

# Instruction Manual

## iXL600 and iXL1000 Dry Pump Systems




Description	Item Number
iXL600 200-460 V 50/60 Hz	A541-33-010
iXL600N 200-460 V 50/60 Hz	A541-34-010
iXL1000 200-460 V 50/60 Hz	A541-53-020
iXL1000N 200-460 V 50/60 Hz	A541-54-020

### Original Instructions



## Material Declaration

In accordance with the requirements of the Chinese regulatory requirement on the Management Methods for the Restriction of the Use of Hazardous Substances in Electrical and Electronic Products Order No. 32 (also known as 'China RoHS2') and SJ/T 11364 Marking for the Restricted Use of Hazardous Substances in Electronic and Electrical Products:

Product	Product Labels	Meaning
All iXL120 models All iXL200 models All iXL600, 600N, 600M models All iXL1000, 1000N, 1000M models IPUP2 Tool Interface (MicroTIM) (If Fitted)		This product contains hazardous substances in at least one of the homogeneous materials used which are above the limit requirement in GB/T 26572 as detailed in the declaration table below. These parts can safely be used for the environmental protection use period as indicated.

### 材料成分声明 Materials Content Declaration

部件名称 Part name	有害物质 Hazardous Substances					
	铅 Lead (Pb)	汞 Mercury (Hg)	镉 Cadmium (Cd)	六价铬 Hexavalent Chromium (Cr VI)	多溴联苯 Polybrominated biphenyls (PBB)	多溴二苯醚 Polybrominated diphenyl ethers (PBDE)
机壳 Enclosure	X	0	0	0	0	0
电机（泵和机械增压泵） Motors (pump and mechanical booster)	X	0	0	0	0	0
泵和增压泵 Pump and booster	X	0	0	0	0	0
电子元件和控件 Electronics and Controls	X	0	X	0	0	0
冷却系统 Cooling system	X	0	0	0	0	0
吹扫系统 Purge system	X	0	0	0	0	0
机台接口 Tool Interface	X	0	0	0	0	0

0: 表示该有害物质在该部件的所有均质材料中的含量低于 GB/T 26572 标准规定的限量要求。  
0: Indicates that the hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in GB/T 26572.

X: 表示该有害物质在该部件的至少一种均质材料中的含量超出 GB/T26572 标准规定的限量要求。  
X: Indicates that the hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement of GB/T26572.

NOTE: These products are EU RoHS compliant, the following Exemptions apply:

- 6(b) **Lead** as an alloying element in aluminium containing up to 0.4% by weight
- 6(c) Copper alloy containing up to 4% **lead** by weight
- 7(a) **Lead** in high melting temperature type solder (i.e. lead based alloys containing 85% by or more)
- 7(b) **Lead** in solders for servers, storage and storage array systems, network infrastructure equipment for switching, signalling, transmission, and network management for telecommunications
- (c) I Electrical and electronic components containing **lead** in a glass or ceramic other than dielectric ceramic in capacitors, e.g. piezoelectronic devices, or in a glass or ceramic matrix compound
- 7(c) II **Lead** in dielectric ceramic in capacitors for a rated voltage of 125 V AC or 250 V DC or higher
- 8(b) **Cadmium** and its compounds in electrical contacts
- 15 **Lead** in solders to complete a viable electrical connection between semiconductor die and carrier within integrated circuit flip chip packages
- 34 **Lead** in cermet-based trimmer potentiometer elements

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## Associated publications

### Publication title

### Publication number

Vacuum Pump and Vacuum System Safety	P400-40-100
Semiconductor Pumping Application Guide	P411-00-090

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# 1 Introduction

## 1.1 Scope and definitions

This manual provides installation, operation and maintenance instructions for the Edwards iXL600 and iXL1000 dry pumping systems. The pump must be used as specified in this manual. Read this manual before installing and operating the pump.

Important safety information is highlighted as WARNING and CAUTION instructions; these instructions must be obeyed. 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 units throughout this manual conform to the SI international system of units of measurement.

The following warning labels are on the pump:



Warning - Refer to accompanying documentation.



Warning - Moving parts present.



Warning - Risk of electric shock.



Warning - Heavy object.



Warning - Hot surfaces.



Protective earth (ground).



Warning - use protective equipment.



RF earth (ground).

The following warnings only appear in this manual:



Warning - Risk of explosion.



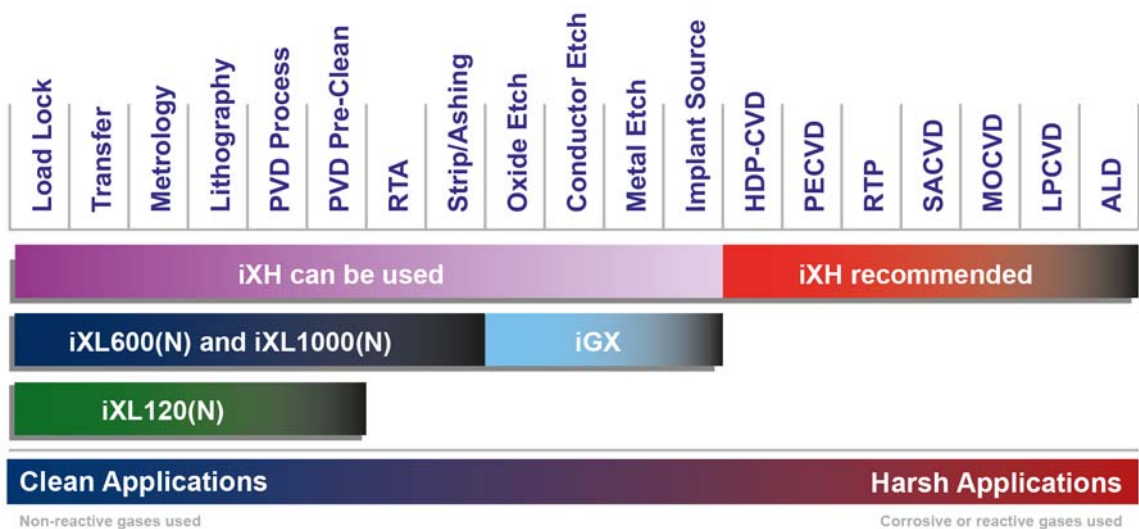
Warning - pressurised.

Material Safety Data Sheets for chemicals supplied by Edwards can be obtained by contacting Edwards, or on [www.edwardsvacuum.com](http://www.edwardsvacuum.com).

## 1.2 Applications

The dry pump systems are intended for use on load lock and light duty applications as shown in Figure 1. Users must complete a risk assessment and implement any necessary controls for pumping potentially flammable gases. Edwards can offer advice and assistance in matching the pump to the application. If using the iXL600(N) or iXL1000(N) system on an application for which it is not intended, the warranty may be invalidated.

