HY-SAVE®

LPA® Liquid Pressure Amplification
Established 1986

LDS Operating Manual

for roof top applications

The information contained herein is based on tests and technical data, which we believe to be reliable, and is intended for use by **Competent trained personnel** having the technical knowledge to perform the work described in this Manual.

Free Cooling LPA®
Liquid Delivery System (LDS)

BEFORE INSTALLING LDS
READ THESE INSTRUCTIONS

Models: LPA-875-1
LPA-860-1

Metric HT Pack Capacities 150-210 kW –9'C
Metric LT Pack Capacities 45-80 kW –37'C
English HT Rack Capacities 45-60 Tons +15F
English LT Rack Capacities 13-22 Tons –35F

50Hz

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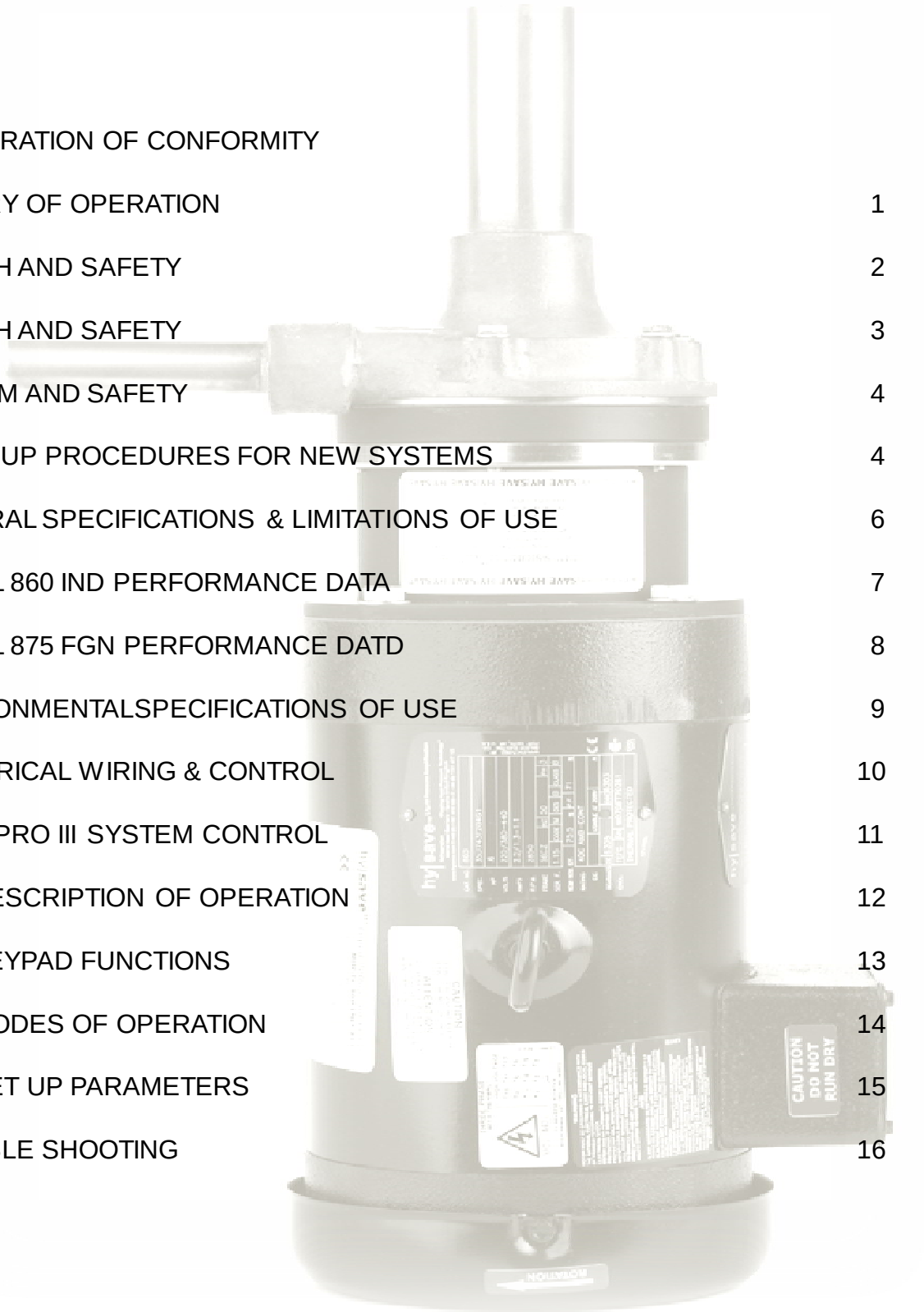

