0.1/0.01s	9999	
	266	Power failure deceleration time switchover frequency	0 to 400Hz	0.01Hz	60Hz	
----	267	Terminal 4 input selection	0, 1, 2	1	0	1 +
----	268	Monitor decimal digits selection	0, 1, 9999	1	9999	
----	269	Parameter for manufacturer setting. Do not set.				
----	299	Rotation direction detection selection at restarting	0, 1, 9999	1	9999	
Digital input	300	BCD input bias	Parameter for digital input option (FR-A7AX)			
	301	BCD input gain				
	302	BIN input bias				
	303	BIN input gain				
	304	Digital input and analog input compensation enable/disable selection				
	305	Read timing operation selection				
Analog output	306	Analog output signal selection	Extension analog output/digital output option Parameter for (FR-A7AY)			
	307	Setting for zero analog output				
	308	Setting for maximum analog output				
	309	Analog output signal voltage/ current switchover				
	310	Analog meter voltage output selection				
	311	Setting for zero analog meter voltage output				
	312	Setting for maximum analog meter voltage output				

+ Indicates setting changed from initial value

Appendix B2: Variable Speed Drive Inverter (F800)

B2.2.2 Parameter List (continued)

Function	Parameters	Name	Setting Range	Minimum Setting Increments	Initial Value	Factory Setting
Digital output	313	DO0 output selection	Parameter for extension analog output/digital output option (FR-A7AY)			
	314	DO1 output selection				
	315	DO2 output selection				
	316	DO3 output selection				
	317	DO4 output selection				
	318	DO5 output selection				
	319	DO6 output selection				
Relay output	320	RA1 output selection	Parameter for relay output option (FR-A7AR)			
	321	RA2 output selection				
	322	RA3 output selection				
Analog output	323	AM0 0V adjustment	Parameter for extension analog output/digital output option (FR-A7AY)			
	324	AM1 0mA adjustment				
----	329	Digital input unit selection	Parameter for digital input option (FR-A7AY)			

Appendix B2: Variable Speed Drive Inverter (F800)

B2.2.2 Parameter List (continued)

Function	Parameters	Name	Setting Range	Minimum Setting Increments	Initial Value	Factory Setting
RS-485 communication	331	RS-485 communication station number	0 to 31(0 to 247)	1	0	1
	332	RS-485 communication speed	3, 6, 12, 24, 48, 96, 192, 384	1	96	
	333	RS-485 communication stop bit length	0, 1, 10, 11	1	1	
	334	RS-485 communication parity check selection	0, 1, 2	1	2	
	335	RS-485 communication retry count	0 to 10, 9999	1	1	
	336	RS-485 communication check time interval	0 to 999.8s, 9999	0.1s	0s	
	337	RS-485 communication waiting time setting	0 to 150ms, 9999	1	9999	
	338	Communication operation command source	0, 1	1	0	
	339	Communication speed command source	0, 1, 2	1	0	
	340	Communication startup mode selection	0, 1, 2, 10, 12	1	0	12
	341	RS-485 communication CR/LF selection	0, 1, 2	1	1	
	342	Communication EEPROM write selection	0, 1	1	0	1
	343	Communication error count	----	1	0	
DeviceNet	345	DeviceNet address	Parameter for DeviceNet communication option (FR-A7ND)			
	346	DeviceNet baud rate				
CC-Link PROFIBUS-DP	349	Communication reset selection	Parameter for CC-Link and PROFIBUS-DP communication option (FR-A7NC, FR-A7NP)			

Appendix B2: Variable Speed Drive Inverter (F800)

B2.2.2 Parameter List (continued)

Function	Parameters	Name	Setting Range	Minimum Setting Increments	Initial Value	Factory Setting
LONWORKS	387	Initial communication delay time	Parameter for LONWORKS communication option (FR-A7NL)			
	388	Send time interval at hart beat				
	389	Minimum sending time at hart beat				
	390	% setting reference frequency				
	391	Receive time interval at hart beat				
	392	Event driven detection width				
Remote output	495	Remote output selection	0, 1	1	0	
	496	Remote output data 1	0 to 4095	1	0	
	497	Remote output data 2	0 to 4095	1	0	
Communication error	500	Communication error execution waiting time	Parameter for communication option			
	501	Communication error occurrence count display				
	502	Stop mode selection at communication error				
Maintenance	503	Maintenance timer	0 (1 to 9998)	1	0	
	504	Maintenance timer alarm output set time	0 to 9998, 9999	1	9999	
CC-Link	542	Communication station number (CC-Link)	Parameter for CC-Link communication option (FR-A7NC)			
	543	Baud rate (CC-Link)				
	544	CC-Link extended setting				
Communication	549	Protocol selection	0, 1	1	1	
	550	NET mode operation command source selection	0, 1, 9999	1	9999	
	551	PU mode operation command sourceselection	1, 2	1	2	
Current average monitor	555	Current average time	0.1 to 1.0s	0.1s	1s	
	556	Data output mask time	0.0 to 20.0s	0.1s	0s	
	557	Current average value monitor signaloutput reference current	0 to 500A/0 to 3600A	0.01/0.1A	Rated inverter current	

