

# Instruction Manual

## Proximity Booster Pumping Systems



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Description	Electrical Supply	Item Number
pHMB1800	200-230 V 50-60 Hz	A533-00-958
pHMB1800	380-460 V 50-60 Hz	A533-00-959
pHMB1800 + PRV	200-230 V 50-60 Hz	A533-03-958
pHMB1800 + PRV	380-460 V 50-60 Hz	A533-03-959
pHMB1800 + PRV + NRV	200-230 V 50-60 Hz	A533-06-958
pHMB1800 + PRV + NRV	380-460 V 50-60 Hz	A533-06-959
pHMB2400	200-230 V 50-60 Hz	A533-01-958
pHMB2400	380-460 V 50-60 Hz	A533-01-959
pHMB2400 + PRV	200-230 V 50-60 Hz	A533-04-958
pHMB2400 + PRV	380-460 V 50-60 Hz	A533-04-959
pHMB2400 + PRV + NRV	200-230 V 50-60 Hz	A533-07-958
pHMB2400 + PRV + NRV	380-460 V 50-60 Hz	A533-07-959
pHMB3000	200-230 V 50-60 Hz	A533-02-958
pHMB3000	380-460 V 50-60 Hz	A533-02-959
pHMB3000 + PRV	200-230 V 50-60 Hz	A533-05-958
pHMB3000 + PRV	380-460 V 50-60 Hz	A533-05-959
pHMB3000 + PRV + NRV	200-230 V 50-60 Hz	A533-08-958
pHMB3000 + PRV + NRV	380-460 V 50-60 Hz	A533-08-959





## Declaration of Conformity

We, BOC Edwards,  
Manor Royal,  
Crawley,  
West Sussex RH10 2LW, UK

declare under our sole responsibility that the product(s):

	200-230V 50-60Hz	380-460V 50-60Hz
pHMB1800	A533-00-958	A533-00-959
pHMB1800 + PRV	A533-03-958	A533-03-959
pHMB1800 + PRV + NRV	A533-06-958	A533-06-959
pHMB2400	A533-01-958	A533-01-959
pHMB2400 + PRV	A533-04-958	A533-04-959
pHMB2400 + PRV + NRV	A533-07-958	A533-07-959
pHMB3000	A533-02-958	A533-02-959
pHMB3000 + PRV	A533-05-958	A533-05-959
pHMB3000 + PRV + NRV	A533-08-958	A533-08-959

to which this declaration relates is in conformity with the following standard(s)  
or other normative document(s):

EN61010-1 (2001)  
EN61326 (1998)  
(Industrial location,  
Class A Emissions)  
EN1012-2 (1997)

Electrical Safety: Laboratory Measurement & Control Equipment.  
Electrical equipment for measurement, control and laboratory use –  
EMC requirements.

Compressors and Vacuum Pumps – Safety Requirements:  
Part 2 – Vacuum Pumps.

following the provisions of:

98/37/EC  
89/336/EEC  
73/023/EEC

Machinery Directive  
Electromagnetic Compatibility Directive  
Low Voltage Directive

  
I. Currington, Technical Manager

4-01-2006 Shorcham  
Date and Place

This product has been manufactured under a quality system registered to ISO9001

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For return of equipment, complete the HS Forms at the end of this manual.

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# 1 Introduction

## 1.1 Scope and definitions

This manual provides installation, operation and maintenance instructions for the Edwards pHMB system. You must install and maintain the pHMB system as specified in this manual.

Read this manual before you install and operate your pumping system. Important safety information is highlighted as WARNING and CAUTION instructions; you must obey these instructions. The use of WARNINGS and CAUTIONS is defined below.



### WARNING

Warnings are given where failure to observe the instruction could result in injury or death to people.

### CAUTION

Cautions are given where failure to observe the instruction could result in damage to the equipment, associated equipment and/or process.

The following warning labels may appear on the pumping system:



Warning - use protective equipment.



Warning - hot surfaces.



Protective earth (ground).



Warning - moving parts present.



Warning - refer to accompanying documentation.



Warning - heavy object.



RF earth (ground).



Warning - risk of electric shock.

The units used throughout this manual conform to the SI international system of units of measurement.

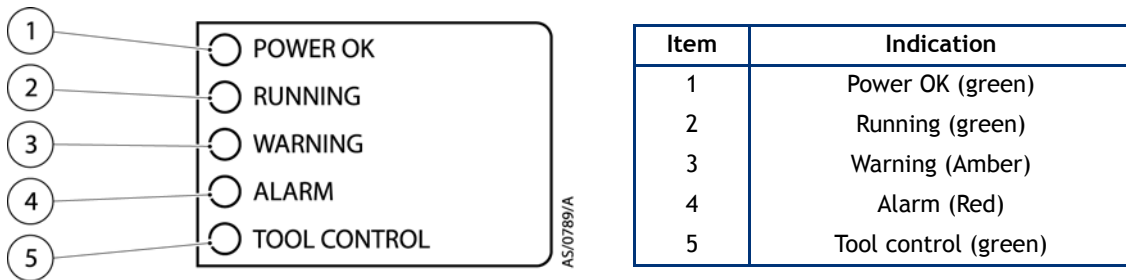
## 1.2 Description

The pHMB Proximity Booster is available in the following range of sizes; pHMB1800, pHMB2400 and pHMB3000. Each system must be backed using a suitable Edwards dry pump selected to match process and performance specifications. These systems are not intended for use as stand-alone units.

The pHMB Proximity Booster pump is a water-cooled, positive displacement Roots vacuum pump driven through an a.c. inverter.

The pHMB pumping system is automatically controlled by either the Edwards backing pump or Edwards System Controller. The status of the system can be monitored through the LED's at the rear of the pump:

Figure 1 - Rear status panel LED indicators



## 1.3 Safety



### WARNING

Potential hazards on the pHMB system include electricity, hot surfaces, rotating parts, process chemicals, Fomblin oil and pressurised gases/water.

All of the components of the pHMB system are fitted inside an enclosure. Panels of the enclosure should only be removed for access during maintenance and should at no time be removed by the operator. Do not operate the pump with panels removed.

All installations of the pHMB system should consider that the vacuum connections and components between the pHMB and related backing pump/s operate at pressures up to 3 bar.

An operator or a signal from the tool may start the booster remotely via equipment such as a Edwards backing pump or the Edwards System Controller. Therefore it is essential when carrying out maintenance on the pHMB system, that it is adequately purged, shutdown and isolated.

Detailed safety information is given in [Section 3 \(Installation\)](#), [Section 6 \(Maintenance\)](#) and Edwards publication number P300-20-000 Vacuum pump and vacuum safety.

In the event of an emergency the booster can be shutdown via either the local red EMS button at the rear of the pump or remote EMS connections.



## 1.4 Applications

The pHMB system should be used as follows:

- pHMB systems not fitted with a PRV<sup>\*</sup> or NRV<sup>†</sup> can only be used on load lock applications. These must be used in conjunction with iF backing pump systems.
- pHMB systems fitted with a PRV<sup>\*</sup> can only be used on transfer chamber applications. These can be used in conjunction with both iF and iH backing pump systems.
- pHMB systems fitted with both a PRV<sup>\*</sup> and an NRV<sup>†</sup> can only be used for harsh process applications such as PECVD and must not be used on load locks or transfer chambers.

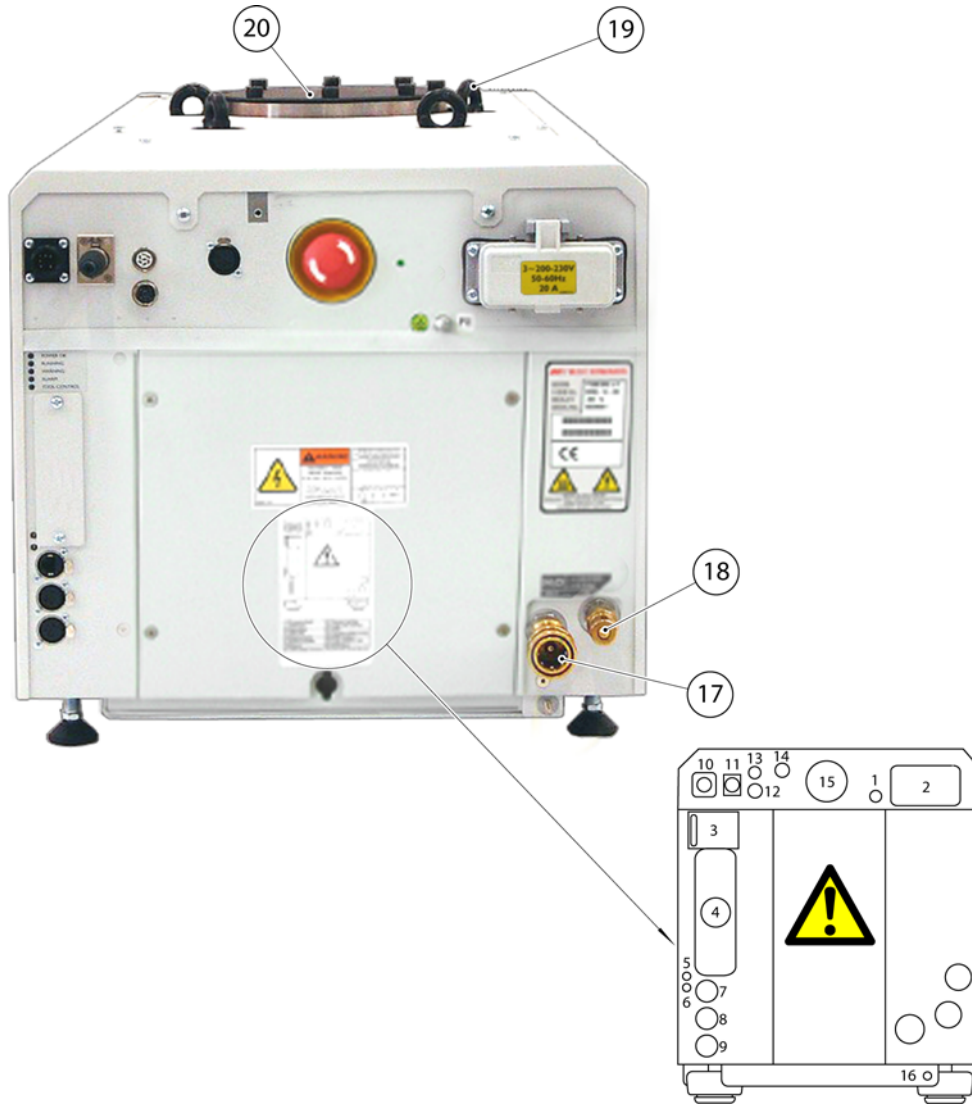
\* PRV - Pressure relief valve, used to limit the shock load to the backing pump.