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CE- DECLARATION OF CONFORMITY:

HY-SAVE®

Declares under its sole responsibility that the liquid refrigerant pump models to which this declaration relates:

Spec # 35U743T204G1
Cat. # 860 IND

Spec # 34U743T204G1
Cat. # 875 IND/FGN

Are in conformity with the following standard (s) or other normative document(s), provided that these are used in accordance with our instructions:

Conforms to the following Product Specifications:

- **PED: 97/23/EC**

References of Technical Standards and Specifications used:

- **Internal Ref: HYS 2005/I/PTM**
- **ASTM B62-02, ANSI B16.22, ANSI B31.5, ASME Sec. VIII, ANSI/ASRAE 15 ASTM B280, AWSA5.8**

Conformity Assessment Procedure Followed:

- **Module A**

Supplemental Information:

- **This product herewith complies with the requirements of the Low-Voltage Directive 73/23/EEC and EMC Directive 89/336/EEC.**
- **In accordance with Directive 97/23/EC.**
- **This pressure assembly is manufactured, tested and inspected for compliance and thus carries the CE marking.**

Following the provisions: **Directives as amended.**

Electromagnetic Compatibility 89/336/EEC
Machinery Safety 98/37/EC
Low Voltage 73/23/EEC
PED 97/23/EC

THEORY OF OPERATION:

The function of the Liquid Delivery System (LDS) is to deliver 100% liquid to the expansion valves without the penalty loss of capacity and other problems inherent with low refrigerant flow rates and poor oil return. Thermostatic or Electronic expansion valves will maintain capacity and meter properly with as little as 30 psi (2 bar) pressure drop across the valve if *vapor-free* liquid is present at the valve inlet. Condensing temperatures can be lowered to float with ambient temperature and operating suction temperatures be restored back to design condition both improving capacity and efficiency.

Expansion valve commissioning will be for a full bore of liquid at all fixtures regardless of fixture location. Expansion valves are designed to meter the flow of liquid refrigerant to the evaporator and work properly only if the liquid metering device has a liquid seal to the valve inlet. Since the expansion valve controls the flow of refrigerant, pumping the liquid ahead of a properly sized and adjusted valve will not lead to overfeed the evaporator. It may be necessary to reset superheat on the valve only if the valve has been misadjusted previously in attempt to deliver cooler case temperatures. Because the LDS will always feed the liquid metering device with a solid column of liquid, only a one-time adjustment should be required to the misadjusted valve. Seasonal changes will not affect the settings. Restore back to factory default setting for each case.

Occasionally it may be necessary to add extra refrigerant due to increased density of the liquid at the lower operating condensing temperatures or if flash gas volume previously occupied the liquid line.
At part load conditions evaporators can operate with as much as 70% more liquid than at full load condition.

While the LDS is in operation outlet pressure can vary between 0.5 to 1.2 bar depending on pack demand and loading.

The LDS pack and operating performance of the LDS controller has been set-up to run under most operating conditions. Therefore it would not be necessary to make any adjustments or parameter changes to the LDS sequence of operation via the LCD display.

The LDS pack has been programmed to run in default mode which is suitable under most running conditions.

HEALTHY AND SAFETY:

READ AND FOLLOW SAFETY INSTRUCTIONS!

This is a safety alert symbol. When you see this symbol on your pump or in this manual, look for one of the following signal words and be alert to the potential for personal injury.

⚠CAUTION Warns about hazards that **will or can** cause serious personal injury, death or major property damage if ignored.

DANGER Warns about hazards that **will** cause serious personal injury, death or major property damage if ignored.

WARNING Warns about hazards that **can** cause serious personal injury, death or major property damage if ignored.