Appendix B2: Variable Speed Drive Inverter (F800)

B2.2.2 Parameter List (continued)

Function	Parameters	Name	Setting Range	Minimum Setting Increments	Initial Value	Factory Setting
----	563	Energization time carrying-over times	(0 to 65535)	1	0	
----	564	Operating time carrying-over times	(0 to 65535)	1	0	
Multiple rating	570	Multiple rating setting	0, 1	1	0	
----	571	Holding time at a start	0.0 to 10.0s, 9999	0.1s	9999	
----	573	4mA input check selection	1, 9999	1	9999	
PID control	575	Output interruption detection time	0 to 3600s, 9999	0.1s	1s	
	576	Output interruption detection level	0 to 400Hz	0.01Hz	0Hz	
	577	Output interruption cancel level	900 to 1100%	0.1%	1000%	
Pump function	578	Auxiliary motor operation selection	0 to 3	1	0	
	579	Motor connection function selection	0 to 3	1	0	
	580	MC switching interlock time	0 to 100s	0.1s	1s	
	581	Start waiting time	0 to 100s	0.1s	1s	
	582	Auxiliary motor connection-timedeceleration time	0 to 3600s, 9999	0.1s	1s	
	583	Auxiliary motor disconnection-time acceleration time	0 to 3600s, 9999	0.1s	1s	
	584	Auxiliary motor 1 starting frequency	0 to 400Hz	0.01Hz	60Hz	
	585	Auxiliary motor 2 starting frequency	0 to 400Hz	0.01Hz	60Hz	
	586	Auxiliary motor 3 starting frequency	0 to 400Hz	0.01Hz	60Hz	
	587	Auxiliary motor 1 stopping frequency	0 to 400Hz	0.01Hz	0Hz	
	588	Auxiliary motor 2 stopping frequency	0 to 400Hz	0.01Hz	0Hz	
	589	Auxiliary motor 3 stopping frequency	0 to 400Hz	0.01Hz	0Hz	
	590	Auxiliary motor start detection time	0 to 3600s	0.1s	5s	
	591	Auxiliary motor stop detection time	0 to 3600s	0.1s	5s	

Appendix B2: Variable Speed Drive Inverter (F800)

B2.2.2 Parameter List (continued)

Function	Parameters	Name	Setting Range	Minimum Setting Increments	Initial Value	Factory Setting
----	611	Acceleration time at a restart	0 to 3600s, 9999	0.1s	5/15s	
----	867	AM output filter	0 to 5s	0.01s	0.01s	
----	869	Current output filter	0 to 5s	0.01s	0.02s	
----	872	Input phase failure protection selection	0, 1	1	0	
Regeneration avoidance function	882	Regeneration avoidance operation selection	0, 1, 2	1	0	
	883	Regeneration avoidance operation level	300 to 800V	0.1V	DC380V/ 760V	
	884	Regeneration avoidance at deceleration detection sensitivity	0 to 5	1	0	
	885	Regeneration avoidance compensation frequency limit value	0 to 10Hz, 9999	0.01Hz	6Hz	
	886	Regeneration avoidance voltage gain	0 to 200%	0.1%	100%	
Free parameter	888	Free parameter 1	0 to 9999	1	9999	
	889	Free parameter 2	0 to 9999	1	9999	
Energy saving monitor	891	Cumulative power monitor digit shifted times	0 to 4, 9999	1	9999	
	892	Load factor	30 to 150%	0.1%	100%	
	893	Energy saving monitor reference (motor capacity)	0.1 to 55kW/ 0 to 3600kW	0.01/0.1kW	SLD/LD value of Applied motor Capacity	
	894	Control selection during commercial power-supply operation	0, 1, 2, 3	1	0	
	895	Power saving rate reference value	0, 1, 9999	1	9999	
	896	Power unit cost	0 to 500, 9999	0.01	9999	
	897	Power saving monitor average time	0, 1 to 1000h, 9999	1	9999	
	898	Power saving cumulative monitor clear	0, 1, 10, 9999	1	9999	
	899	Operation time rate (estimated value)	0 to 100%, 9999	0.1%	9999	

Appendix B2: Variable Speed Drive Inverter (F800)

B2.2.2 Parameter List (continued)