† NRV - Non-return valve, used to prevent process contamination of the gearbox.

## 1.5 Services and interface connections

The following interfaces are located at the rear of the pHMB pumping system.

Figure 2 - Rear connections



AS/0767/A

- |                                              |                                                         |
|----------------------------------------------|---------------------------------------------------------|
| 1. Protective earth (ground) M5              | 11. EMS                                                 |
| 2. Mains supply connection                   | 12. Accessory module interface                          |
| 3. Status panel                              | 13. GRC interface                                       |
| 4. Comms 4 - MicroTIM connection (if fitted) | 14. Comms 5 - User interface / PDT                      |
| 5. Ethernet active LED                       | 15. EMS button                                          |
| 6. Ethernet installed LED                    | 16. RF Earth (ground) M6 stud                           |
| 7. Comms 3 - Ethernet connection             | 17. Cooling water return                                |
| 8. Comms 2 - LON module connection           | 18. Cooling water supply connection                     |
| 9. Comms 1 - System interface                | 19. Lifting Eyebolt (4 off M16)                         |
| 10. Gate valve interface                     | 20. Inlet (pHMB1800/pHMB2400: ISO160, pHMB3000: ISO200) |

**Note:** Exhaust connection is situated underneath the product (not shown), ISO100

## 1.6 Control functions

The operation of the pump is controlled and monitored by an internal control module, which communicates with either the Edwards backing pump or an optional Edwards System Controller; refer to [Section 1.3](#) for further details.

The status of the pHMB system can be monitored through the LED's at the rear of the pump, refer to [Section 1.2](#) for further details.

### 1.6.1 Motor and water supply temperature protection

The booster motor temperature and water supply temperature are measured by thermistors monitored through the internal control module. If the temperature is too high the control module will send an alarm signal and shut the booster down, indicated by the Alarm LED at the rear of the pump.

The water supply temperature protection has an additional advisory warning state and is indicated by the Warning LED at the rear of the pump.

**Note:** *Alarms and Warnings may be viewed remotely.*

Refer to [Section 6.3](#) for details of the types of warnings and alarms that can be found.

### 1.6.2 Booster outlet temperature protection

A thermocouple is fitted to the outlet of the booster to provide over temperature protection.

For further information please refer to [Table 4](#) in [Section 2.1](#).

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## 2 Technical data



### WARNING

During typical application cycles it is possible that the noise level of the full load lock system of which pHMB/iF400/diFXK is a part may exceed OSHA 1910.95 Occupational Noise Exposure Limits, the EU noise directive 2003/10/EC or other regional noise limits dependant upon the process, duty cycle, installation or environment in which being operated.

A sound pressure survey must be conducted after installation and, if necessary, controls implemented to ensure that the relevant limits are not exceeded during operation and that adequate precautions are taken to prevent personnel from exposure to high noise levels during operation.

### 2.1 General

Table 1 - General technical data

Dimensions, refer to Figures 2, 4 and 5	1175 x 457 x 424 mm
Mass of pHMB variants	
pHMB1800	289 kg
pHMB2400	325 kg
pHMB3000	358 kg
Noise at ultimate	
pHMB1800	<53.5 dBA
pHMB2400	<55 dBA
pHMB3000	<55 dBA
Vibration to Foreline at ultimate	<1.5 mm/s
Vibration to floor at ultimate	<0.1 mm/s
Operating pressure range (Inlet)	ultimate vacuum to 1000 mbar*
Operating pressure range (outlet)	ultimate vacuum to 3000 mbar
Warm-up time till nominal pump performance	15 minutes
Minimum warm-up time till process gas pumping	4 hours
Ambient operating temperature range	-20 to 40 °C
Relative Humidity	10-90%
Storage	-40 to +55 °C
Maximum operating altitude	2000 m
Pollution degree	2(IEC60664-1)
Materials in contact with pumping gases	steel, SG iron, PTFE, fluoroelastomer and aluminium
Gearbox oil capacity	0.7 litres
Grade of oil	SAE40/ISO150
Recommended oil type	Fomblin® 25/6 Krytox® 1525 Drynert® 25/6

\* At certain inlet pressures the pHMB Booster will get hot due to compression of gases, this will cause a reduction in performance; refer to [Table 4, page 8](#). The booster may trip out at higher inlet pressures if the pressure does not recover after 3 minutes.

**Note:** All pHMB pumping systems are supplied already filled with oil.

**Note:** Edwards Material Safety Data Sheets for the above oils and greases are available on request.

Table 2 - Over temperature protection - stator thermocouple

Stator Thermocouple	Action
115 °C	Additional water cooling is switched on until temperature falls below 110 °C
125 °C	Booster will slow down to 20Hz, until temperature falls to below 90 °C
165 °C	An advisory warning will be indicated by an LED at the rear of the pump
170 °C	An alarm will stop the booster, indicated by an LED at the rear of the pump

Figure 3 - pHMB side view - dimensions (mm)

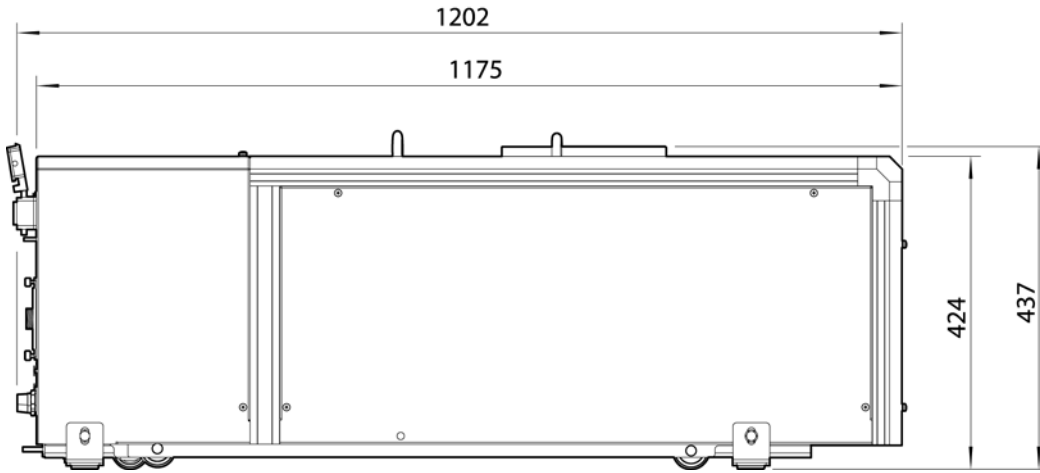
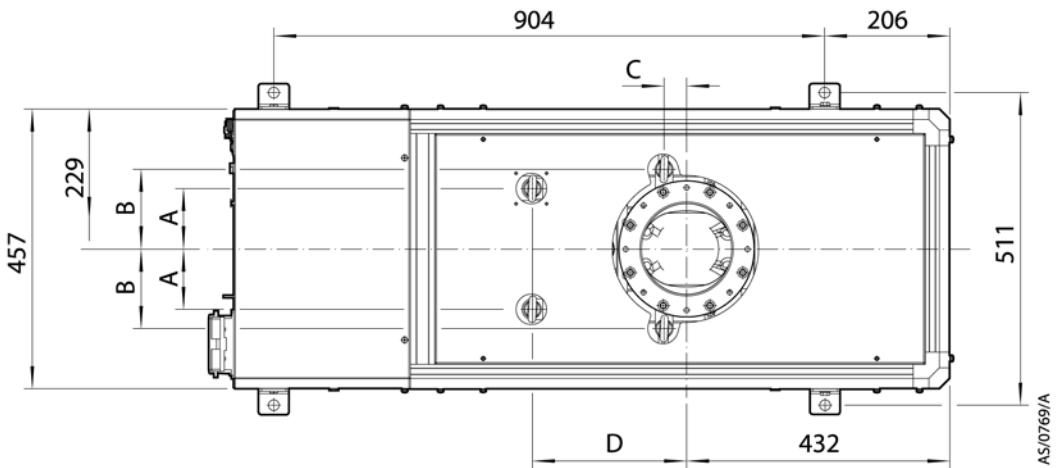