Figure 1 - Applications

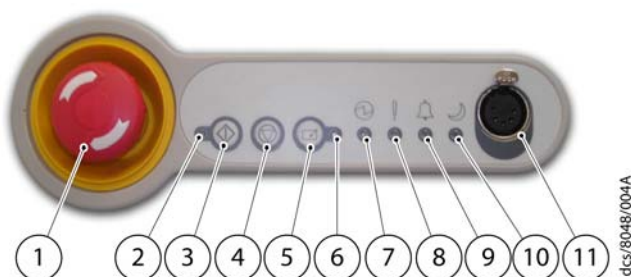


CS/0043/B

## 1.3 The iXL600 and iXL1000 Systems

The iXL600 and iXL1000 are combination dry pump and booster systems. The systems are for use on light duty applications and the N variants are fitted with a gas module that supplies nitrogen purge gas to the pump mechanism areas. The stators, motors and the inverter drives are water cooled. The pumping systems can be controlled by the front control panel, a PDT accessory or by the tool via a MicroTim.

Figure 2 - The front panel controls



Item	Control/connector identification	Item	Control/connector identification
1	EMS button	7	Power LED (green)
2	Running LED (green)	8	Warning LED (amber)
3	Start button	9	Alarm LED (red)
4	Stop button	10	Green Mode LED (green)
5	Local control button	11	PDT (Pump Display Terminal) connection
6	Local control LED (green)		

Figure 3 - Front view of pumping system

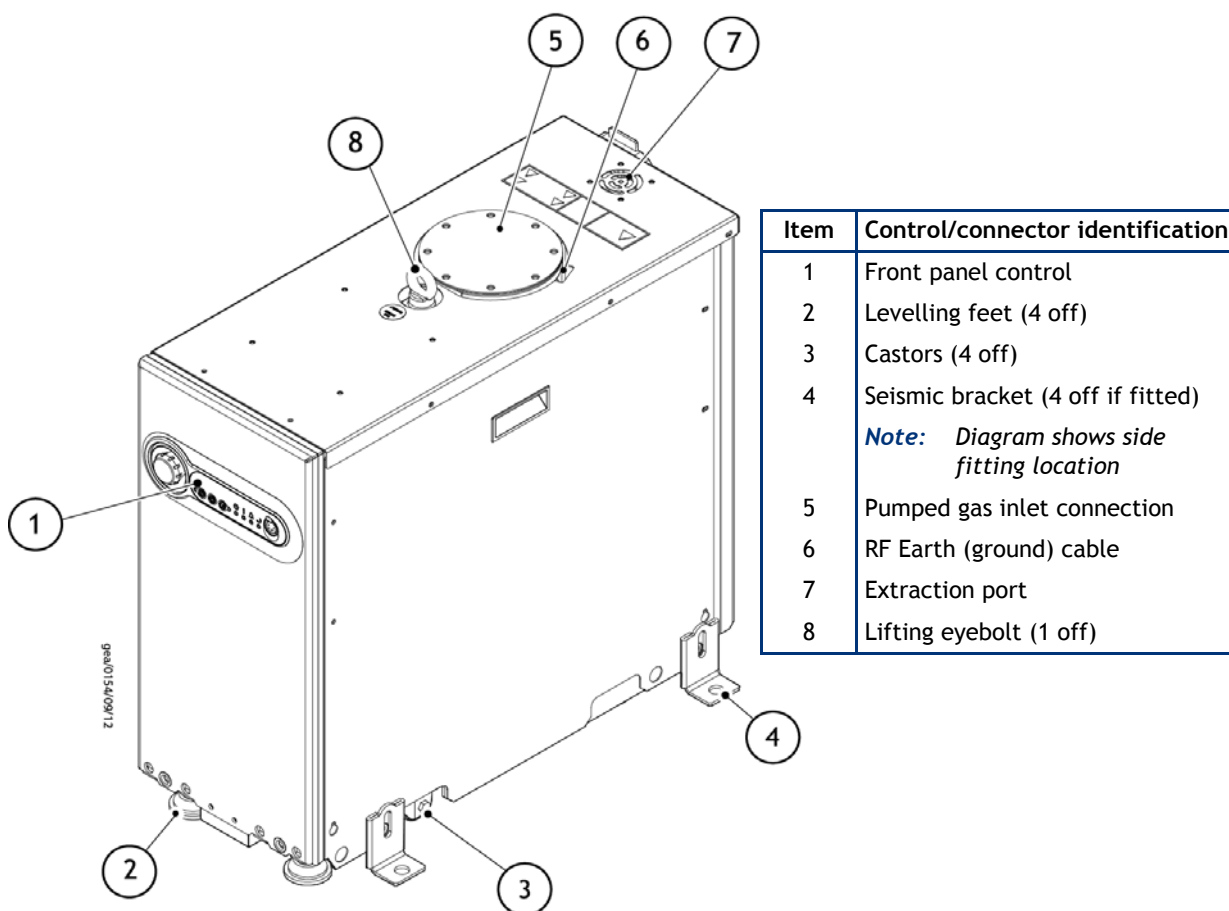
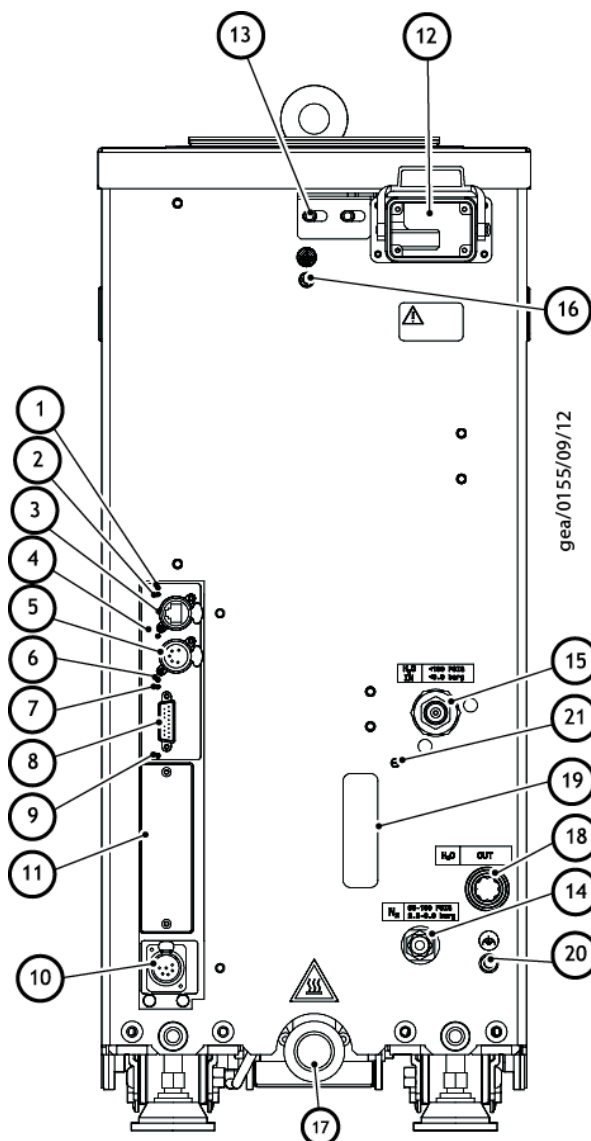