Function	Parameters	Name	Setting Range	Minimum Setting Increments	Initial Value	Factory Setting
Calibration parameters	C0 (900)	CA terminal calibration	----	----	----	
	C1 (901)	AM terminal calibration	----	----	----	
	C2 (902)	Terminal 2 frequency setting bias frequency	0 to 400Hz	0.01Hz	0Hz	
	C3 (902)	Terminal 2 frequency setting bias	0 to 300%	0.1%	0%	
	125 (903)	Terminal 2 frequency setting gain frequency	0 to 400Hz	0.01Hz	60Hz	
	C4 (903)	Terminal 2 frequency setting gain	0 to 300%	0.1%	100%	
	C5 (904)	Terminal 4 frequency setting bias frequency	0 to 400Hz	0.01Hz	0Hz	
	C6 (904)	Terminal 4 frequency setting bias	0 to 300%	0.1%	20%	0 +
	126 (905)	Terminal 4 frequency setting gain frequency	0 to 400Hz	0.01Hz	60Hz	
	C7 (905)	Terminal 4 frequency setting gain	0 to 300%	0.1%	100%	
Analog output current calibration	C8 (930)	Current output bias signal	0 to 100%	0.1%	0%	
	C9 (930)	Current output bias current	0 to 100%	0.1%	0%	
	C10 (931)	Current output gain signal	0 to 100%	0.1%	100%	
	C11 (931)	Current output gain current	0 to 100%	0.1%	100%	
----	989	Parameter copy alarm release	10, 100	1	10/100	
PU	990	PU buzzer control	0, 1	1	1	
	991	PU contrast adjustment	0 to 63	1	58	
Clear parameter	Pr.CL	Parameter clear	0, 1	1	0	
	ALLC	All parameter clear	0, 1	1	0	
	Er.CL	Alarm history clear	0, 1	1	0	
	PCPY	Parameter copy	0, 1, 2, 3	1	0	

+ Indicates setting changed from initial value

Appendix B2: Variable Speed Drive Inverter (F800)

B2.3 Alarms

B2.3.1 Inverter Fault and Alarm Indications

- When the inverter detects a fault, depending on the nature of the fault, the operation panel displays an error message or warning, or a protective function activates to trip the inverter.
- When any fault occurs, take an appropriate corrective action, then reset the inverter, and resume the operation. Restarting the operation without a reset may break or damage the inverter.
- When a protective function activates, note the following points:

Item	Description
Fault output signal	Opening the magnetic contactor (MC) provided on the input side of the inverter at a fault occurrence shuts off the control power to the inverter, therefore, the fault output will not be retained.
Fault or alarm indication	When a protective function activates, the operation panel displays a fault indication.
Operation restart method	While a protective function is activated, the inverter output is kept shutoff. Reset the inverter to restart the operation.

- Inverter fault or alarm indications are categorized as below:

Displayed Item	Description
Error message	A message regarding an operational fault and setting fault by the operation panel and the parameter unit. The inverter does not trip.
Warning	The inverter does not trip even when a warning. However, failure to take appropriate measures will lead to a fault.
Alarm	The inverter does not trip. An Alarm (LF) signal can also be output with a parameter setting.
Fault	A protective function activates to trip the inverter and output a Fault (ALM) signal.

NOTE: The faults can be displayed on the operation panel.

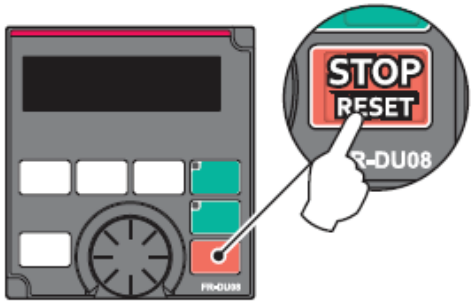
Appendix B2: Variable Speed Drive Inverter (F800)

B2.3.2 Check Alarm Output Conditions

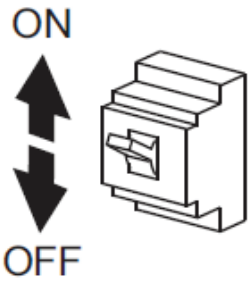
Reset the inverter by performing any of the following operations. Note that the accumulated heat value of the electronic thermal relay function and the number of retries are cleared (erased) by resetting the inverter. The inverter recovers about 1 second after the reset is released.

- On the operation panel, press 

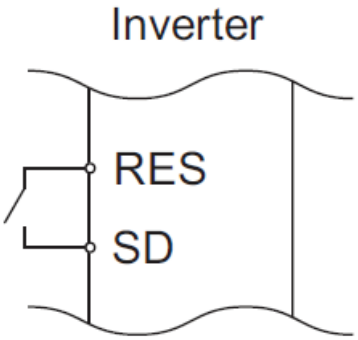
to reset the inverter. (This may only be performed when a fault occurs.)



- Switch the power OFF once, then switch it ON again.



- Turn ON the reset signal (RES) for 0.1 second or more. (If the RES signal is kept ON, “En” appears (flickers) to indicate that the inverter is in a reset status.)