Figure 4 - pHMB side view, including tabulated eyebolt positions - dimensions (mm)



	A	B	C	D
pHMB1800	99	130	37	253
pHMB2400	99	130	66	288
pHMB3000	99	150	58	326

Figure 5 - pHMB rear view - dimensions (mm)

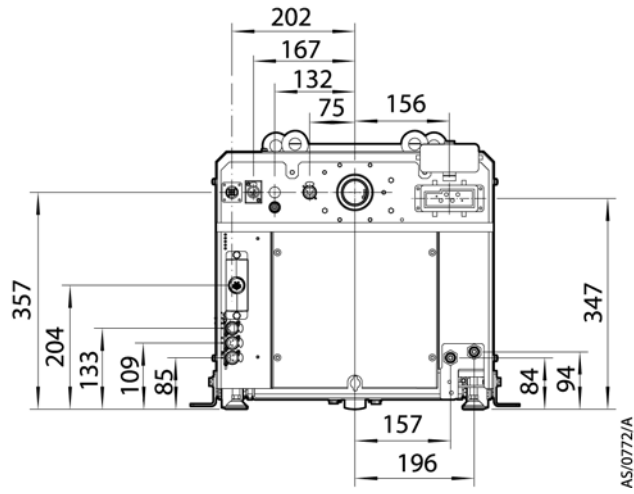
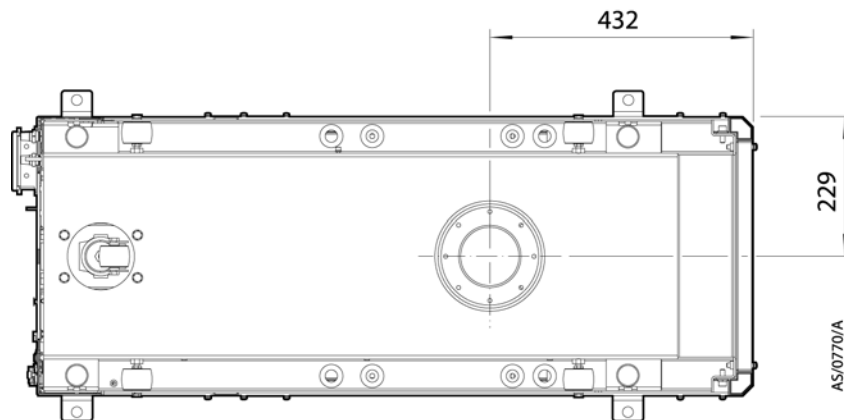


Figure 6 - pHMB underside view - dimensions (mm)



## 2.2 Connections

Table 3 - pHMB connection data

Inlet flange type - pHMB variants	
pHMB1800	ISO160
pHMB2400	ISO160
pHMB3000	ISO200
Exhaust flange type - pHMB variants	
pHMB1800	ISO100
pHMB2400	ISO100
pHMB3000	ISO100
Mains power connector	
Type	Harting HanK4/2 or ILME CXF4/2 (Harting equivalent)
Cable outside diameter range	18-27 mm
Maximum conductor cross sectional area	16 mm <sup>2</sup>
Water inlet connector	3/8 inch male quick-disconnect
Water outlet connector	3/8 inch female quick-disconnect

Table 4 - pHMB connector types

Mains connection	See Section 2.2	
Ethernet connection	Standard RJ45 type	IEE802.3 10BaseT Ethernet
LON module connection	XLR type 4-way plug	24 V d.c. 0.75 A
PDT	XLR type 5-way plug	24 V d.c. 0.75 A
System Controller	XLR type 5-way plug	24 V d.c. 0.75 A
Gate valve interface	CPC 9-way plug, standard gender, socket contacts	24 V d.c. (48 V peak), 100 mA
EMS	XLR type 6-way plug	
External emergency stop switch 1 - supply, 2 - return		24 V d.c. 100 mA
Internal emergency stop switch 3 - common, 4 - normally open	30 V a.c. 1 A 60 V d.c. 0.55 A	
Comms supply 5 - supply, 6 - return		24 V d.c. 0.5 A
Accessory module interface	Preh locking DIN 8-way plug	24 V d.c. 1.3 A
GRC		
GRC interface 3 - common, 5 - normally open 4 - normally closed	DIN type 6 way plug 30 V a.c. 1 A 30 V d.c. 1 A 60 V d.c. 0.5 A	
DeviceNET Interlock 1 - normally open, 6 - common 2 - normally open		



## 2.3 Electrical data

Table 5 - Electrical data

Supply Voltage/Frequency	200-230 V, 50-60 Hz, 3 phase 380-460 V, 50-60 Hz, 3 phase
Motor rating (pHMB1800/2400/3000)	3.5 kw
pHMB full load RMS input current	20 amps @ 200-230 V, 50-60 Hz 12 amps @ 380-460 V, 50-60 Hz
Voltage tolerance range	±10%
Installation category	II(IEC60664-1)

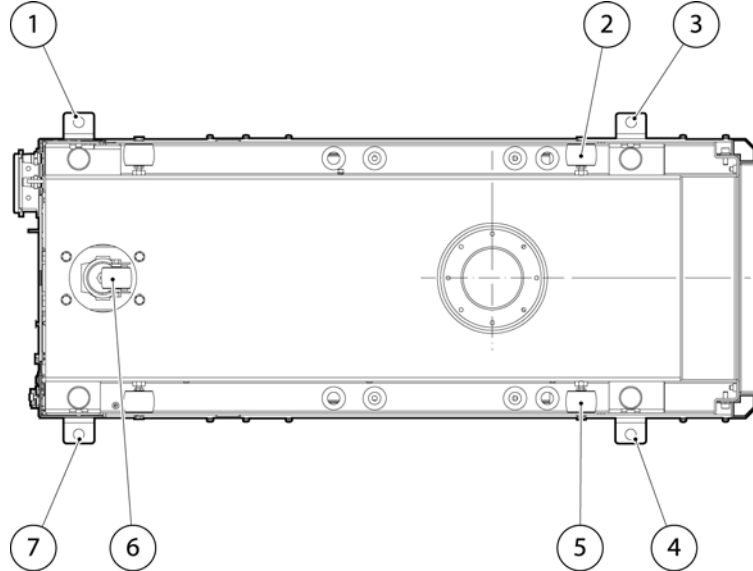
## 2.4 Cooling water supply

Table 6 - Water cooling system data

Maximum supply pressure	100 psig
Minimum flow rate required	2 l min <sup>-1</sup>
Typical flow rate required	3 l min <sup>-1</sup>
Cooling-water supply temperature range	10 - 30 °C
Typical pressure differential across supply and return with flow of 3 l/min	35 psig
Maximum particle size	0.03 mm <sup>2</sup>
Acidity	6.5 to 8.0 pH
Hardness	< 100 ppm
Resistivity	> 1 k cm
Solids (turbidity)	< 100 ppm
Materials in contact with cooling-water	Stainless steel and PTFE

## 2.5 Loading

Figure 7 - Load distribution



AS/0772/A

Variant	Mass Distribution on Levelling Feet			
	1	3	4	7
pHMB1800	55	83	92	59
pHMB2400	54	92	112	67
pHMB3000	56	101	126	75

Variant	Mass Distribution on Castors		
	2	5	6
pHMB1800	94	95	100
pHMB2400	108	111	106
pHMB3000	120	127	111

## 3 Installation

### 3.1 Safety



#### WARNING

Obey the safety instructions given below and take note of appropriate precautions. If you do not, you can cause injury to people and damage to equipment.



#### WARNING

All four eyebolts must be used to lift the pHMB system.



#### WARNING

All trailing cables and hoses must be considered as a potential trip hazard and appropriate action taken to minimise the hazard.



#### WARNING

Do not leave the cooling-water supply turned on until after you complete the electrical installation of the pump. If you do, condensation may form inside the enclosure and there may be a risk of electric shock.

A suitably trained and supervised technician must perform the installation of your pumping system. Obey the safety procedures listed below when you install the pumping system, especially when you connect into existing systems. Details of specific safety precautions are given at the appropriate point in these instructions.

- Ensure that the installation technician is familiar with the safety procedures, which relate to the products pumped. Appropriate safety clothing must be worn when coming into contact with contaminated components. Dismantle and clean contaminated components inside a fume-cupboard.
- When you refer to a Supplementary Publication for details of an installation operation, you must obey all of the appropriate WARNING and CAUTION instructions contained therein.
- Vent and purge the vacuum system before starting installation work.
- Check that all the required parts are available and the correct type before starting.
- Provide adequate access to all pump servicing points and oil-level sight glasses.
- Disconnect the other components in the vacuum system from the electrical supply so that they cannot be operated accidentally.
- All four eyebolts identified in [Section 1.5](#), must be used when lifting to ensure that the pHMB system is kept horizontal.
- Ensure that suitable lifting equipment is used.
- All installations should consider that the vacuum connections and components between the pHMB and related backing pump/s operate at pressures up to 3 bar.
- Do not re-use O-rings or co-seals.
- Leak-test the system after installation work is complete.

## 3.2 System requirements

Consider the following points when you install your vacuum system:

### CAUTION

If flexible bellows are used to isolate vibration then the bellows must be constrained to prevent crushing under the load of the foreline or the force of the vacuum within the foreline.