Figure 4 - The controls/connectors on the rear of the pump



Item	Control/connector identification
1	Ethernet LAN LED (green)
2	Ethernet link LED (yellow)
3	Ethernet connection
4	Power LED (green)
5	System interface
6	Warning LED (yellow)
7	Running and Alarm LED (changes colour according to system status, either green or red)
8	Accessory interface
9	MicroTIM in control LED (green)
10	EMS interface

Item	Control/connector identification
11	Micro TIM connection (if fitted)
12	Electrical supply connection
13	Electrical connector locking mechanism
14	Nitrogen purge connection (if fitted)
15	Cooling water supply connection
16	Protective earth (ground) M5 stud
17	Exhaust gas outlet connection
18	Cooling water return connection
19	Nitrogen Purge Flow Meter (if fitted)
20	RF Earth M6 stud (ground)
21	Nitrogen purge adjustment (if fitted)

## 1.4 Priority of control

The pumping system can be controlled by one of a number of modules: the front control panel (refer to [Figure 2](#)), a Pump Display Terminal (PDT), the Edwards System Controller or by the tool through the MicroTIM or one of the serial interfaces. Only one of these can have control of the system at any one time. That is, once one of these has control of the system, control requests from the others are denied.

The PDT indicates what is in control. LEDs provided on the rear panel, front panel or PDT illuminate to indicate 'in control'.

**Note:** *The pump as supplied can only be controlled using the front panel. The PDT, System Controller and the MicroTim are all accessories. Refer to [Section 7.3](#).*

## 1.5 Green Mode

The Green Mode function reduces utility consumption of the system while on stand-by. The Green Mode functionality is controlled via a PDT accessory or the tool via a MicroTIM accessory. Refer to [Section 7.3](#). Contact Edwards for advice on application and activation.

**Note:** *This mode of operation can only be activated 20 minutes after pump start in order to allow for the pump to warm up.*

## 2 Technical data

### 2.1 General technical data

Table 1 - Technical data

Pump	Characteristics								
	Body dimensions Length x Width x Height (excludes exhaust enclosure)*	Mass (excluding packaging)	Average Noise level (at ultimate)	Typical vibration level at inlet	Initial force to push the pump <sup>†</sup>	Sustained force to push the pump <sup>†</sup>	Pump inlet flange (bolted)	Exhaust gas outlet	Extraction port diameter
Units	mm	kg	dB(A)	mm/s	kg force	kg force			mm
iXL1000/ iXL600(N)	695 x 280 x 650	167	55	< 2	< 20	< 4	ISO100	NW25	50

\* Contact Edwards for installation drawings

<sup>†</sup> Measured in laboratory on level concrete surface

Table 2 - Technical data

Item	Description	Rating	Units
Operating conditions	Intended use	Indoor	
	Ambient temperature range:		
	Operating	5 to 40	°C
	Storage	-45 to 55	°C
	Maximum relative humidity:	80% for temperatures up to 31 °C decreasing linearly to 50% relative humidity at 40 °C	
Maximum operating altitude	2000		m
Pollution degree	2 (IEC 61010)		
Materials in contact with process gas	Pump, shaft and rotors	Cast Iron, Steel	
	Seals	Methacrylate ester, PTFE and fluoroelastomer	
	Gas system	Stainless steel, aluminium, PTFE and fluoroelastomer	
Degree of protection provided by enclosure	Enclosure protection when installed	11D (IEC60529)	



## 2.2 Performance data

Table 3 - Performance data

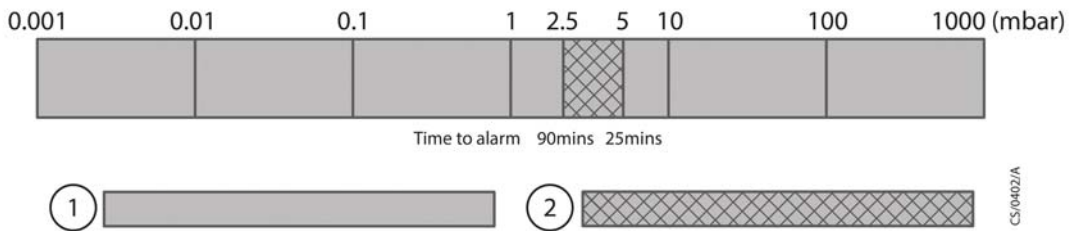
Pump	Characteristics			
	Average values <sup>*</sup>		Factory test limits	
	Typical peak pumping speed	Ultimate	Ultimate	Maximum continuous inlet pressure <sup>†</sup>
Units	m <sup>3</sup> /h	mbar	mbar	mbar
iXL600	600	0.001	0.005	1000
iXL600N <sup>‡</sup> (10 slm purge)	600	0.002	0.008	1000
iXL1000	930	0.001	0.005	1000
iXL1000N <sup>‡</sup> (10 slm purge)	930	0.002	0.008	1000

<sup>\*</sup> Average values are the mean value taken from a sample of typical production units.

<sup>†</sup> The maximum pressure at which the pump will operate without generating warnings or alarms.

<sup>‡</sup> For iXL600N and iXL1000N with no purge use values for iXL600 and iXL1000.