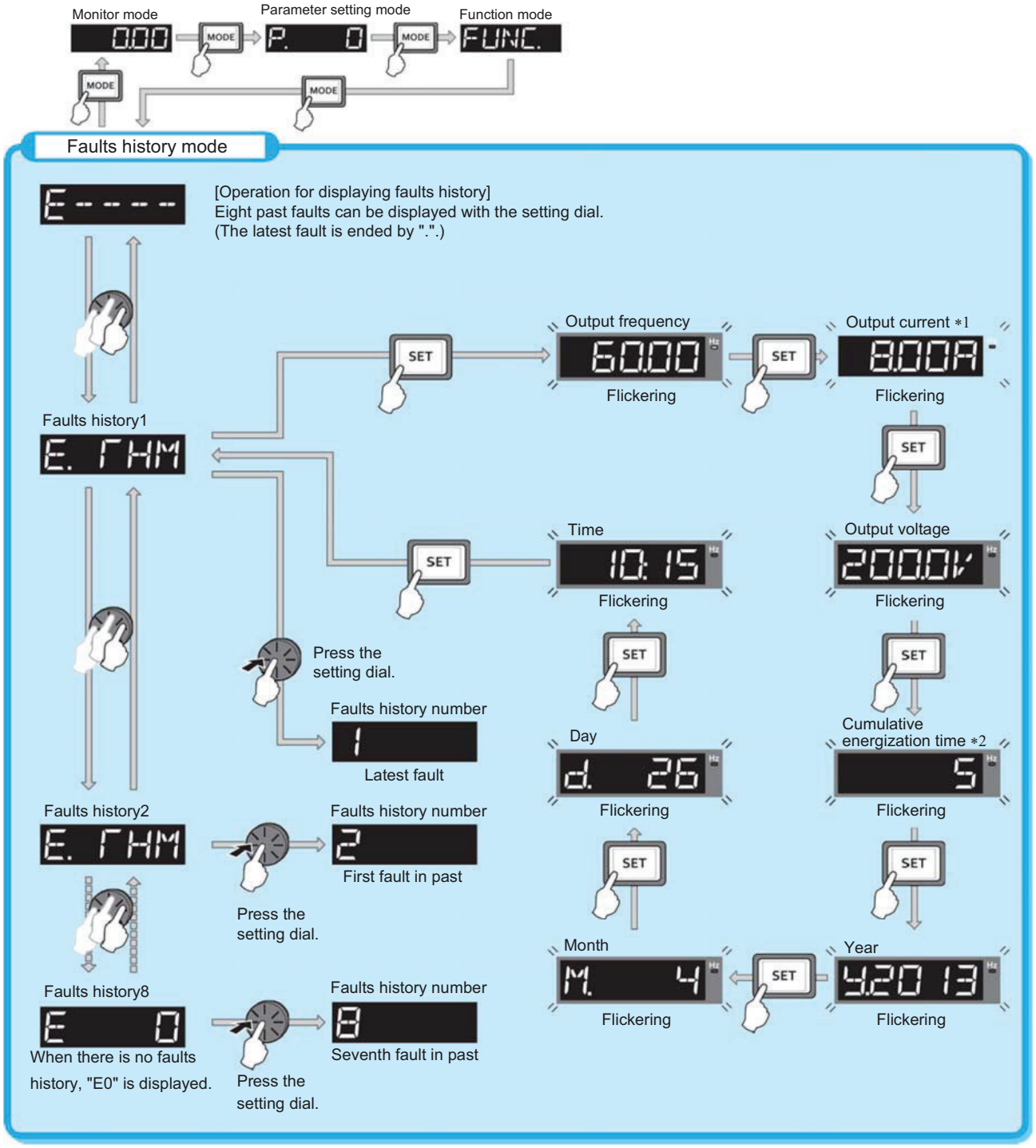


NOTE: OFF status of the start signal must be confirmed before resetting the inverter fault. Resetting an inverter fault with the start signal ON restarts the motor suddenly.

Appendix B2: Variable Speed Drive Inverter (F800)

B2.3.3 Check and Clear the Faults History

The operation panel stores the fault indications which appears when a protective function is activated to display the fault record for the past eight faults. **<Check for the faults history>**



*1 When an overcurrent trip occurs by an instantaneous overcurrent, the monitored current value saved in the faults history may be lower than the actual current that has flowed.

*2 The cumulative energization time and actual operation time are accumulated from 0 to 65535 hours, then cleared, and accumulated again from 0.

Appendix B2: Variable Speed Drive Inverter (F800)

<Faults history clearing procedure>

NOTE: Set Err.CL **Fault history clear** = "1" to clear the faults history.

	Operation
1.	Screen at power-ON The monitor display appears.
2.	Parameter setting mode Press MODE to choose the parameter setting mode. (The parameter number read previously appears.)
3.	Selecting the parameter number Turn until Err.CL (faults history clear) appears. Press SET to read the present set value. "0" (initial value) appears.
4.	Faults history clear Turn to change the set value to " 1". Press SET to start clear. " 1" and "Err.CL " flicker alternately after parameters are cleared. • Turn to read another parameter. • Press SET to show the setting again. • Press SET twice to show the next parameter.