IMPORTANT INFORMATION:

The Label NOTICE indicates special instructions which are important but not related to hazards.
Carefully read and follow all safety instructions and method of operation in this manual.

WARNING Hazards associated with installation include death, severe injury, or equipment damage due to: electric shock, fluids under high pressure, extremely cold fluids, flammable fluids under pressure, the use of a torch near combustibles and on piping systems containing flammable liquids or vapors, asphyxiation, exposure to toxic chemicals and toxic chemical by-products, hazardous moving parts, and working with heavy parts and supplies.

WARNING DO NOT ISOLATE THE LPA PUMP OR SECTIONS OF TUBING that may contain liquid refrigerant as dangerous hydraulic pressure can develop, which may cause the piping or other system devices to burst. The LPA pump described in this manual has a **safety pressure device set at 25.4 bars** between the pump inlet and outlet isolation valves as a safety precaution. For service between these points, close minimum flow bypass line and recover using suitable refrigerant recovery equipment.

⚠CAUTION LEAK TESTING. All Liquid Delivery Systems have been factory tested at 24.5 bar (350 psi). Testing of field welds must be done at or below 22 bar (320 psi).

⚠CAUTION Do not apply power to the LDS panel without first verifying that the LDS control panel is wired correctly for the applied voltage. **Refer to DWG/EW/LDS08** Electrical Panel wiring schematic provided in the LDS Control Panel.

HEALTHY AND SAFETY CONTINUED:

READ AND FOLLOW SAFETY INSTRUCTIONS!

⚠ CAUTION For new installations do not run the LPA Pump for 24 hours after the pack has been in operation to ensure any foreign particles left over from the installation have been removed via the system's filter drier circuit. During this period it is recommended that the LPA inlet ball valve be closed.

⚠ CAUTION Do not run the LPA pump with the inlet or outlet ball valve closed. Do not run the LPA pump with the Minimum Flow By-pass closed.

⚠ CAUTION Do not "pump-down" the LPA pump housing or decompress suddenly as impeller damage may occur. To avoid, use a recovery machine and reduce pressure gradually. Refer to **Service Manual HYS/SM08** for further advice and guidance.

WARNING Observe regulations concerning proper system evacuation, recovery, and disposal of regulated refrigerants and lubricants.

SYSTEM SAFETY AND START UP PROCEDURES – *For New Equipment*

BEFORE STARTING THE LDS, CHECK THE FOLLOWING:

1. Electrical Power Supply Wiring: (Field Wiring) A, 415 V 3ph, Neutral and Earth supply is required to operate the LDS. The minimum cable c/s area permitted is 2.5mm. Ensure cable glands at panel entry are secure and wiring to terminal blocks F1 F2 F3, Earth and Neutral in the LDS control panel is wired according to DWG/EW/LDS08.
2. Compressor Start Control Signal: (Field Wiring) Ensure volt free start control cable from each compressor n/o contactors are wired across ALL compressors and terminated in the LDS control panel terminals 7 & 8 according to DWG/EW/LDS08.
3. LPA Pump Rotation: All models rotate clockwise when looking at pump inlet. Do not check rotation unless there is refrigerant in the system and the pack is in operation. To change rotor direction, reverse any phase.
4. Condenser Drain Pipework from condenser outlet to LDS receiver inlet. Natural condenser drainage and receiver venting essential for proper operation. Check that there are no traps in this section and verify that bi-directional flow and receiver venting is available.

COMMISIONING THE LDS FOR NEW INSTALLATIONS:

1.For new equipment care should be taken to flush away any foreign particles that may have been left behind after installation. Close the LDS inlet ball valve and ensure LDS electrical isolator is in the off position. Do not close LDS discharge or minimum flow by-pass line ball valves. Run the Pack as normal for at least 24 hours before commissioning or starting the LDS pack.

2.Once the pack has been running for 24 hours and that the pack condensing pressures are stable, open the LDS inlet ball valve and turn on the LDS pump. After an initial delay of 30 seconds the LDS will start. Check rotation by turning the LDS isolator off then back on again.

3.Once the LDS has started and has been running for 60 seconds, check refrigerant levels in receiver to ensure adequate 1/3 level is maintained. The LPA pump will cycle off if there is insufficient levels in the receiver to prevent proper operation. Please refer to page 10 for LPA method of Control and Operation.