Figure 5 - Continuous operating zones



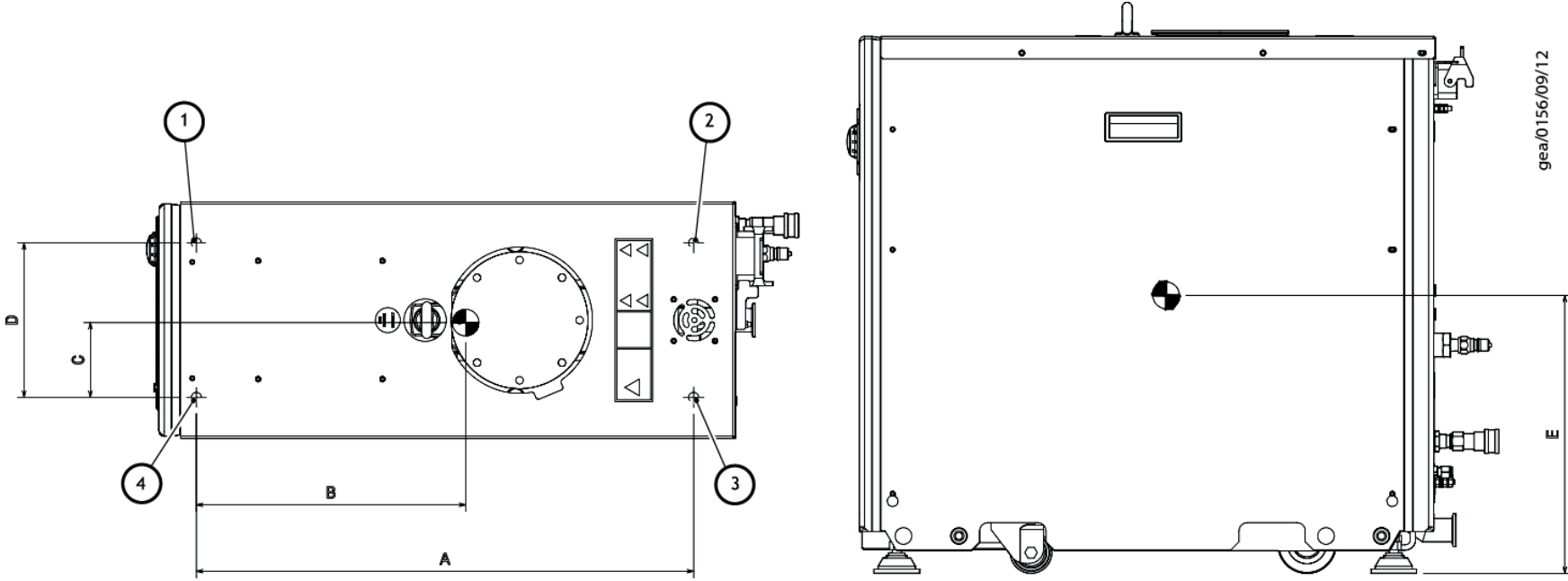
Item	Description
1	Continuous operation - no warnings or alarms
2	Discontinuous operation - time to alarm indicated

## 2.3 Loading data

Table 4 - Loading data (refer to Figure 6)

Pump	Dimension to centre of gravity					Load at levelling foot position			
	A	B	C	D	E	1	2	3	4
Units	mm	mm	mm	mm	mm	kg	kg	kg	kg
iXL1000/ iXL600(N)	600	326	91	186	335	37	44	46	38

Figure 6 - Centre of gravity and levelling foot loads



## 2.4 Nitrogen purge data

Table 5 - Nitrogen purge data

Characteristics	Rating	Units
Nitrogen supply pressure range	2.5 - 6.9	bar gauge
	36 - 100	psi gauge
Nitrogen supply quality	To ISO 8573	
Nitrogen inlet connection	¼ inch tube fitting	
Flow:- N Variant (Factory set)	10	slm

**Note:** Nitrogen purge can be set in the range 0-40 slm. Please contact Edwards to discuss the application.

## 2.5 Electrical data

Table 6 - Electrical ratings

Characteristics	Value	Units
Dry pump motor rating	1.5	kW
Mechanical booster motor rating	1.9	kW
System full load power (continuous)	2.4	kW
System peak current (200 V)	18	A (rms)
System peak current (400 V)	11	A (rms)
Full load current rating (200 - 230 V supply)	22	A (rms)
Full load current rating (380 - 460 V supply)	14	A (rms)
Recommended branch circuit fuse UL (200 - 230 V supply)	25	A
Recommended branch circuit fuse UL (380 - 460 V supply)	15	A
Recommended mains cable size (or corresponding AWG size)	6 (10)	mm <sup>2</sup> (AWG)

Table 7 - General electrical data

Description	Rating	Units
Supply voltage 3-phase	200 - 460 (see rating plate)	V a.c.
Frequency	50/60	Hz
Wiring configuration	3 wire plus earth (ground)	
Branch circuit protection requirement	Current rating, refer to Table 6	
Voltage tolerance range	UL Class CC fuse or equivalent I <sup>2</sup> t characteristic rated to 600 V ± 10%	
Installation category	II (IEC 60664)	
Input supply voltage unbalance	Should not exceed 2% when assessed over any one minute period	

Table 7 - General electrical data (continued)

Description	Rating	Units
Short circuit current rating (when installed with class T or class J fuses)	200	kA
Second protective earth (ground) conductor	Must be fitted with cross-sectional area at least equal to phase conductor size of 6 mm <sup>2</sup>	
Typical earth leakage*		
for 200 - 230 V supply	<5	mA
for 380 - 460 V supply	<10	mA

\* Typical earth leakage values were measured at steady-state conditions.  
Note that higher leakage currents may occur:  
i) under transient conditions such as power on or pump acceleration or  
ii) with abnormal supply configurations such as a missing or earthed phase or unbalanced supply voltages.

Contact Edwards for more information about configuration requirements for earth leakage reduction.

Table 8 - Electrical connections

Description	Mating Connector description / external supply rating	Internal supply rating
<b>Mains connection</b>  Refer to installation section for wiring diagram	Weidmuller Axial screw connector:  Insert type HDC S4 BAS p/n:1789980000 Hood type HDC 16D TOLU 1PG21G p/n:1652680000  Alternative: Harting Axial screw connector  Insert type Han 40A Axial module p/n:09140022701 x 2 off used with p/n:09140060313 (Hinged Frame) Hood type PG21 Top Entry p/n:09300060442  6 mm <sup>2</sup> stranded wire, 13-18 mm cable OD	
<b>PDT Interface (front)</b>	XLR type 5-way plug	24 V d.c. 0.2 A
<b>System/PDT Interface (rear)</b>	XLR type 5-way plug	24 V d.c. 0.75 A*
<b>Ethernet interface</b>	Standard RJ45 type or Neutrik® EtherCon® RJ45	(IEEE802.3i 10 Base T Ethernet)
<b>EMS interface</b> External emergency stop switch Pin 1 - supply, Pin 2 - return <b>Note: If there is no external connection a link plug must be fitted to operate the pump.</b>  Comms 24 V supply Pin 5 - supply, Pin 6 - 0 V supply common	XLR type 6-way plug	24 V d.c. 100 mA  24 V d.c. 0.75 A*

Table 8 - Electrical connections (continued)

Description	Mating Connector description / external supply rating	Internal supply rating
<b>Accessory interface</b> Analogue measurement for water flow meter Pin 1 - input, Pin 5 common Active accessory module Pin 3 - RS485 +, Pin 10 - RS485 - Pump running status contacts Pin 6 - Dry pump (normally open) Pin 14 - Mechanical booster (normally open) Pin 15 - common	15-way D socket           30 V a.c. 1 A, 60 V d.c. 0.5 A	
<b>Gate valve</b> Pin 4 - Gate valve drive transistor (open collector)  Gate valve position sense Pin 7 - 'Closed', Pin 8 - 'Open'		
<b>Power Supplies</b> Pin 12 - Accessory 24 V supply Pin 13 - Accessory 24 V supply <sup>†</sup> Pin 5 - 0 V supply common		24 V d.c. 0.75 A* 24 V d.c. 0.2 A

\* The System interface, the EMS interface and the Accessory interface have a combined current rating of 0.75 A.

† This supply will be disconnected in the event of an emergency stop.