B2.3.4 List of Faults Displays

If the displayed message does not correspond to any of the following or if you have any other problem, please contact your sales representative.

<Alarm>

The inverter does not trip. An Alarm (LF) signal can also be output with a parameter setting.

Operation panel indication	Name
FN	Fan alarm

Appendix B2: Variable Speed Drive Inverter (F800)

<Error message>

A message regarding operational fault and setting fault by the operation panel and the parameter unit is displayed. The inverter does not trip.

Operation panel indication	Name
E-----	Faults history
HOLd	Operation panel lock
LOCd	Password locked
Er 1 to Er4 Er8	Parameter write error
rE 1 to rE4 rE6 to rE8	Copy operation error
Err.	Error

<Warning>

A message regarding operational fault and setting fault by the operation panel and the parameter unit is displayed. The inverter does not trip.

Operation panel indication	Name
OL	Stall prevention (overcurrent)
oL	Stall prevention (overvoltage)
rH	Electronic thermal relay function pre-alarm
PS	PU stop
CP	Parameter copy
SA	Safety stop
MT 1 to MT3	Maintenance signal output
UF	USB host error
EV	24 V external power supply operation
Ed	Emergency drive in operation
LdF	Load fault warning

<Fault>

- A protective function trips the inverter and outputs a Fault (ALM) signal.
- The data code is used for checking the fault detail via communications or with **Pr.997 Fault initiation.**

Operation panel indication	Name	Data code
E. OC 1	Overcurrent trip during acceleration	16 (H10)
E. OC2	Overcurrent trip during constant speed	17 (H11)
E. OC3	Overcurrent trip during deceleration or stop	18 (H12)
E. OV 1	Regenerative overvoltage trip during acceleration	32 (H20)
E. OV2	Regenerative overvoltage trip during constant speed	33 (H21)
E. OV3	Regenerative overvoltage trip during deceleration or stop	34 (H22)
E. THT	Inverter overload trip (electronic thermal relay function)	48 (H30)
E. THM	Motor overload trip (electronic thermal relay function)	49 (H31)
E. FIN	Heatsink overheat	64 (H40)
E. IPF	Instantaneous power failure	80 (H50)
E. UVT	Undervoltage	81 (H51)
E. ILF	Input phase loss	82 (H52)
E. OLT	Stall prevention stop	96 (H60)
E. SOT	Loss of synchronism detection	97 (H61)
E. LUP	Upper limit fault detection	98 (H62)
E. LdN	Lower limit fault detection	99 (H63)
E. bE	Internal circuit fault	112 (H70)
E. GF	Output side earth (ground) fault overcurrent	128 (H80)
E. LF	Output phase loss	129 (H81)
E. OHT	External thermal relay operation	144 (H90)

Appendix B2: Variable Speed Drive Inverter (F800)

Operation panel indication	Name	Data code
E. PTC	PTC thermistor operation	145 (H91)
E. OPT	Option fault	160 (HA0)
E. OP1	Communication option fault	161 (HA1)
E. 16	User definition error by the PLC function	164 (HA4)
E. 17		165 (HA5)
E. 18		166 (HA6)
E. 19		167 (HA7)
E. 20		168 (HA8)
E. PE	Parameter storage device fault	176 (HB0)
E. PUE	PU disconnection	177 (HB1)
E. RET	Retry count excess	178 (HB2)
E. PE2	Parameter storage device fault	179 (HB3)
E. CPU	CPU fault	192 (HC0)
E. 5		245 (HF5)
E. 6		246 (HF6)
E. 7		247 (HF7)
E. CTE	Operation panel power supply short circuit/RS-485 terminals power supply short circuit	193 (HC1)
E. P24	24 VDC power fault	194 (HC2)
E. CdO	Abnormal output current detection	196 (HC4)
E. 1 OH	Inrush current limit circuit fault	197 (HC5)
E. SER	Communication fault (inverter)	198 (HC6)
E. AIE	Analog input fault	199 (HC7)
E. USb	USB communication fault	200 (HC8)
E. SAF	Safety circuit fault	201 (HC9)
E. PbT	Internal circuit fault	202 (HCA)
E. 13		253 (HFD)
E. OS	Overspeed occurrence	208 (HD0)
E. LCI	4 mA input fault	228 (HE4)
E. PCH	Pre-charge fault	229 (HE5)
E. PId	PID signal fault	230 (HE6)

Operation panel indication	Name	Data code
E. 1	Option fault	241 (HF1)
E. 2		242 (HF2)
E. 3		243 (HF3)

If faults other than the above appear, contact BeaconMedaes.

Appendix B2: Variable Speed Drive Inverter (F800)

B2.3.5 Troubleshooting Checklist

NOTE: If the cause is still unknown after every check, contact **BeaconMedæs Tech Support** at 888-4-MEDGAS.

Motor does not rotate as commanded

1) Check the value of torque boost setting (Pr. 0).