- Vacuum pipelines must be adequately supported.
- If necessary, incorporate flexible bellows in your system pipelines to reduce the transmission of vibration and to prevent loading of the coupling joints. If you use flexible bellows, you must ensure they have a maximum pressure rating which is greater than the highest pressure that can be generated in your system.
- You must be able to isolate the pumping system inlet and exhaust from the atmosphere and from your vacuum system if you will use or produce corrosive chemicals in the pumping system.
- Ensure that your design incorporates all appropriate safety precautions if toxic, inflammable or explosive gases or particulates will be pumped.

## 3.3 Unpack and inspect



### WARNING

Use suitable lifting-equipment. Some of the components weigh in excess of 25 Kg, please refer to [Section 2.1](#) for exact weights.



### WARNING

When lifting ensure the slings do not become twisted and that the maximum angle between paired slings is 60°.

1. Use a forklift truck or a pallet truck to place the system pallet in a convenient position.
2. Remove all packaging materials.
3. Use suitable lifting gear attached to all four of the lifting eyebolts, to ensure the pHMB booster system is lifted horizontally as it is removed from the pallet.
4. When lifting, consider the component weight, centre of gravity and position of lifting slings.
5. Remove all protective covers and inspect the components. If any of the components are damaged, notify your supplier and the carrier in writing within three days; state the Item Number together with your order number and your supplier's invoice number. Retain all packing materials for inspection. Do not use the pumping system if it is damaged.
6. If the system is not to be used immediately, refit the protective covers. Store the system in suitable conditions as described in [Section 6.1](#).

### 3.4 Locate the pumping system



#### WARNING

Use suitable lifting-equipment. Some of the components weigh in excess of 25Kg, please refer to Section 2.1 for exact weights.



#### WARNING

When lifting ensure the slings do not become twisted and that the maximum angle between paired slings is 60°.



#### WARNING

When manoeuvring the pHMB system on its castors use a tow handle to avoid strains and injuries to the back.

Use suitable equipment to move the pHMB system close to its final operating position; the castors are then designed for final positioning of the pHMB system.

The pHMB system is fitted with five castors (4 fixed and 1 swivel). When manoeuvring the pHMB system on a flat smooth surface, it will use three castors (2 fixed and 1 swivel), the remaining 2 fixed castors are only used when assembled into a frame.

When manoeuvring the pHMB system, a tow handle must be used to avoid injury to the operator. Provision has been made to locate a tow handle at the back of the pump.

**Note:** *The castors are not suitable for moving the pHMB system over uneven ground.*

### 3.5 Connect to your vacuum system

Do not reuse any O-ring and do not allow debris into the pHMB system during installation.

When you connect your pHMB system to your vacuum system, take note of the following:

- To get the best pumping speed, ensure that the pipeline which connects the vacuum system to the pHMB system is the minimum length possible and has an internal diameter not less than the pHMB system inlet-port.
- Ensure that all components in the vacuum pipeline have a maximum pressure rating which is greater than the highest pressure that can be generated in your system.
- Use the four jacking feet to ensure that the pHMB booster system is levelled. The pHMB system is levelled by removing one of the eye bolts and using a bull's-eye level indicator.
- Check the pHMB oil level and ensure that it is between the Max and Min marks on the bezel of the sight glass, refer to Section 6.2.2 for details.
- Incorporate flexible pipelines in the vacuum pipeline to reduce the transmission of vibration and to prevent loading of coupling-joints. We recommend that you use Edwards braided flexible pipelines.
- Adequately support vacuum/exhaust pipelines to prevent the transmission of stress to pipeline coupling-joints.
- Incorporate a dead leg in the foreline, near to the booster inlet. This will help to prevent debris entering the booster.
- Incorporate a pressure gauge in the inlet pipeline, so that you determine that the pHMB system operates correctly.

- You must be able to isolate the pHMB system inlet and exhaust from the atmosphere and from your vacuum system if you have pumped or produced corrosive chemicals.

Refer to Figures 1 and 2 for interface connection details.

- Remove the temporary cover from the inlet and exhaust of the pHMB system and retain the nuts, bolts, washers and temporary cover for future use.
- Use a suitable O-ring to connect to the inlet of the pHMB system, pHMB1800/2400 require an ISO160 trapped O-ring or co-seal at the inlet and a pHMB3000 requires an ISO200 trapped O-ring or co-seal at the inlet.
- Use an ISO100 O-ring to connect to the exhaust of the pHMB system.
- Trapped O-rings must be used to seal the vacuum connections and components between the pHMB and related backing pump/s, due to their over pressure capability.

### 3.6 Leak-test the system



#### WARNING

Leak test the system after installation and maintenance to prevent leakage of dangerous substances out of the system and leakage of air into the system.

Leak-test the system after installation. Dangerous substances that leak from the system will be hazardous to personnel and there may be a risk of explosion if air leaks into the system.

The minimum recommended requirement is  $1 \times 10^{-5}$  mbar l s<sup>-1</sup> helium.

If you need further information on leak testing, contact Edwards for advice.

### 3.7 Connect the electrical supply



#### WARNING

This equipment is suitable for Installation Category II as defined in IEC 60664-3. Connect the system to the electrical supply through a suitably rated isolator/connector for your dry pumping system.



#### WARNING

Ensure that the system and your electrical supply cable are suitably protected against earth (ground) faults and that the earth (ground) conductor of the electrical supply cable is longer than the phase conductors in the connector. You must fit a second protective earth (ground) conductor (with a cross-sectional area at least equal to phase conductor size) to the protective earth (ground stud).



#### WARNING

All connections to the interface control must be double insulated or have equivalent protection. Do not connect voltages greater than 30V a.c. or 60V d.c. to the control/interface connections. If you do, the interface control will not provide protection against electric shock.

#### CAUTION

This is an industrial (Class A) product as defined by EN61326. To ensure compliance with European Electromagnetic Compatibility (EMC) requirements for EMC emissions, please note that it is not intended for use in domestic buildings, or in properties directly connected to an electrical supply network which also supplies domestic buildings.

---

### CAUTION

Do not connect voltages greater than specified in [Section 2.2](#) to the control interface. If you do the interface may be damaged.

---

**Note:** *Edwards recommend that the electrical supply be connected to a suitable isolator, which is easily accessible for maintenance and clearly identified.*

Refer to [Figure 2](#), item 2 to locate the mains power connector.

Use the following procedure to connect the electrical supply to the pHMB system. When you make the electrical supply cable, ensure that the earth (ground) conductor is longer than the phase conductors. This will ensure that if the cable is accidentally dragged and the strain relief bush on the electrical supply connector mating-half fails, the earth (ground) conductor will be the last conductor to be pulled from the connector.

You must fit a secondary protective earth (ground) conductor (with a cross-sectional area at least equal to phase conductor size) to the protective earth (ground) stud. Never operate the pHMB system (even for test purposes) unless a second protective earth (ground) is fitted.

The following steps refer to [Figure 8](#).

- Make sure that the strain relief bush is fitted but at this stage, not fully tightened. Then pass a suitable cable through the strain relief bush and cover.
- Prepare cable.
- Remove two screws from connector block and replace with coding pins according to voltage variant.
- Connect the 3 phase cables (R, S and T) to terminals 1, 2 and 3 on the connector block.
- Connect the earth (ground) wire of the cable to one of the two earth (ground) connections on the connector block.
- Refit the cover around the connector block, and tighten the strain relief bush.
- Connect the mating half to the electrical supply connector of the pHMB system.
- Connect the other end of the supply cable to your electrical supply via a suitable isolator.

Figure 8 - Power connector wiring details

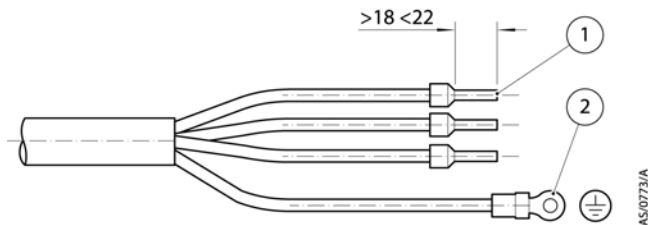
- 1. Use a suitable crimping tool



- 2. The cables must be terminated using a colour coded Ferrule of the appropriate size, compliant with local regulations

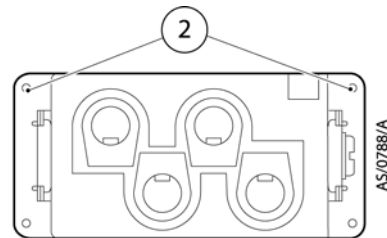
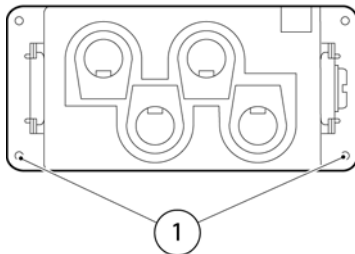


- 3. The cable should be constructed to the following dimensions



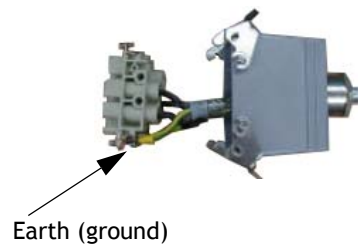
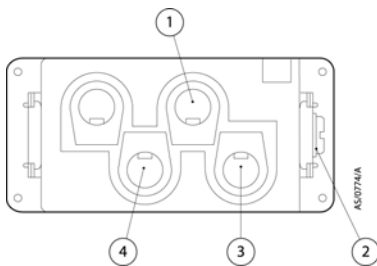
- 1. Ferrule sleeve
- 2. Ring terminal