## 2.6 Cooling water data

Table 9 - Water cooling system data

Description	Rating	Units
Typical heat load at ultimate	1100	W
	88	%
Maximum supply pressure	6.9	barg
	100	psig
Maximum allowable system differential pressure	5.5	bar
Minimum required pressure differential across supply and return	0.5	bar
Supply temperature range	10-30	°C
Minimum flow rate required	1.6 (20 °C water & 20 °C ambient) 2.0 (30 °C water & 40 °C ambient)	l/min
Rated minimum pressure differential*	1	bar
Water type	Treated or non-corrosive industrial	
Maximum particle size	0.03	mm <sup>2</sup>
Acidity	6.5 to 8.0	pH

Table 9 - Water cooling system data (continued)

Description	Rating	Units
Hardness	<100	ppm of CaCO <sub>3</sub> (<100 mg of CaCO <sub>3</sub> per litre)
Resistivity	1k ≤ ρ ≤ 1000k	ohm-cm
Materials in contact with cooling water	Stainless steel, PVDF, Nitrile, PTFE and fluoroelastomer	
Water inlet connection	3/8 inch male quick connector	
Water outlet connection	3/8 inch female quick connector	

\* Water consumption varies with pump operating temperature and water temperature; these figures measured at factory default internal pump temperature, 15 °C water inlet temperature and ultimate inlet pressure.

**Note:** The temperature management system is a valved system and the 'Rated Min Pressure Differential' may not correlate with water flow rates stated in the table under all operating conditions. The 'Rated Min Pressure Differential' is required to maintain adequate cooling water flow under adverse operating conditions.

## 2.7 Tracer gas analysis

Tracer gas fugitive emission testing was carried out in accordance with the method given in [Appendix A2](#) of SEMI S6.

A 50 mm duct was connected to the extraction port on top of the enclosure.

**Table 10 - Tracer gas test parameters**

<b>Test Parameters</b>	
Tracer gas	SF <sub>6</sub> (Sulphur Hexafluoride)
Tracer gas concentration	100%
Tracer gas release rate	0.25 to 1 slm
Tracer gas release points	Tracer gas flow evenly split between 2 release points 1) exhaust flange on pump 2) exhaust elbow joint within exhaust extraction cover

**Table 11 - Tracer gas test system parameters**

System Parameters	iXL600/ iXL1000	iXL600N/ iXL1000N	Units
Extraction flow rate: From port on top of enclosure	180	180	m <sup>3</sup> /h
Volume of enclosure	0.11	0.11	m <sup>3</sup>
Free volume of enclosure	0.069	0.068	m <sup>3</sup>
Air changes per minute	43.5	44.3	per min

**Table 12 - Worst case test results**

Process Gas		Maximum Gas Flow (slm)	TLV/LEL (ppm)	25% TLV/LEL (ppm)	SF <sub>6</sub> Release rate (slm)	Max SF <sub>6</sub> Detected outside enclosure	ERC (ppm)	Pass/Fail*
Chlorine	Cl <sub>2</sub>	0.2	0.5	0.125	1	0.25	0.05	Pass
Ammonia	NH <sub>3</sub>	20	25	6.25	1	0.25	5.00	Pass
Carbon Monoxide	CO	0.3	1	0.25	1	0.25	0.08	Pass
Fluorine	F <sub>2</sub>	0.5	25	6.25	1	0.25	0.13	Pass
Hydrogen	H <sub>2</sub>	30	4000	1000	1	0.25	7.50	Pass
Methane	CH <sub>4</sub>	0.05	1000	250	1	0.25	0.01	Pass
Nitrous Oxide	N <sub>2</sub> O	20	50	12.5	1	0.25	5.00	Pass
Nitrogen Trifluoride	NF <sub>3</sub>	0.5	10	2.5	1	0.25	0.13	Pass
Hydrogen Chloride	HCl	0.4	5	1.25	1	0.25	0.10	Pass
Sulphur Hexafluoride	SF <sub>6</sub>	0.2	1000	250	1	0.25	0.05	Pass
Silicone Tetrachloride	SiCl <sub>4</sub>	0.1	1	0.25	1	0.25	0.03	Pass

\* Where Pass indicates acceptable enclosure (satisfies SEMI S2 criteria of less than 25.0% of the TLV).

## 3 Installation



### WARNING

Obey the safety instructions in this Section and take note of appropriate precautions. Failure to observe these instructions may result in injury to people and damage to equipment.



### WARNING

The system should not be operated with the enclosure panels removed.



### WARNING

The system contains electrolytic capacitors which may emit dangerous fumes under certain fault conditions. Ensure the system is installed in a well-ventilated area.

Potential hazards on the dry pumping system include electricity, hot surfaces, process chemicals, Fomblin<sup>®</sup> oil, nitrogen and water under pressure.

Detailed safety information is given in [Section 4](#) and Edwards Safety Manual Publication Number P400-40-100 Vacuum Pump and Vacuum Systems.

- Only Edwards trained engineers may install the dry pumping system. Users can be trained by Edwards to conduct the tasks described in this manual. Contact the local service centre or Edwards for more information.
- Do not remove the temporary covers or blanking plates from the dry pumping system inlet and exhaust until connecting the dry pumping system to the vacuum or exhaust extraction system. Do not operate the dry pumping system unless the inlet and exhaust are connected to the vacuum and exhaust extraction system.
- Vent and purge the process system (if the dry pumping system is to replace an existing pumping system) with nitrogen for 15 minutes before starting installation work. Refer to [Section 5](#).
- Disconnect the other components in the process system from the electrical supply so that they cannot be operated accidentally.
- Electrical, nitrogen and water supplies are all potentially hazardous energy sources. Before carrying out any maintenance, the supply of these sources should be locked and tagged out.
- The pump system includes provision for ventilation extraction and secondary containment of oil and water leaks. Any unintended overflows or spills must be removed immediately to avoid risk of slips.
- Obey all national and local rules and safety regulations when installing the dry pumping system. Consult Edwards Safety Manual Publication Number P400-40-100 before pumping hazardous materials. This publication is available on request: contact the supplier or Edwards.
- Route and secure cables, hoses and pipework during installation to avoid possible risk of trips.
- Before locating the pump, ensure that the installation area is clean and free from debris and contamination (such as oil).

In order for the pumping system to perform to specification, provide appropriate facilities as detailed in this manual.



### 3.1 Locate the dry pumping system



#### WARNING

Use suitable lifting equipment to move the system. Failure to do so can cause injury to people and damage to the equipment.



#### WARNING

Do not exceed the topple angle of 10 ° when moving the pump. Wheel the system on its castors to move it into its operating position. The system should only be wheeled short distances over flat surfaces. If the floor surface is uneven or has obstacles, the system should be lifted with suitable lifting equipment. If lifting the system is impractical, or there are other site difficulties, please consult Edwards for further advice.