2) Check the main circuit.
   - Check that a proper power supply voltage is applied (operation panel display is provided).
   - Check that the motor is connected properly.
   - Check that the jumper across P/+-P1 is connected.

3) Check the input signals.
   - Check that the start signal is input.
   - Check that both the forward and reverse rotation start signals are not input simultaneously.
   - Check that the frequency setting signal is not zero. (When the frequency command is 0Hz and the start command is entered, FWD or REV LED on the operation panel flickers.)
   - Check that the output stop signal (MRS) or reset signal (RES) is not on.
   - Check that the CS signal is not OFF with automatic restart after instantaneous power failure function is selected (Pr. 57 ≠ "9999").
   - Check that the sink or source jumper connector is fitted securely.

4) Check the parameter settings.
   - Check that the reverse rotation prevention selection (Pr. 78) is not selected.
   - Check that the Operation mode selection (Pr. 79) setting is correct.
   - Check that the bias and gain (calibration parameter C2 to C7) settings are correct.
   - Check that the starting frequency setting (Pr. 13) is not greater than the running frequency.
   - Check that frequency settings of each running frequency (such as multi-speed operation) are not zero.
   - Check that especially the maximum frequency setting (Pr. 1) is not zero.
   - Check that the jog frequency setting (Pr. 15) is not lower than the starting frequency setting (Pr. 13) value.

5) Inspection of load.
   - Check that the load is not too heavy.
   - Check that the shaft is not locked.

Appendix B2: Variable Speed Drive Inverter (F800)

B2.3.5 Troubleshooting Checklist (continued)

Motor generates abnormal noise

1) No carrier frequency noises (metallic noises) are generated.
   - Soft-PWM control to change the motor tone into an unoffending complex tone is factory-set to valid by the PWM frequency selection (Pr.72). Adjust PWM frequency selection (Pr.72) to change the motor tone. (When operating the inverter with the carrier frequency of 3kHz or more set in Pr. 72, the carrier frequency will automatically decrease if the output current of the inverter exceeds the value in parenthesis of the rated output current. This may cause the motor noise to increase. But it is not a fault.)
2) Check for any mechanical looseness.
3) Contact the motor manufacturer.

Motor generates heat abnormally

1) Is the fan for the motor is running? (Check for accumulated dust.)
2) Check that the load is not too heavy. Lighten the load.
3) Check that the inverter output voltages (U, V, W) balanced.
4) Check that the torque boost setting (Pr.0) is correct.

Motor rotates in opposite direction

1) Check that the phase sequence of output terminals U, V and W is correct.
2) Check that the start signals (forward rotation, reverse rotation) are connected properly.

Speed greatly differs from the setting

1) Check that the frequency setting signal is correct. (Measure the input signal level.)
2) Check that the Pr. 1, Pr. 2, Calibration parameter C2 to C7 settings are correct.
3) Check that the input signal lines are not affected by external noise. (Use shielded cables)
4) Check that the load is not too heavy.
5) Check that the Pr. 31 to Pr. 36 (frequency jump) settings are correct.

Acceleration/deceleration is not smooth

1) Check that the acceleration and deceleration time settings are not too short.
2) Check that the load is not too heavy.

Appendix B2: Variable Speed Drive Inverter (F800)

B2.3.5 Troubleshooting Checklist (continued)

Motor current is large

1) Check that the load is not too heavy.
2) Check that the torque boost setting (Pr. 0) is correct.
3) Check that the base frequency setting (Pr. 3) is correct.
4) Check that the load pattern selection setting (Pr. 14) is appropriate.
5) Check that the base frequency voltage setting (Pr. 19) is correct.

Speed does not increase

1) Check that the maximum frequency setting (Pr. 1) is correct. (If you want to run the motor at 120Hz or more, set Pr. 18 High speed maximum frequency. Refer to Instruction Manual.)
2) Check that the load is not too heavy. (In agitators, etc., load may become heavier in winter.)
3) Check that the brake resistor is not connected to terminals P/+-P1 accidentally.

Speed varies during operation

1) Inspection of load
   - Check that the load is not varying.
2) Check the input signal
   - Check that the frequency setting signal is not varying.
   - Check that the frequency setting signal is not affected by noise.
   - Check for a malfunction due to undesirable currents when the transistor output unit is connected.
3) Others
   - Check that the wiring length is not too long for V/F control.

Operation panel (FR-DU07) display is not operating

Check that the operation panel is connected to the inverter securely.

Parameter write cannot be performed

1) Make sure that operation is not being performed (signal STF or STR is not ON).
2) Make sure that you are not attempting to set the parameter in the external operation mode.
3) Check Pr. 77 Parameter write selection.
4) Check Pr. 161 Frequency setting/key lock operation selection.

Appendix B2: Variable Speed Drive Inverter (F800)

B2.4 Correspondences Between Digital and Actual Characters

There are the following correspondences between the actual alphanumeric characters and the digital characters displayed on the operation panel.