4.After the LDS has started and has been running continuously for 1 hour and pack suction superheats are stable, condensing pressure can be reduced. It is recommended that condensing pressure be reduced by 1 bar every 15 minutes to allow for the temperature of the liquid in the receiver to reach its new saturation temperature. Do not raise and lower the condensing pressure, which will cause unstable LPA operation and repeat cycling.

5.For both HT and LT Packs, set final condensing temperature to 18'C. For HT and LT suction pressures set at –9'C and –37'C respectively.

6.Check expansion valve superheats and adjust as necessary for a full bore of liquid.

GENERAL SPECIFICATIONS & LIMITATIONS OF USE – *For New Equipment :*

Important: The liquid Delivery System (LDS) and associated system duties below are designed for use at **ROOF TOP LEVEL LOCATIONS ONLY.** For other system configuration, duties or LOCATIONS, please contact HY-SAVE™® UK Ltd. for detail. +44 (0) 1761 416 123

	HT SYSTEM		LT SYSTEM
Refrigerant	R404A	R407A	R404A
System Compressor Duty KW	180-210	180-210	60-80
LPA Pump Model	875-1	875-1	860-1
Pump Quantity	1	1	1
LDS Model Number	LPA-875-1	LPA-875-1	LPA-860-1
Refrigerant	R404A	R407A	R404A
System Compressor Duty KW	150-179	150-179	45-59
LPA Pump Model	875-1	860-1	860-1
Pump Quantity	1	1	1
LDS Model Number	LPA-860-1	LPA-860-1	LPA-860-1
Receiver Type	Flow-Through	Flow Through	Flow Through
Receiver Volume L	180	180	180
Design SST Temp C	-9	-9	-37
Design SCT Temp C	42	42	42
Design Ambient Temp C	32	32	32
Total Superheat K	17	17	35
Useful Superheat K	5	5	20
Liquid sub cooling K	0	0	0

MODEL 860 IND – PERFORMANCE DATA:

Model:	**LPA-860-1**
Nominal Flow GPM @ 50Hz (60Hz)	**21 (25)**
Head @ Nominal Flow Feet @ 50Hz (60Hz)	**24 (34.5)**
Motor Power (Watts) **Power supply frequency variation:**	**370** **± 2 Hz.**
Motor Frame	**56CZ (TEFC)**
RPM 50Hz (60Hz)	**2850 / (3450)**
Motor Protection	**Thermal O/L**
Voltage 3ph	**220/460**
Rated Amperage 208/230/460V	**2.2/1.1**
Connection Sizes	
Suction	**1-5/8 ODM**
Discharge	**7/8 ODM**
Materials in contact with solution:	**HSS, S/S Bronze, Kynar,**
	Ceramic, Neoprene, PEEK **Copper, Brazing Silver Solder**
Packed Weight: Kg	**23.14 kg**
Box Dimensions: mm	**660 x 400 x 270**
Allowable Pressures (bar)	
PS maxi	**44,2 bar**
PS mini	**- 1 bar**
Allowable Temperatures (C) (Fluid)	
TS maxi	**+72°C**
TS mini	**-30°C**
Manufactured to:	**DIR 97/23/EC "CE" CAT 1**
Fluid Type / GROUP 2 GAS	**R-11, R12, R22**
	R-114, R-123, R-124, R-134A
	R-401a, R-401b, R-401c, R-402a,
	R-402b, R-404a, R-407a, R-407b,
	R-407c, R-408a, R-408b, R-409a,
	R-410a, R-410b, R-411a, R-411b,
	R-412a, R-500, R502, R-507

MODEL 875 FGN – PERFORMANCE DATA:

Model:	**LPA-875-1**
Nominal Flow GPM @ 50Hz (60Hz)	**35 (40)**
Head @ Nominal Flow Feet @ 50Hz (60Hz)	**24 (34.5)**
Motor Power (Watts) **Power supply frequency variation:**	**500** **± 2 Hz.**
Motor Frame	**56CZ (TEFC)**
RPM 50Hz (60Hz)	**2850 / (3450)**
Motor Protection	**Thermal O/L**
Voltage 3ph	**220/460**
Rated Amperage 208/230/460V	**2.2/1.1**
Connection Sizes:	
Suction	**1-5/8 ODM**
Discharge	**1-1/8 ODM**
Materials in contact with solution:	**HSS, S/S Bronze, Kynar,**
	Ceramic, Neoprene, PEEK **Copper, Brazing Silver Solder**
Packed Weight: Kg	**26.14 kg**
Box Dimensions: mm	**660 x 400 x 270**
Allowable Pressures (bar)	
PS maxi	**44,2 bar**
PS mini	**- 1 bar**
Allowable Temperatures (C) (Fluid)	
TS maxi	**+72°C**
TS mini	**-30°C**
Manufactured to:	**DIR 97/23/EC "CE" CAT 1**
Fluid Type / GROUP 2 GAS	**R-11, R12, R22**
	R-114, R-123, R-124, R-134A
	R-401a, R-401b, R-401c, R-402a,
	R-402b, R-404a, R-407a, R-407b,
	R-407c, R-408a, R-408b, R-409a,
	R-410a, R-410b, R-411a, R-411b,
	R-412a, R-500, R502, R-507

ENVIRONMENTAL & SPECIFICATIONS OF USE:

Pump Environment:

Environment* - Environment as classified in EN 60721 (corresponds to IEC 60721)

* Outdoor installation* (IP54)
* Ambient temperature range: -29°C to +60°C, class 4K3*
* Altitude: = 2000 m
* Presence of hard solids, class 4S2 (no significant dust present)
* Presence of corrosive and polluting substances, class 4C2 (negligible)
* Vibration and shock, class 4M2

Electric Motor Environment:

Provide adequate motor ventilation. Do not place the pump in unvented enclosures. Protect the motor against water damage. The 875 IND & 860 IND models TEFC (Totally Enclose Fan Cooled) are wash down and wind-driven rain proof, however the motor cannot be immersed in water due to the small vent holes in the motor body.

Design Duration of Life:

Under normal use your LDS will prove to be extremely reliable if installed correctly. Follow the installation instructions manual for proper pump installation procedures and your LDS will provide years of trouble free operation.

* Motor 7 - 10 years non-continuous service
* Impeller, Bushing > 50,000 h continuous service

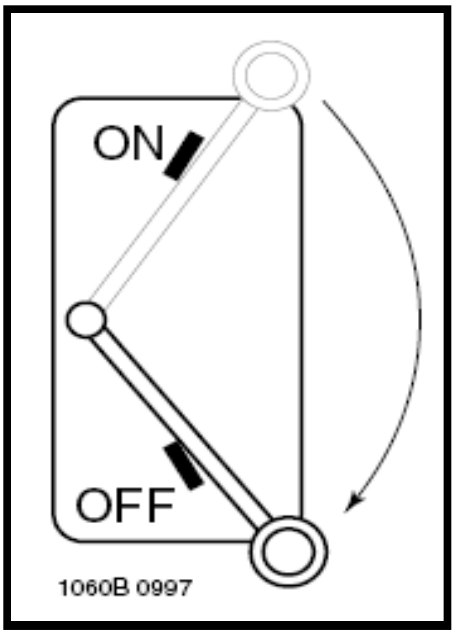
Vibration During Operation:

Vibration during operation is not significant: Since vibration is minimal during operation or use, it is not necessary to mount the pump on vibration eliminators; instead it can be fixed directly to ground or any other solid surface providing that this surface is contained within the flexible structure.

Corrosion:

Your LPA-875-860-1 model pump conforms to EA 006 of which the protection level for this class is IP43B (according to reference document IEC 60529).

ELECTRICAL WIRING & CONTROL:

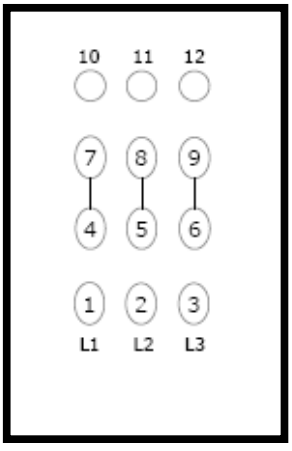


WARNING:
Isolate and lock off electrical supply before servicing this pump.
Release all pressure on system before working on any component.