Use the following procedure to locate the system in its operating position. The system must be located on a firm, level surface, to ensure that it works correctly and the system is not damaged. The pump must be level to a maximum of 3 degrees in any direction, measured at the pump inlet.

It is important to note that the castors are intended only to aid manoeuvre of the system into its final operating position. The force required to push a pump on its castors varies greatly depending on the surface finish and cleanliness of the floor and any slopes or inclines. It is the user's responsibility to carry out a risk assessment of the location and take appropriate measures to ensure that the system is manoeuvred safely and in accordance with local and national manual handling guidelines:

1. Use suitable lifting equipment attached to the eyebolt to move the system close to its final operating position.
2. Adjust the levelling feet (Figure 3, item 2) to make sure that the system is level and is not supported by the castors. The suggested jacking height is 5 mm.
3. Remove the lifting eyebolt and replace with the lifting eyebolt hole plug supplied with the system.
4. Ensure that access is possible to the emergency stop button (refer to Figure 2, item 1). If not, use a disconnect box (refer to Section 7.3).

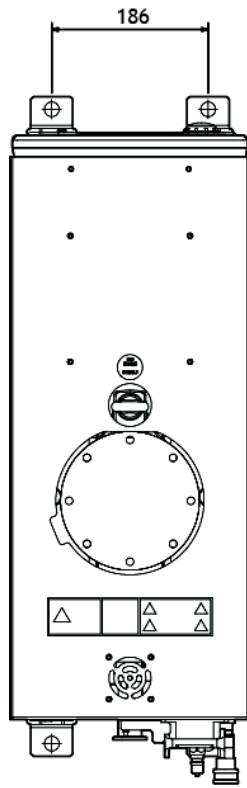
#### 3.1.1 Seismic brackets fitting

If securing the system in place to prevent inadvertent movement (for example, during an earthquake), take note of the following:

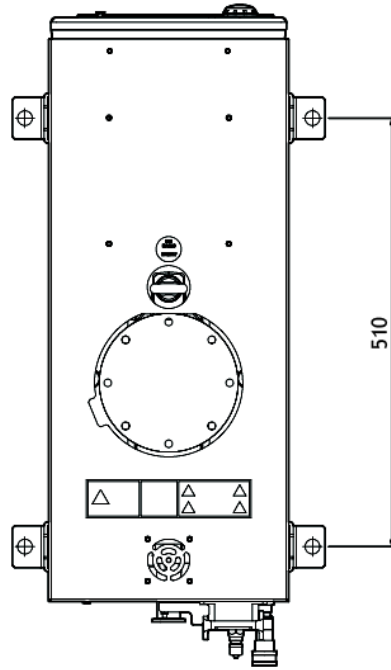
- The seismic brackets (Figure 3, item 4) are designed to withstand a level 4 earthquake in a ground floor installation.
- The system can be secured to the floor by fitting suitable bolts or studs (not supplied) through the 17.5 mm diameter hole in the seismic brackets.
- If vibration transmission to the floor is a concern, suitable vibration isolators (not supplied) should be fitted between the seismic brackets and the bolt or stud.
- Ensure that the bolt spacing is adequate for the floor strength and loads anticipated.

Although the iXL system can be secured using four seismic brackets, two brackets are capable of protecting the system during an earthquake. These can be fitted to the sides or the front and back of the pump, whichever is most convenient, as shown in Figure 7.

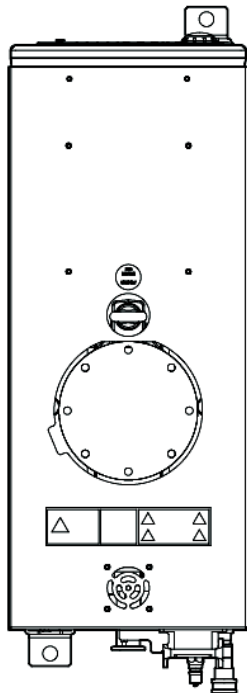
Figure 7 - Seismic bracket front and side attachments with dimensions



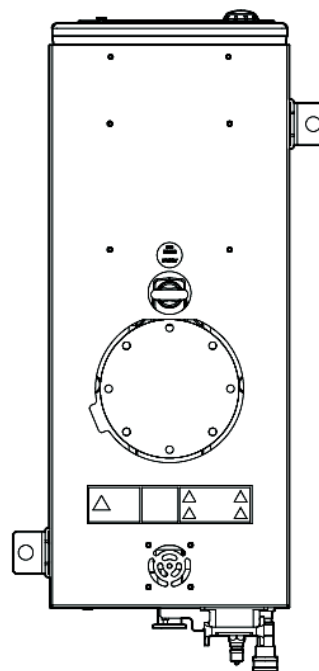
Front/Back Fitting



Side Fitting



Front/Back Fitting  
using 2 brackets



Side Fitting  
using 2 brackets

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## 3.2 Lubrication

The pumping system is given a charge of oil before leaving the factory. There is no requirement to check and adjust the oil level.

## 3.3 Connect the dry pumping system to the vacuum/exhaust system



### WARNING

Pipe the exhaust to a suitable treatment plant to prevent the discharge of dangerous gases or vapours to the surrounding atmosphere.



### WARNING

Do not touch the pump exhaust and check valve (if fitted) whilst the pump is running since the temperatures of these parts can cause burns. These parts will remain hot after the pump has stopped.



### WARNING

Do not operate the system with the exhaust pipeline blocked. If the exhaust pipeline is blocked, the system can generate exhaust pipeline pressures of up to 3.5 bar ( $3.5 \times 10^5$  Pa).

### CAUTION

Use a catchpot to prevent the drainage of condensate back into the system. Condensate that drains back into the system could damage the pump.

Do not reuse any O-ring or O-ring assembly and do not allow debris to get into the system during installation.

When connecting pumping system to the vacuum system, take note of the following:

- To get the best pumping speed, ensure that the pipeline which connects the vacuum system to the pumping system is the minimum length possible and has an internal diameter not less than the 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 the system.
  - Incorporate flexible pipelines in the vacuum pipeline to reduce the transmission of vibration and to prevent loading of coupling joints. Edwards recommends using Edwards braided flexible pipelines.
  - Adequately support vacuum/exhaust pipelines to prevent the transmission of stress to pipeline coupling joints.
  - Incorporate a pressure gauge in the inlet pipeline to determine that the dry pumping system operates correctly.
  - Ensure that the dry pumping system inlet can be isolated from the atmosphere and from the vacuum system if pumping or producing corrosive chemicals.
  - The pump is fitted with an integral exhaust check valve which prevents the suck-back of exhaust vapours after the pumping system is shut down.
1. Referring to [Figure 8](#), remove the temporary cover or blanking plate from the inlet of the pumping system. Take care not to drop screws, tools etc. into the pump inlet. Retain the nuts, bolts, washers and blanking plate for future use. Retain the temporary cover for future use on non-contaminated pumps only.
  2. Use the O-ring supplied and suitable nuts, bolts and washers (not supplied) to connect the inlet flange ([Figure 3](#), item 5) to the vacuum system. Refer to [Figure 8](#).