Actual	Digital
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	

Actual	Digital
A	
B	
C	
D	
E	
F	
G	
H	
I	
J	
L	

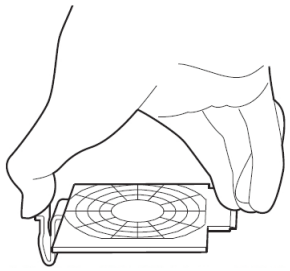
Actual	Digital
M	
N	
O	
o	
P	
S	
T	
U	
V	
r	
-	

Appendix B2: Variable Speed Drive Inverter (F800)

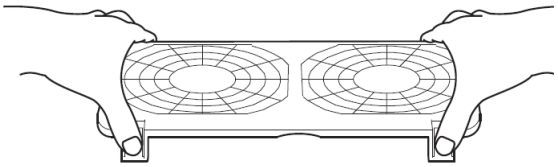
B2.5 Cooling Fan Replacement

B2.5.1 Removal

1. Push the hooks from above and remove the fan cover.



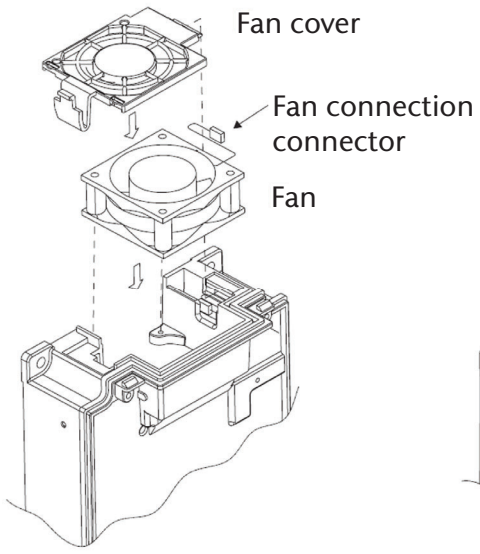
FR-F820-00105 to 00250
FR-F840-00083 to 00126



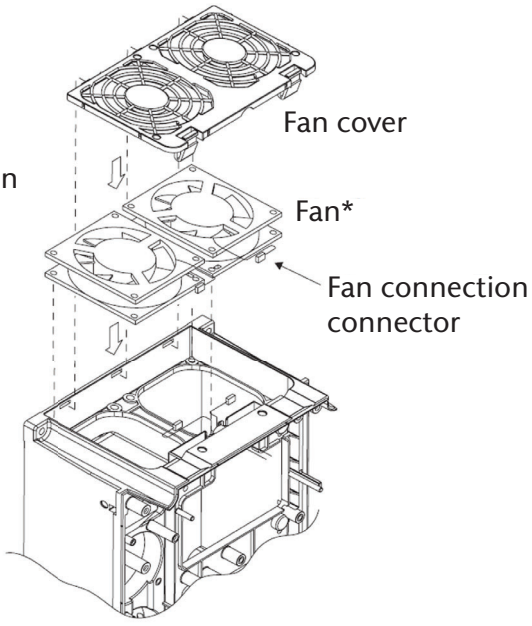
FR-F820-00340 to 01540
FR-F840-00170 to 00770

2. Disconnect the fan connectors.

3. Remove the fan.



FR-F820-00105 to 00250
FR-F840-00083 to 00126

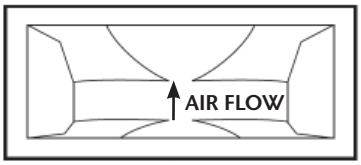


FR-F820-00340 to 01540
FR-F840-00170 to 00770

Appendix B2: Variable Speed Drive Inverter (F800)

B2.5.2 Reinstallation

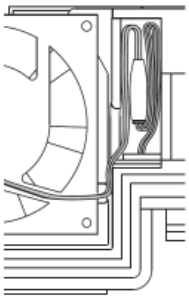
1. After confirming the orientation of the fan, reinstall the fan so that the arrow on the left of "AIR FLOW" faces up.



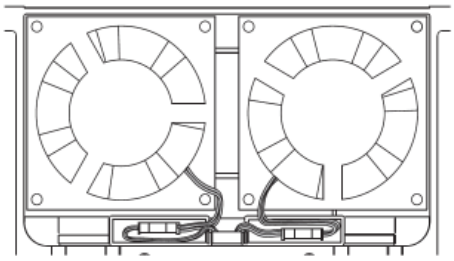
<Fan side face>

CAUTION: Installing the fan in the opposite air flow direction can cause the inverter life to be shorter.