- 4. High and low volt coding pin arrangement



- 1. High volt coding pin positions
- 2. Low volt coding pin position

- 5. The cable should be connected to the mains connector as illustrated



- 1. Terminal 3 - phase 3 (T)
- 2. Earth (ground)
- 3. Terminal 1 - phase 1 (R)
- 4. Terminal 2 - phase 2 (S)



### 3.8 Connect an additional RF earth (ground) - optional

If you will operate the pHMB system in an area subject to high RF (radio frequency) emissions, in accordance with good RF installation practice, we recommend that you:

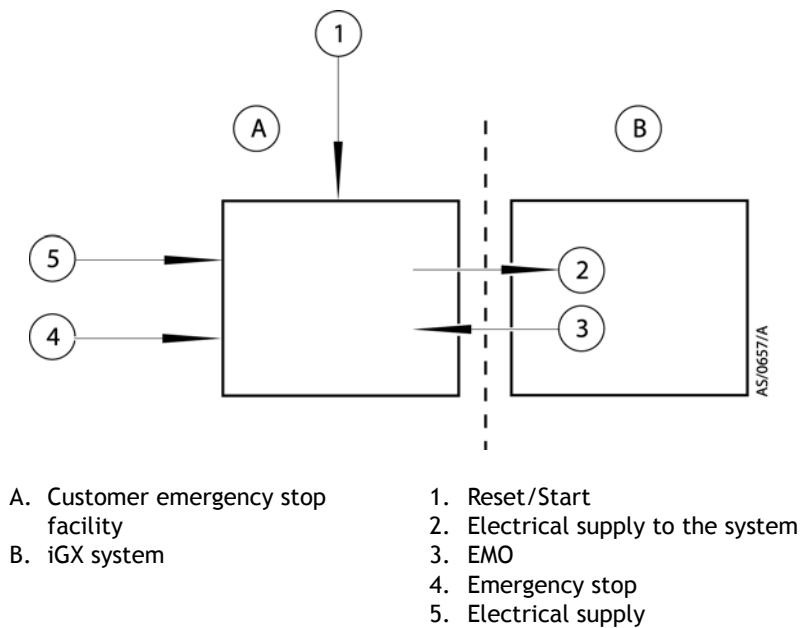
- Use a star washer to connect the end of the earth (ground) cable connected to the pHMB inlet to one of the bolts that you use to secure the inlet-flange
- Connect an additional earth (ground) cable to the RF earth (ground) stud (Figure 2, item 16). You must use a suitable low-impedance cable (for example, use braided cable)

### 3.9 Connect to your emergency stop circuit

**Note:** If you do not connect to your own control equipment, you must fit the external EMS shorting plug supplied to the EMS connector (Figure 2, item 7) on the rear of the pHMB system. If you do not, you will not be able to operate the pHMB system.

If required, you can connect your own control equipment to the pHMB system to shut it down in an emergency using the EMS connection (Figure 2, item 7 and Table 4). The emergency stop control must be compliant with IEC 60947-5-1 (red self latching mushroom push button on a yellow background).

Figure 9 - pHMB EMS circuit



### 3.10 Connect the cooling-water hoses



#### WARNING

Do not leave the cooling-water supply turned on after you complete the electrical installation of the pump. If you do, condensation may form inside the motor terminal-box and there may be a risk of electric shock.



#### WARNING

A release of water under pressure constitutes a significant safety hazard. The water supply should be provided with an isolator.



#### WARNING

Allow the pump to cool down to a safe temperature before disconnecting or isolating the cooling water supply. Failure to do so will result in high pressures being generated in the pump cooling system.

#### CAUTION

Drain the cooling-water from the iF system, if you will transport or store it in conditions where the cooling-water could freeze. If you do not, cooling-water may freeze in the iF system and damage the pump(s) and/or the cooling-water pipelines.

#### CAUTION

If cooling water has been interrupted whilst the pump is in operation, do not restore the cooling until the pump has cooled down to a safe temperature. Restoring the cooling water supply whilst the pump is in operation may result in FDP seizure.

**Note:** For optimum water-cooling, ensure that your cooling-water supply complies with [Section 2](#), and that the pHMB is installed in parallel with other devices. Refer to [Section 1.5](#). 3/8 inch quick connectors have been provided to reduce the risk of water spillage during connection/ disconnection.

Connect the cooling-water supply as follows:

1. Remove the dust-caps from the cooling-water inlet and outlet
2. Connect your water return hose to the cooling-water outlet ([Figure 2](#), item 3) and connect your water supply hose to the cooling-water inlet ([Figure 2](#), item 4)
3. Turn on the cooling-water supply
4. Inspect the water hoses, pipelines and connections and check that there are no leaks

Turn off the water supply while you complete the remainder of the installation procedures.

**Note:** To minimise the build up of condensation, do not leave the cooling water switched on when the pump is not in use.

### 3.11 Connect the pHMB communications



#### **WARNING**

The pHMB system may automatically be started and stopped by external devices once this connection is made.

The pHMB system can communicate with other devices as follows:

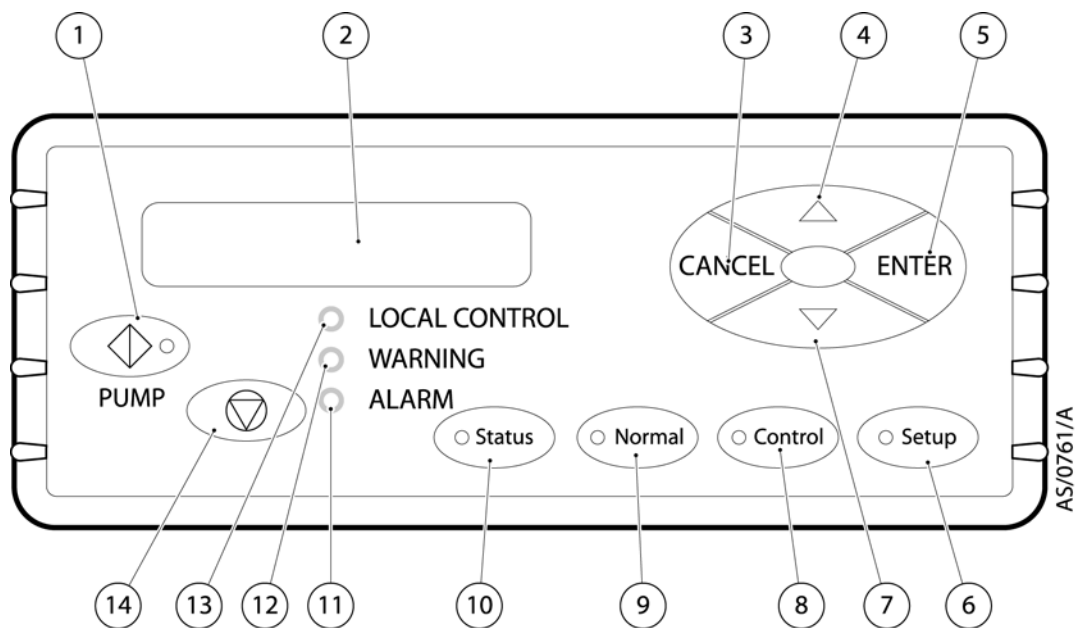
1. Direct to Edwards backing pump, for example iH or iF pump  
Connect the 4 way XLR, LON module connection, at the rear of the pHMB (Figure 2, item 16), to the backing pump's 4 way XLR, LON connection.
2. Direct to Edwards System Controller  
Connect the 5 way XLR, system interface at the rear of the pHMB (Figure 2, item 15) to the System Controller.
3. Direct control via PDT  
Connect a Edwards PDT to the User Interface / PDT port at the rear of the pHMB system, refer to Figure 2, item 14.
4. Direct to tool  
Connect a Edwards micro TIM to the micro TIM connection; refer to Figure 2, item 10.

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## 4 Pump Display Terminal (PDT)

The PDT provides basic on/off and status reporting of the remote pump and proximity booster. Warnings and Alarms are indicated to the user via the PDT, see [Section 6](#) for details.

Figure 10 - PDT interface



- |                         |                           |
|-------------------------|---------------------------|
| 1. On button            | 8. Control button and LED |
| 2. Display              | 9. Normal button and LED  |
| 3. CANCEL button        | 10. Status button and LED |
| 4. Up button            | 11. ALARM LED             |
| 5. ENTER button         | 12. WARNING LED           |
| 6. Setup button and LED | 13. LOCAL CONTROL LED     |
| 7. Down button          | 14. Off button            |

### 4.1 Status LEDs

- The Local Control LED illuminates to indicate when this PDT has control of the remote pump.
- The Pump ON LED (within the Pump Start button) illuminates to indicate that the remote pump is running.
- The Warning LED illuminates to indicate when a remote pump or on-tool booster warning is present. It will flash until all new warnings are acknowledged by pressing 'ENTER'.
- The Alarm LED illuminates to indicate when remote pump or on-tool booster alarm is present. It will flash until all new alarms are acknowledged by pressing 'ENTER'.