All HY-SAVE LDS packs are extremely reliable and do not usually require routine maintenance, although care should be taken to wipe clean any dust if operated in a dirty area.

If service is required for any reason, then follow the working instruction manual HYS/WI/860-875 for disassembly and assembly of the LPA pump.

Wire as per local or national electrical codes. Use properly sized wire, suitable conduit, CE listed materials and properly ground the motor. Grounding is essential to prevent any shock hazard, as it will cause fuses to blow should a fault to ground occur in the motor. Grounding can also aid in troubleshooting an electrical problem.



ALL HY-SAVE LDS Motors are 3 Phase 415 - 460 Volts

Wire according to the diagram on the left. Wiring No.1, 2 and 3 is supply. Wiring 4 and 7 are joined and insulated. Wiring 5 and 8 are joined and insulated. Wiring 6 and 9 are joined and insulated. Wiring 10, 11 and 12 are not used. Terminate and insulate separately. A wiring diagram is also located on the motor body. For further details contact HYSAVE UK on

Tel: +44 (0) 1761 416 123 Fax: +44 (0) 1761 417 123

PUMP PRO III SYSTEM CONTROL:

1. THEORY OF OPERATION:

The function of PP3 is to control, manage and protect the LPA free cooling pump from loss of refrigerant during normal running of the LDS system

2. FEATURES OF PUMP PRO III:

- ❑ Can be used for a maximum of three circuits.
- ❑ Configuration is through the key board panel.
- ❑ Employs 16 bit processor for high accuracy and speed computing.
- ❑ Optical isolation is provided in IO terminals.
- ❑ Uses LCD display to display dynamic values of inlet, outlet, differential pressures.
- ❑ LED indications for all operations.
- ❑ Alarm for fault condition.

3. SPECIFICATION:

3.1 HARDWARE SPECIFICATION:

- ❑Input Voltage: 24V AC/DC (+/-) 5V.
- ❑Normal operating current: 100 mA.
- ❑Peak current: 400 mA.
- ❑Analog channel: 2 [12 bit, Sigma/Delta conversion]
- ❑Digital channel: 3 Inputs & 6 Outputs [pot. Free, electrically isolated]
- ❑Operating temperature: -20 Deg C to 70 Deg C.
- ❑HM interface: 2x16 Alphanumeric LCD with backlight & soft touch membrane keypad.
- ❑Connecting Terminals: Horizontal plug in – detachable screw head terminal connectors.
- ❑Mounting provision: DIN RAIL mountable enclosure.
- ❑Enclosure: IP-65.
- ❑Approval: CE.

3.3 DESCRIPTION OF OPERATION:

3.3.3 LDS Sample Period:

After the initial start delay period expires, the Pump Pro3 will switch the LDS ON, for a sample period, (default 8 Seconds). During the sample period the differential pressure generated by the LDS is sampled. If this pressure exceeds the preset pressure, default 0.2 bar (3psi), the Pump Pro3 permits the LDS to enter running condition.

3.3.4 LDS Retry Mode:

If the pressure does not achieve the preset set point within the sample period, the LDS which is enabled by the corresponding compressor is stopped and the retry timer is started [default 10 Seconds]. After the retry timer expires, the LDS sample period is then restarted. This cycle will be retried until either the LDS achieves the preset pressure or the number of pump retries [default 50], is equaled. If the number of retries is equaled then Pump Pro3 will enter into fault mode and the corresponding Fault output is switched on and the LDS operation is locked out while the LDS enable signal remains. This is usually due to low refrigerant levels.

3.3.5 LDS Running Mode:

In this mode the LDS pressure is continually sampled ensuring the LDS is running in a healthy condition and the retry counter is reset to default value 50. Any Fault condition previously occurred is cleared. In this mode, if LDS pressure is reduced below the set-point for longer than 6 seconds, the LDS enters the retry mode.

3.3.6 LCD Display:

During normal running mode, PumpPro3 displays the following parameters every 2 seconds:

a) Inlet or Condensing Pressure in bar & psig
b) LDS Outlet Pressure in bar & psi
c) D.P in bar & psi

All the above 3 parameters will be displayed one after other in 2 seconds intervals.