- Use the trapped O-ring seal and clamp supplied to connect the exhaust outlet (Figure 4, item 17) on the exhaust pipe to the exhaust extraction system.

Figure 8 - Connecting the pump inlet



Undo screws



Remove cover

### 3.4 Connect to the factory extraction system (optional)

An extraction port is provided to allow secondary exhaust ventilation. When connected to the Photohelic switch/gauge accessory, the system will continuously monitor the airflow from the enclosure and if interrupted it will stop the pump in combination with the Disconnect Box accessory.

Refer to Section 2.7 for extraction rates required and to Section 7.3 for the required exhaust extraction cover kit.

Refer to Figure 3, item 7 for location of the extraction port.

### 3.5 Connect the nitrogen supply



#### WARNING

A release of nitrogen has potential to cause harm by asphyxiation. The nitrogen supply should enable isolation in accordance with SEMI S2-0200 Lockout/Tagout requirements.

#### CAUTION

Ensure that the nitrogen supply conforms to the requirements given in the Technical Data Section. If it doesn't, the gas pipelines may become blocked or the system may be damaged.

Refer to Figure 4, item 14 for the location of the nitrogen purge port. Refer to Section 5.6 for instructions on gas module configuration.

**Note:** Only the 'N' variants have the facility for a nitrogen purge. Refer to Section 2.4 for nitrogen supply requirements.

### 3.5.1 Flammable/pyrophoric materials



#### WARNING

Obey the instructions and take note of any precautions given below to ensure that pumped gases do not enter their flammable ranges.

When flammable or pyrophoric materials are present within the pump there may be additional risks that the user is responsible for assessing and managing as part of the entire Process Tool installation. The severity of the risks and the necessary control measures will depend largely on whether the tool exhaust is in the flammable region, if this is part of normal Process Tool operation, or if it might only occur under rare conditions. The additional risks arise because all dry pumps must be considered a potential source of ignition owing to the heat of compression, or possibly friction. If ignition occurs then the following may happen:

- High pressures could occur within the pump and may not be contained.
- A flame front could travel back up the foreline.
- A flame front could travel downstream from the exhaust of the pump.

Industry best practice suggests that the following measures will reduce the risks of pumping flammable mixtures and pyrophoric materials, but it is the user's responsibility to carry out a risk assessment and take appropriate measures:

- Do not allow air to enter the equipment.
- Ensure that the system is leak tight.
- Ensure that gases in the pump do not enter the flammable range. This may be achieved by diluting gases in the pump by supplying sufficient inert gas purge. For example, dilution with nitrogen to below one quarter LEL (lower explosive limit) or, if that is not practical, to below 60% LOC (limiting oxidant concentration).
- The gas module supplied with the pump is not intended to perform a safety function. Users may need to consider adding appropriate measures to monitor the flow of purge gas, for example external sensors.

For further information, please refer to Semiconductor Pumping Application Guide (Publication no. P411-00-090) or contact Edwards.

### 3.5.2 Gas purges



#### WARNING

The pumps are not suitable for use with hazardous production materials. Any hazardous production materials must be diluted to a safe level before entering the pump.

Gas purge is provided for the sole purpose of enabling the pumping of inert light gases such as helium.

## 3.6 Leak test the system



#### WARNING

Leak test the system after installation and seal any leaks found to prevent leakage of dangerous substances out of the system and leakage of air into the system.

**Note:** If further information on leak testing is required, contact the supplier or Edwards for advice.

### 3.7 Electrical supply



#### WARNING

Ensure that the electrical installation of the pumping system conforms with local and national safety requirements. It must be connected to a suitably fused and protected electrical supply and a suitable earth (ground) point.



#### WARNING

This equipment is suitable for Installation Category II as defined in IEC 60664-1. The dry pumping system must be connected to an isolator that disconnects all current carrying conductors and can be locked out in the off position (LOTO). The isolator must be in close proximity to the equipment, within easy reach of the operator and identified as the disconnect device for the equipment.



#### WARNING

Isolate the electrical supply before disconnecting the electrical supply cable from the dry pumping system.



#### WARNING

Ensure that the system and the 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. Fit a second protective earth (ground) conductor (with a cross-sectional area at least equal to phase conductor size up to 16 mm<sup>2</sup>) to the protective earth (ground) stud, [Figure 4](#), item 16.



#### WARNING

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



#### WARNING

The power wiring to the system must be properly protected.

#### 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 [Table 8](#) to the control/interface connections. If higher voltages are connected, the interface control may be damaged.

Contact Edwards if using the system with a power supply in a different voltage range to that specified on the rating plate.

The system is protected from motor overloads and short circuits by solid state electronics. The power wiring between the system and the electrical installation must be protected. When selecting overload protection, refer to

Section 2.5.

**Note:** Pump rating information can be found on the label on the rear of the pump.

If connecting the electrical supply to the system through an ELCB (or RCD depending on territory) it must be suitable for protection of equipment with a d.c. component in the fault current, and suitable for short-duration, switch-on surges, and for high-leakage current (for example, type B, according to EN50178).

The secondary protective earth (ground) is required in case of failure of the primary earth and because pump filters can cause high earth leakage currents, refer to [Table 7](#).

**3.7.1 Mains supply cable connection**



**WARNING**

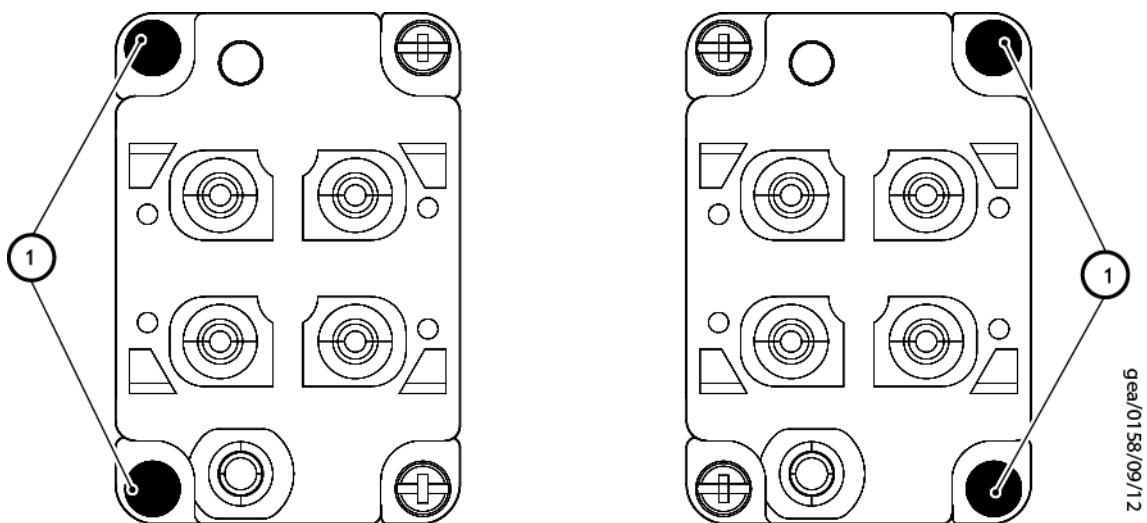
The mains connector is not approved for connection and disconnection under load.