### 4.2 Control button

Used to take control of the pHMB and backing pump system by pressing the 'Control' key. If another device already has control then the PDT will display an error message 'Control locked'.

## 4.3 Pump on/off buttons

Press Start button:

Table 7 - Pump start state

Remote Pump State	Menu
Off	'Start Pump <' (starts pHMB and remote pump)
On	Display: 'Pump Running' 'Press CANCEL'

Press Stop button:

Table 8 - Pump stop state

Remote Pump State	Menu
Off	Display: 'Pump Stopped' 'Press CANCEL'
On	'Fast Shutdown <' (default) 'Auto Shutdown' [Shutdown of remote pump]

Use up and down arrows, plus ENTER to make selection.

## 4.4 Display - warnings and alarms

Each new warning/alarm will appear on the display screen on detection, overwriting any text already present. This will always occur unless another 'unacknowledged' warning is currently being displayed. The corresponding warning/ alarm LED will flash to indicate a new warning/ alarm.

Pressing 'Enter' will 'acknowledge' and remove the warning/ alarm currently displayed, after which the warning/ alarm text will appear until all are cleared. At this point the warning/ alarm LED's will stop flashing.

The text indicating acknowledged warning conditions that are still present can be viewed as the last entries on the status display.

Warnings that have not been acknowledged by pressing enter will 'time out' after 36 hours - i.e.: they will be 'acknowledged' automatically after this period. This prevents the build up of unacknowledged warnings on the PDT.

Alarms will stop the pHMB immediately, unless the system has been set to "Run till crash".

## 4.5 Menu display and selection

The following menu displays only apply when the PDT is connected directly to the pHMB. Not all of the parameters and menus will be available if the PDT is connected to the backing pump, refer to the relevant backing pump instruction manual.

### 4.5.1 Normal menu

The default display is the "Normal" menu, accessed by pressing 'Normal' button.

Four parameters displayed, scrolled by pressing up/down keys and 'Cancel' to exit:

- Serial number
- Control Holder (PDT, Tool, ModBus, local PC)

- "PB Current" - pHMB motor current
- "DP Current" - Remote pump motor current

#### 4.5.2 Status menu

Accessed by pressing 'Status' button.

Parameters displayed, scrolled by pressing up/down keys and 'Cancel' to exit:

- Serial Number
- Control Holder (PDT, Tool, ModBus, local PC)
- "PB Current" - pHMB motor current
- "DP Current" - remote pump motor current
- "MB Current" - remote booster motor current
- System AUC state
- "PB Valve" - pHMB gate valve open/closed state
- "DP Valve" - remote gate valve open/closed state
- "PB Speed" - pHMB speed (%)
- "PB Speed" - pHMB speed (Hz)
- "DP speed" - remote pump speed (Hz)
- "MB speed" - remote booster pump speed (Hz)
- "PB Temp" - pHMB stator temperature (°C)
- "PB Cooling" - pHMB cooling block temperature (°C)
- "DP Temp1" - remote pump temperature 1 (°C)
- "DP Temp2" - remote pump temperature 2 (°C)
- "MB Temp1" - remote booster pump temperature 1 (°C)
- "MB Temp2" - remote booster pump temperature 2 (°C)
- "PB Run Hrs" - pHMB run hours (hours)
- "DP Run Hrs" - remote pump run hours (hours)
- "time to stop" - system time to stop
- "N2 flow" - N2 flow rate
- Exhaust pressure
- Active gauge pressure
- Water flow OK/low state
- Water flow rate (value)
- Alarms and warnings (if present)

### 4.5.3 Set-up menu

Accessed by pressing 'Setup' button.

Parameters displayed, scrolled by pressing up/down keys and 'Cancel' to exit:

- Command menu
  - Gate valve open/shut<sup>\*</sup>
  - AUC State on/off<sup>†</sup>
- Inverter Fault History menu
  - pHMB Booster fault history<sup>‡</sup>
- Display Controller Software version
- Display serial number
- Edit display attributes:
  - Normal display lines selection
  - Units to display
    - Pressure (PSI/kPa)
    - Temperature (Centigrade/Fahrenheit)
    - Speed (RPM/Hz/percent)
    - AG Pressure (mbar/Torr/kPa)

<sup>\*</sup> Requires entry of a 3 digit numeric code to access.

<sup>†</sup> The PDT will need to be in control to perform the function above. If it isn't, then the following message will be displayed:

PDT not in Control  
Press CANCEL

<sup>‡</sup> Selecting <nn> Inverter Fault History will cause the 4 last error code numbers obtained from the inverter to be displayed as follows: "xxx xxx xxx xxx" where each xxx is an error code in decimal numerical format, with the oldest error code listed first.



## 5 Operation

Take precautions to avoid accidental contact with hot surfaces, allow the pump to cool before removing the enclosure panels.



### WARNING

Do not operate the system with any enclosures removed or damaged. If you do there may be a risk of electric shock.



### WARNING

Do not operate the system with any enclosure panels removed or damaged and do not touch any parts of the pump(s) when the system is on. Surfaces of the pump(s) are very hot and can cause injury to people.



### WARNING

Do not remove the inlet connections until the pump has been allowed to stop rotating and the power has been isolated. The pump can take up to three minutes to completely stop.

### CAUTION

The system is designed to continue operating through short term power interruptions and to automatically restart once the power is restored.

### CAUTION

Do not operate the pHMB pumping system without a suitable Edwards backing pump.

Take precautions to avoid accidental contact with hot surfaces, allow the pump to cool before removing the enclosure panels.

### 5.1 Initial start-up

Start-up the pumping system as described in the procedure below. This should be done in addition to the instructions provided with the Edwards backing pump used. This procedure assumes that the pump and the vacuum system are at atmospheric pressure.

- Ensure supply voltage corresponds with system configuration.
- Switch on your electricity supply and check the Power OK LED (Figure 1, item 1) goes on.
- Turn on the cooling water supply.
- Close all inlet valves.
- Apply the start command from your control system or a PDT connected to either the pHMB or Edwards backing pump.
- The pHMB system may need to operate for approximately 15 minutes before nominal performance is achieved.
- The pHMB system must operate for a minimum of 4 hours before pumping process gases.
- The PDT plugged into the pHMB or Edwards backing pump should produce a normal display (no warnings or alarms).

## 5.2 Shutdown



### WARNING

The pHMB can be started by a remote control signal. If you intend to do maintenance on the pHMB system ensure that it is adequately purged, shutdown and isolated.



### WARNING

If a pump is automatically shut-down, ensure that it is safe to restart before restarting the pump.

An operator or a signal from the tool may start the booster remotely via equipment such as a Edwards backing pump or the Edwards System Controller. Therefore it is essential when carrying out maintenance on the pHMB system, that it is adequately purged, shutdown and isolated.

### 5.2.1 Manual shutdown

Use the Switch Off menu on the PDT to shut down the pHMB system. Note the menu has two shut down options: Fast and Auto. We recommend that you use the Auto shutdown option, as this ensures that the backing pump is purged for 15 minutes before it is shutdown. When selecting auto-shut down the following actions will occur:

- The pHMB is switched off.
- The Power On LED will start to flash.
- If not already open, the gas solenoid-valve is opened to switch on the backing pump nitrogen purge.
- After 15 minutes the gas solenoid-valve is closed, switching off the nitrogen purge to the backing pump. At the same time the backing pump is switched off.
- The Power On LED is switched off.

Fast shutdown will switch off the pHMB booster and then 30 seconds later switch off the backing pump. When selecting fast shutdown the following actions will occur:

- The pHMB is switched off.
- The gas solenoid-valves are opened to switch on the nitrogen purges to the backing pump.
- After approximately 30 seconds the gas solenoid-valves are closed to switch off the nitrogen purges to the backing pump and at the same time the backing pump is switched off.
- The Power On LED is switched off.

### 5.2.2 Automatic shutdown

### CAUTION

If you select 'Run till crash', the pump can be damaged and you may invalidate any warranties on the pHMB system equipment.

**Note:** The emergency stop button, the emergency stop signal from your control equipment (if fitted) and the safety sensors can shut down the pHMB system, even if you have selected run to crash.

**Note:** Use the Setup/Run Till Crash menu to select "run till crash".

**Note:** "Run till crash" is automatically reset to "off" when the pHMB system electrical supply is switched off.

Normally, if an alarm condition exists, the pHMB control system will shutdown the pump. If required you can request 'run till crash' operation. In this mode of operation, most alarm conditions will be ignored and the pump will continue to operate. Note, however, that for safety reasons the following alarms will shut down the pHMB system even if you have selected 'run till crash':

- EMS - (error number 801)
- Motor Thermistor (error number 809)
- PB speed too low (locked rotor) (error code 823)
- Inverter trip indicated (or not running when it should be) (error code 825)

### 5.2.3 Local emergency stop

In case of an emergency, the "Emergency Stop" button mounted at the rear of the pump (Figure 2, item 15) should be pressed to stop the pump and booster immediately.

To reset the system, release the EMS and reset the system through the PDT.

### 5.2.4 Remote emergency stop

The system will be shutdown by a remote emergency stop signal connected through the 6-way XLR connector (Figure 2, item 11) at the rear of the pHMB system.

### 5.2.5 Brownout

The system may be shutdown if a brownout occurs for greater than 1 second. For brownouts of less than 1 second, the system will continue running normally.