At any point of time if the “ENTER” key is pressed, The Pumppro3 enters in to setup mode. In setup mode, The Pumppro3 will not sample the pressure or other normal activities. When the screen is brought to default, the Pumppro3 operates as per the specification.

All the parameters can be changed using the navigation keys. On “EXIT” key, the parameters are saved in non-volatile memory.

4. PUMP PRO III KEY PAD FUNCTIONS:

KEY AND FUNCTIONS		INDICATIONS	
	1. Configures pump pro-III when pressed in run mode 2. Confirms the current operation when pressed in setup mode		Power-On indication. Green color LED glows when the system is up and running
	To exit from the setup mode		Indicates ON/OFF status of pump-1, pump-2 and pump-3 respectively
	Scroll through menu and increment values while in setup mode		Indicates the enable signals from compressor-1, compressor-2 and compressor-3 respectively
	Scroll through menu and decrement values while in setup mode		Indicates the presence of corresponding fault signals from Pump-1, Pump-2 and Pump-3 respectively

6. LDS MODES OF OPERATION:

On power-up, Pump Pro-III operates in three modes:

a) Run
b) Setup
c) Shutdown

6.1 Run Mode:

This is the default mode of Pump Pro-III system after power-on. The display would light up with the following message.

PUMP	BAR	PSI	(Line 1)
INLET	0.0	0	(Line 2)

During run mode, the second line of the display toggles, one-by-one, among INLET, OUTLET & DIFFERENTIAL PRESSEURES along with its BAR and PSI values for every two seconds

Kindly refer the specification section of Pump Pro II for a detailed operational procedure of Pump Pro-III

Run mode is terminated when 

key is pressed – leaves the Run Mode enters into Setup Mode.

6.2 Setup:

This mode is selected whenever the 

key is pressed.

6.3 To View Parameters:

After entering the setup mode, the display shows “SETUP” on the first line and the parameter along with its value on the second line. The display toggles among ;

1) St. Delay: 30 s *(Default value is 30 s and the range is 0-120 s)*
2) Sample Run: 08 s *(Default value is 08 s and the range is 5-30 s)*
3) DP Set Pt: 0.2 b *(Default value is 0.2 bar and the range is 0.1-0.5 bar)*
4) Off. Delay: 10 s *(Default value is 10 s and the range is 3-10 s)*
5) Repeat Cycle: 50 *(Default value is 50 and the range is 10-50)*

6.3 To View Parameters Continued:

The default screen, after entering the setup mode is;

SETUP	(Line 1)
St. Delay: 30 s	(Line 2)

Use  or  key to scroll through the aforesaid mentioned parameters.

6.3.1 To Set / Reset Parameters:

To set any one of the aforesaid parameters follow these steps, after entering into the setup mode;

1) Use  or  key to select the parameter to be modified.

2) Press  to select the current parameter, being displayed on the display

3) The cursor blinks at the position of the value to be changed

4) Use  or  key to increment or decrement the corresponding value

5) Press  to confirm the change or press  to discard

6) Once the new value is confirmed, the same is stored into the nonvolatile memory and pops-up the message “Updated” on the first line of the display

7) Redo the steps 1 through 6 for all parameters

8) Press  to come out of the setup mode and enter into the run mode

Upon completion of the above steps, Pump Pro-III revives its normal operation with respect to the new configurations

6.4 Shutdown Mode:

Pump Pro-III is forced to shutdown mode whenever it entertains a fault signal, caused by either external/internal aspect. As a result, the pump operation is locked out along with the fault indication. The fault is indicated with the buzzer and fault lights. The Pump Pro-III must be power cycled to revoke its normal operations.

7. TROUBLESHOOTING:

7.1 PROBLEM:

I. Display is unstable
II. Unreadable characters are displayed
III. The character display is erroneous
IV. Single line display
V. Pump Pro-III is in shutdown mode

SOLUTION:

Power cycle the Pump Pro-III when one of the above mentioned conditions meets. Should you have the same problem repeatedly, contact the Help desk number at the bottom of this manual.

Help Desk No:

UK +44 (0) 1761 416 123

USA 813.395. 2375