2. Reconnect the fan connectors. When wiring, use care to avoid the cables being caught by the fan.



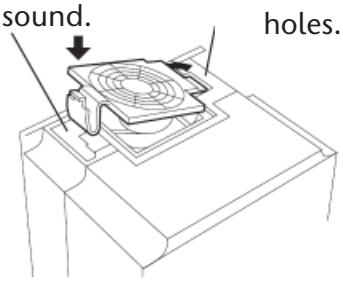
FR-F820-00105 to 00250
FR-F840-00083 to 00126



FR-F820-00340 to 01540
FR-F840-00170 to 00770

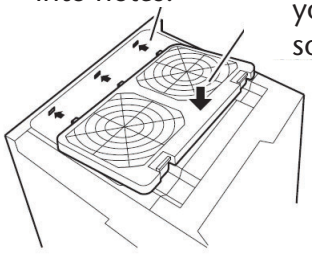
3. Reinstall the fan cover.

2. Insert hooks until you hear a click sound.
1. Insert hooks into holes.



FR-F820-00105 to 00250
FR-F840-00083 to 00126

1. Insert hooks into holes.
2. Insert hooks until you hear a click sound.



FR-F820-00340 to 01540
FR-F840-00170 to 00770

Appendix B2: Variable Speed Drive Inverter (F800)

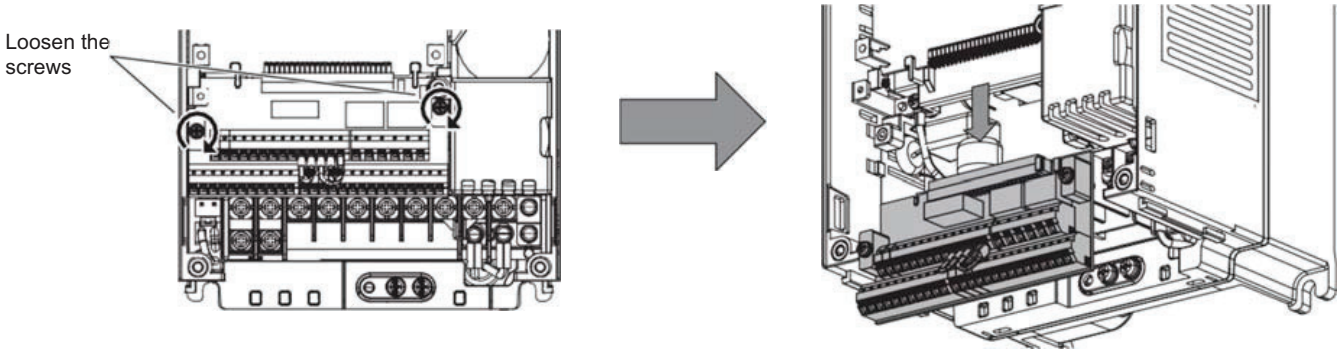
B2.6 Inverter Replacement

WARNING:

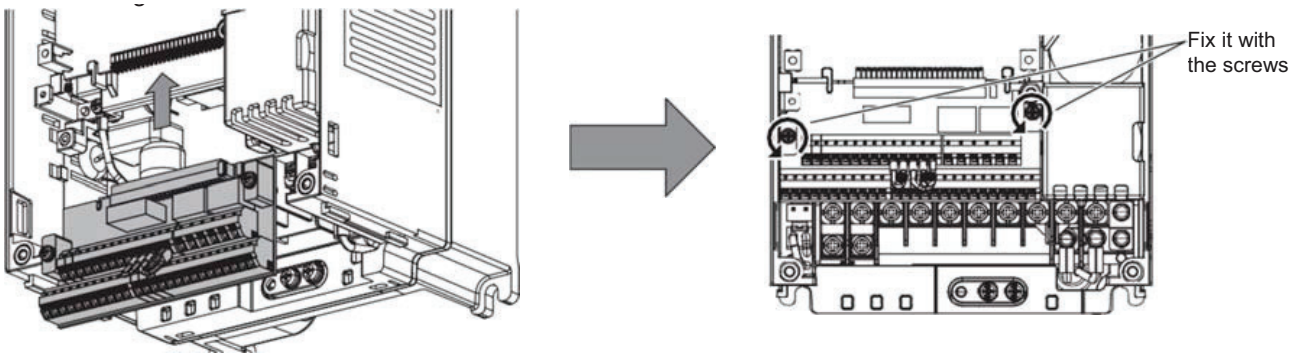
Before starting inverter replacement, switch power off, wait for at least 10 minutes, and then check the voltage with a tester and such to ensure safety.

The inverter can be replaced with the control circuit wiring kept connected. Before replacement, remove the wiring cover of the inverter.

1. Loosen the two mounting screws at both sides of the control circuit terminal block. (These screws cannot be removed.) Slide down the control circuit terminal block to remove it.



2. Using care to not bend the pins of the inverter's control circuit connector, reinstall the control circuit terminal block and fix it with the mounting screws.



Appendix B2: Variable Speed Drive Inverter (F800)

B2.7 Parts List

For information regarding replacement parts, see the spare parts list. For additional parts or information, please contact **BeaconMedæs** Tech Support at 888-4-MEDGAS. Please provide the serial number of your system.

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