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## 6 Maintenance

### 6.1 Safety



#### WARNING

Obey the safety instructions given below and take note of appropriate precautions. If you do not, you can cause injury to persons and damage to equipment.



#### WARNING

Personal protection equipment should be checked and used as specified by its supplier. Hazardous chemicals that have been pumped are located within the pumps and piping. Use of suitable protective gloves and clothing along with a respirator is recommended if contact with substances is anticipated.

Particular caution should be exercised when working with Fomblin oil, which may have been exposed to temperatures greater than 260 °C. Refer to Edwards Material Safety Data Sheets for detailed information.



#### WARNING

Only suitable qualified/trained personnel are to remove the electrical service panel to program a live inverter.

- Only a suitably trained Edwards technician may maintain the pHMB pump series.
- Safety sensors fitted to the pHMB system do not require routine maintenance.
- Ensure that the installation technician is familiar with the safety procedures, which relate to the products pumped. Wear the appropriate Personal Protective Equipment (PPE) when you come into contact with contaminated components. Dismantle and clean contaminated components following local safety procedures.
- Refer to [Section 5.2](#) when shutting down the pHMB pump system.
- Ensure that the pump is completely off (Pump Running LED is off) and is disconnected from the mains supply before attempting work. Onsite Lock Out or Tag Out procedures must also be followed. Refer to Edwards for further details.
- If a backpressure exists in the pipework between the booster and its backing pump, when the inlet connection is broken the booster may rotate.
- Fit a suitable blanking plate on the inlet of the pHMB system as soon as you disconnect the pHMB system from the vacuum system.
- Do not operate the pHMB system unless the blanking plate is fitted or the pHMB system is connected to your vacuum system.
- Fit a suitable blanking plate on the exhaust of the pHMB system as soon as you disconnect the pHMB system from the rest of the vacuum system.
- Do not operate the pHMB system with a blanking plate on the exhaust.
- Allow the pumps to cool to a safe temperature before you start maintenance work.

- Check that all of the required parts for maintenance are available and of the correct type and that the pumping system has been vented and purged with nitrogen before you start any maintenance work.
- Isolate the pumping system and other components from the electrical supply so that they cannot be operated accidentally. Note that the emergency stop button on the pHMB system is not an electrical isolator.
- Wait for at least four minutes after you have switched off the electrical supply before you touch any electrical component on the pHMB system.
- Never operate the pHMB system (even for test purposes) unless a second protective earth (ground) is fitted.
- Do not re-use O-rings and co-seals.
- Dispose of components and waste oil safely (refer to [Section 7.2](#)).
- Take care to protect sealing faces from damage.
- Do not touch or inhale the thermal breakdown products of fluorinated materials, which may be present if the pHMB system has been exposed to temperatures of 260 °C and above. These breakdown products are very dangerous. Fluorinated materials in the pHMB system may include oils, greases and seals. The pHMB system may have overheated if it was misused, if it malfunctioned or if it was in a fire. Edwards Material Safety Data Sheet for fluorinated materials used in the pump are available upon request.
- Leak test your system after maintenance to prevent leakage of dangerous substances out of the system and leakage of air into the system.
- Wipe up any water or oil spilt during maintenance to avoid possible risk of slips.
- Route and secure cables, hoses and pipe work during maintenance to avoid the possible risk of trips
- When you refer to a supplementary publication for details of a maintenance operation, you must obey all of the appropriate WARNING and CAUTION instructions in the supplementary publication.

## 6.2 Maintenance plan

Table 9 - Maintenance plan

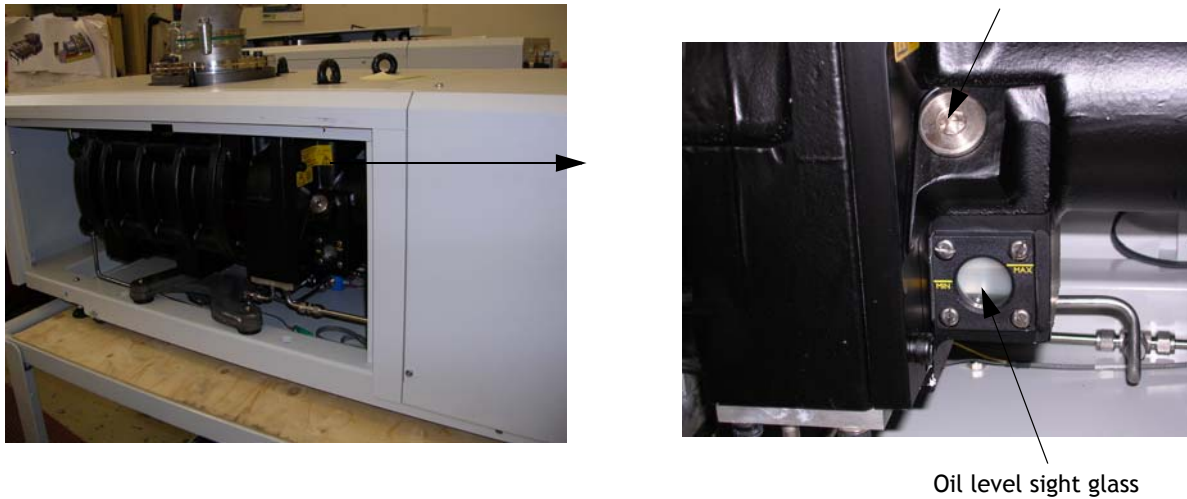
Activity	Period
Inspect oil level	12 months
Inspect pipe work and connection	12 months
Return to Edwards for full overhaul	2-3 year (depending on your application)

### 6.2.1 Inspect oil level

1. Remove enclosure side panel as shown in [Figure 11](#).
2. Check that the oil-level is between the MAX and MIN marks on the bezel of the HMB oil-level sight glass. If the oil level is above the MAX mark, drain excess oil from the sump until the oil level is correct.
  - Shut down the pHMB system, refer to [Section 5.2](#), and allow it to cool.
  - Remove the pHMB oil filler cap, refer to [Figure 11](#).
  - Use a suitable pump or syringe to suck the oil out of the booster.
  - Dispose of the oil O-ring on the oil filler-plug and replace it with a new O-ring (available as a spare: refer to [Section 8.3](#)).
  - Ensure that the new O-ring is correctly positioned on the oil filler plug, and then refit the filler plug to the pHMB pump.
3. If the oil level is below the MIN mark, fill the pump with oil until the oil level is correct.

4. Refit the enclosure side panel.

Figure 11 - Oil filler plug and oil level sight glass



### 6.2.2 Inspect the pumping system connections

- Check that the electrical connections are secure.
- Check the electrical supply cables and connections for damage.
- Inspect the vacuum pipelines for corrosion and damage. Check that all the vacuum connections are secure.
- Leak check the pumping system on installation and whenever the vacuum system is disturbed.

### 6.2.3 pHMB full overhaul

Your local Edwards service centre is enabled to overhaul your pHMB booster system following factory based procedures and to a factory derived specification.

When returning products ensure the procedure in the HS1 form (in the back of this manual) is followed.

Products returned to Edwards should have all accessories removed before shipment. Contaminated products should be sealed at inlet and exhaust blanking flanges, and the HS2 form should be completed and returned with the product.

When returning the pHMB ensure it is packed safely. Due to the weight and size of the system it should be strapped to a wooden pallet, and ensure that the packing protects it during transport.

### 6.3 Alert messages generated with default configuration settings

The following pHMB warnings and alarms will be displayed on the PDT. The alarm message will appear first. Pressing 'Enter' will reveal the 'Action' message, if present.

Table 10 - Alert messages

Object responsible	Alarm Message on PDT	'Action' Message on PDT	Cause
System Node (801)	Warning 801.01 Power interrupt	Check power supply	>1 sec brownout
	Alarm 801.01 Stop Activated	-	The emergency and mandatory trip circuit has triggered, and the inverter is disabled
	Alarm 801.01 Sys Config Fault	-	The system type has not been set on the pHMB controller
	Warning 801.01 Pump Missing	-	The pHMB has lost communications with the dry pump
pHMB Temperature (813)	Warning 813.11 PB Temp High	See manual	pHMB temperature high
	Alarm 813.12 PB Temp High	See manual	pHMB temperature high alarm, which stops pump
	Warning 813.13 Sensor missing	-	Sensor is faulty or disconnected
pHMB Cooling Block Temperature (814)	Warning 814.11 PB Temp High	Check water	pHMB cooling block temperature high
	Alarm 814.12 PB Temp High	Check water	pHMB cooling block temperature high alarm, which stops Booster
	Warning 814.13 Sensor missing	-	Sensor is faulty or disconnected
pHMB Run Hours (817)	Warning 817.01 PB Service Due	-	Pump has been running for more than TBD hours
pHMB Inverter Run Hours (822)	Warning 822.01 PB Inv Usage	See manual	pHMB inverter has exceeded the permitted number of powered hours
pHMB Inverter Speed (823)	Alarm 823.10 PB Stopped	See manual	pHMB speed too low - rotor is probably locked
pHMB Inverter Status (825)	Warning 825.01 PB Inverter Warn	Code xxx See manual	pHMB inverter has raised warning code xxx
	Alarm 825.01 PB Inverter Trip	Code xxx See manual	pHMB inverter has raised alarm code xxx and stopped the pump
	Alarm 825.01 PB Not Running	See manual	pHMB inverter will not start up when requested
	Warning 825.13 No PB Inv Comms	See manual	Loss of comms to pHMB inverter
	Alarm 825.13 No PB Inv Comms	See manual	No comms to pHMB inverter during start - booster not running
Gate Valve Not Closed (835)	Warning 835.01 Valve Not Shut	Check Gate Valve	The gate valve has failed to close
Gate Valve Not Opened (836)	Warning 836.01 Valve Not Open	Check Gate Valve	The gate valve has failed to open



**Table 10 - Alert messages (continued)**

Object responsible	Alarm Message on PDT	'Action' Message on PDT	Cause
Exhaust Gas Temperature (840)	Warning 840.11 Exh Temp High	See manual	pHMB exhaust temperature high
	Warning 840.13 Sensor missing	-	Sensor is faulty or disconnected
PB Support Node (857)	Warning 857.13 PB Sup Missing	See manual	The PB Support module is missing, but should be present
Acc Support Node (858)	Warning 858.13 AC Sup Missing	See manual	The System Accessories Support module is missing, but should be present
End User Support Node (861)	Warning 861.01 EU Sup Missing	See manual	The System EU Support module is missing, but should be present

The following warnings and alarms from the remote pump will be displayed on the PDT.

**Table 11 - PDT alert messages**

Object responsible	Alarm Message on PDT	'Action' Message on PDT	Cause
Total Flow (35)	Warning 35.09 N2 Purge Low	Check N2 supply	Nitrogen supply flow rate too low
	Warning 35.10 N2 Purge Low	Check N2 supply	Nitrogen supply flow rate too low
	Warning 35.11 N2 Purge High	Check Gas Module	Nitrogen supply flow rate too high
	Warning 35.12 N2 Purge High	Check Gas Module	Nitrogen supply flow rate too high
	Warning 35.13 Sensor missing	-	Sensor is faulty or disconnected
	Warning 35.01 N2 Purge Low	Check N2 supply	Nitrogen supply flow rate too low (digital comparator has triggered)
Exhaust Pressure (39)	Warning 39.11 Exh Press High	Exhaust Blocked Service Pump	Exhaust pressure sensor indicates overpressure warning
	Alarm 39.12 Exh Press High	Exhaust Blocked Service Pump	Exhaust pressure sensor indicates overpressure alarm, which stops pump
	Warning 39.13 Sensor missing	-	Sensor is faulty or disconnected
Booster Temperature (54)	Warning 54.11 MB Temp High	See manual	Booster temperature high
	Alarm 54.12 MB Temp High	See manual	Booster temperature high alarm, which stops pump
	Warning 54.13 Sensor missing	-	Sensor is faulty or disconnected
DP Temperature (55)	Warning 55.09 DP Temp Low	See manual	Pump body temperature low
	Warning 55.11 DP Temp High	See manual	Pump body temperature high
	Alarm 55.12 DP Temp High	See manual	Pump body temperature high alarm, which stops pump

Table 11 - PDT alert messages (continued)

Object responsible	Alarm Message on PDT	'Action' Message on PDT	Cause
	Warning 55.13 Sensor missing	-	Sensor is faulty or disconnected
DP Cooling Block Temperature (57)	Warning 57.11 DP Temp High	Check water	Pump cooling block temperature high
	Alarm 57.12 DP Temp High	Check water	Pump cooling block temperature high alarm, which stops pump
	Warning 57.13 Sensor missing	-	Sensor is faulty or disconnected
Booster Cooling Block Temperature (62)	Warning 62.11 MB Temp High	Check water	Booster cooling block temperature high
	Alarm 62.12 MB Temp High	Check water	Booster cooling block temperature high alarm, which stops booster
	Warning 62.13 Sensor missing	-	Sensor is faulty or disconnected
Gate Valve Not Closed (152)	Warning 152.01 Valve Not Shut	Check Gate Valve	The foreline gate valve has failed to close
Gate Valve Not Opened (153)	Warning 153.01 Valve Not Open	Check Gate Valve	The foreline gate valve has failed to open
Booster Inverter Speed (174)	Alarm 174.10 Booster Stopped	See manual	Booster speed too low - rotor is probably locked
DP Inverter Speed (184)	Alarm 184.10 Dry Pump Stopped	See manual	Pump speed too low - rotor is probably locked
[Remote] System warning or alarm	Warning xxx.yy See Manual	-	Other unspecified remote system warning or alarm

## 7 Storage and disposal

### 7.1 Storage

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#### CAUTION

Observe the storage temperature limits in [Section 2](#) of this instruction manual. Storage below -40 °C will permanently damage the mechanical booster pump seals and lubricants.

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#### CAUTION

Drain the cooling water from the pHMB system, if you transport or store it in conditions where the cooling water could freeze. If you do not, the cooling water may freeze in the iH system and damage the pHMB system and or the cooling water pipelines.

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Store the pHMB system as follows:

1. If applicable, ensure that the pHMB Booster Pump has been shutdown as described in [Section 4.2](#) and disconnect all services, process and plant connections.
2. Drain the cooling system of all water, using an airline as appropriate.
3. Fit blanking-plates to all vacuum inlets and exhaust outlets. Place protective covers over the pHMB services connections points.
4. Store the pumping system in cool, dry conditions until required for use.
5. When required, prepare and install the pHMB pumping system as described in [Section 3](#) of this manual.

### 7.2 Disposal

- Dispose of the pHMB system and any components safely in accordance with all local and national safety and environmental requirements.
- Pump system materials for recycling include cast iron, steel, SG iron, PTFE, stainless steel, brass, aluminium, zinc alloy, nickel, mild steel.

Take particular care with the following:

- Viton<sup>®</sup>, which may have decomposed as the result of being subjected to high temperature.
- Components, which have been contaminated with dangerous, process substances.
- Lithium Battery.

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## 8 Services, spares and accessories

### 8.1 Introduction

Edwards products, spares and accessories are available from the Edwards companies in Belgium, Brazil, Canada, China, France, Germany, Israel, Italy, Japan, Korea, Singapore, Switzerland, United Kingdom, U.S.A and a world-wide network of distributors. The majority of these centres employ Service Engineers who have undergone comprehensive Edwards training courses.

Order spare parts and accessories from your nearest Edwards company or distributor. When you order, please state for each part required:

- Model and Item Number of your equipment
- Serial number (if any)
- Item Number and description of the part

### 8.2 Service

Edwards products are supported by a world-wide network of Edwards Service Centres. Each Service Centre offers a wide range of options including: equipment decontamination; service exchange; repair; rebuild and testing to factory specifications. Equipment, which has been serviced, repaired or rebuilt, is returned with a full warranty.

Your local Service Centre can also provide Edwards engineers to support on-site maintenance, service or repair of your equipment.

For more information about service options, contact your nearest Service Centre or other Edwards company.

### 8.3 Spares

Table 12 - pHMB spare item numbers

Spare Item Number	
Krytox <sup>®</sup> 1525 oil (1 kg)	H113-09-018
Fomblin <sup>®</sup> 25/6 oil (1 kg)	H113-12-019
Drynert <sup>®</sup> 25/6 oil (1 kg)	H113-12-021
Terminator plug (4 way)	A532-20-050
Oil filler-plug O-ring: pack of 10	H021-06-110

### 8.4 Ordering accessories

#### 8.4.1 pHMB - Edwards backing pump link

To link a pHMB with a Edwards backing pump through the 4 way XLR sockets.

Table 13 - pHMB link adaptor accessory

4W XLR (M) LINK ADAPTOR	D37370756
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### 8.4.2 LON Extension cables - 4 Way XLR

To enable the pHMB to be installed at a distance from the backing pump.

Table 14 - LON extension cable accessories

Extension cable 1 M	D37207602
Extension cable 3 M	D37207591
Extension cable 5 M	D37207592
Extension cable 10 M	D37207595
Extension cable 15 M	D37207596
Extension cable 25 M	D37207597

### 8.4.3 Single Equipment Monitor and iH Fabworks

The Single Equipment Monitor allows you to monitor pump parameters and configure the iH system. The iH Fabworks allows you to network together all of the iH systems in your installation, and to use a PC to centrally monitor the iH systems. Contact your supplier or Edwards if you want to network your iH systems.

### 8.4.4 iH PC Interface Kit

The iH PC Interface Kit allows you to directly connect the iH system to a laptop PC or to a desktop PC and to use the PC to switch the iH system on and off, and to monitor the status of the iH system. The Kit is supplied with all necessary cables and with the iH Single Equipment Monitor software.

Table 15 - Interface accessory kits

Desktop PC Interface Kit	D37218100
Laptop PC Interface Kit (USA)	D37218200
Laptop PC Interface Kit (Europe)	D37218300
Laptop PC Interface Kit (UK)	D37218400
Laptop PC Interface Kit (Japan)	D37218500
PCMCIA Laptop PC Interface Kit	D37217000

### 8.4.5 PDT

When fitted, the Pump Display Terminal allows the operator to manually control the pump.

Table 16 - PDT accessory

Pump Display Terminal 5-way XLR plug (PDT)	D37280700
PDT Adaptor, 5-way XLR plug/RJ12 socket	D37370526
PDT Holster	D37209800

### 8.4.6 Main Power Connector Kit

Table 17 - Main power connector kit accessory

Main Power Connector Kit	D37312048
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### 8.4.7 Expansion Vessel Kit

Table 18 - Expansion vessel kit accessory

Expansion Vessel Kit (0.3 ltr)	NR5099000
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