Use the following procedure (refer to [Figure 9](#)) to connect the electrical supply to the dry pump system using the connector supplied with the pump. If using a different connector to that supplied, follow the manufacturer's instructions. When making 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.

If further information on connecting the electrical supply is required, contact Edwards for advice.

1. Screw the cable gland onto the connector hood.
2. Pass a suitable cable through the cable gland and hood. The cross sectional area of the cable wires should be 6 mm<sup>2</sup>. Cables must be bare ended without ferrules to ensure correct clamping in the connector block.
3. Fit the coding pins to the connector block according to the branch supply voltage as shown in [Figure 9](#). 200 V supply is Low Volts, 400 V supply is High Volts.

**Figure 9 - High and Low voltage coding pin arrangement**

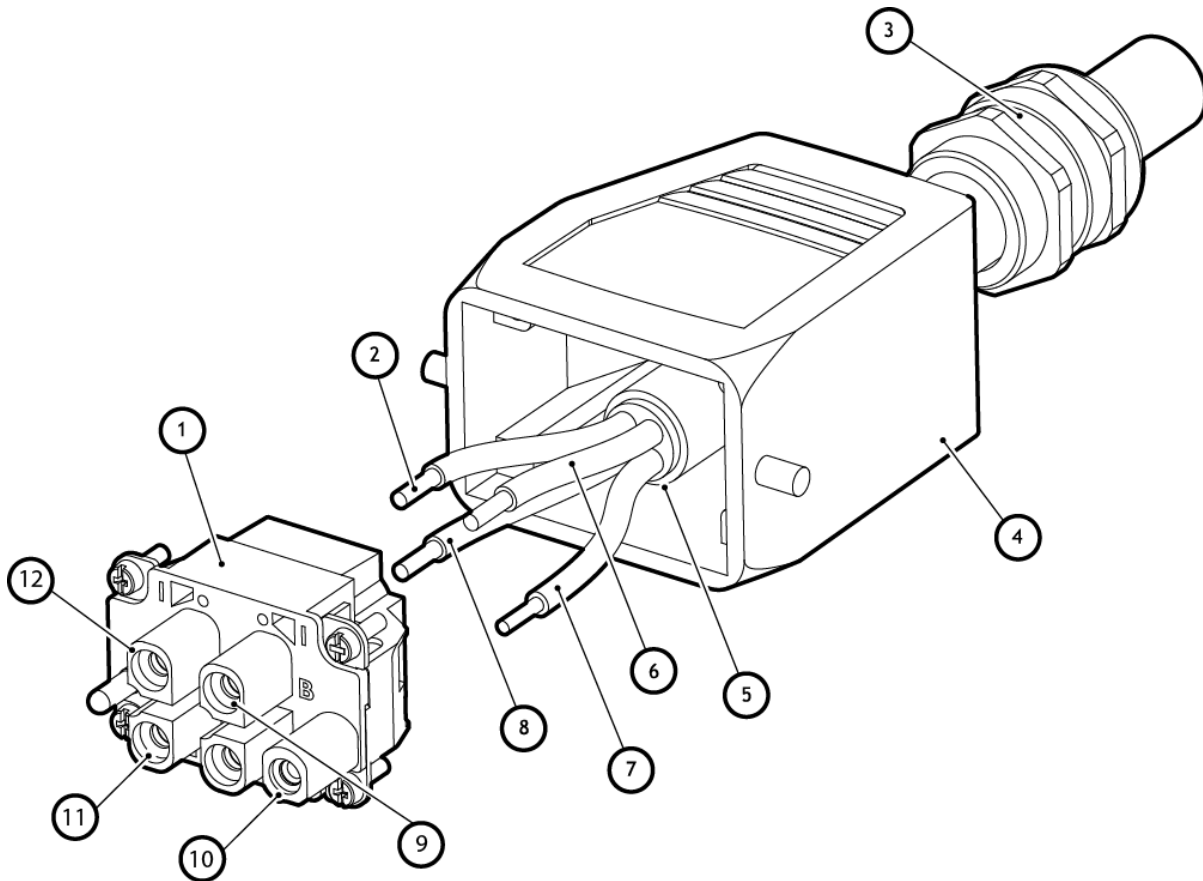


4. Before starting the assembly, use the hex (Allen) key as shown in [Figure 11](#) to ensure that the axial cone is screwed fully anticlockwise to completely open the contact chamber.



5. For the three live conductors (L1, L2, L3), carefully remove the cable insulation to the exact dimension specified in the appropriate figure. Do not twist the cable strands.
6. Referring to [Figure 10](#), connect the three live conductors to the following connections on the connector block: L1 to a1, L2 to a2 and L3 to b1. Insert each wire completely into the contact chamber until the copper strands reach the bottom. Tighten the connection using a 2mm allen key as shown in [Figure 11](#) to a torque of 1.1 Nm. Keep the cable in position while applying the recommended tightening torque.

**Figure 10 - Mains input supply connector**



dcs-6124-012

Item	Control/connector identification
1	Connector Block
2	L1
3	Cable Gland
4	Hood

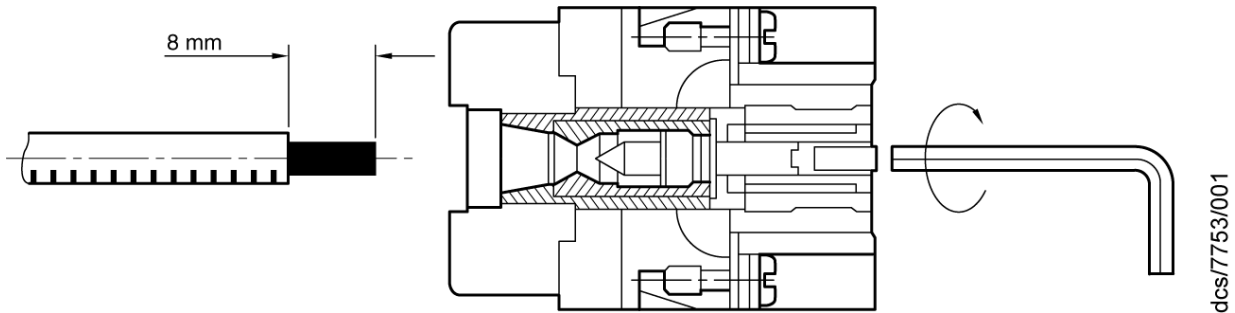
Item	Control/connector identification
5	3-Phase Mains Cable
6	L3
7	Earth
8	L2

Item	Control/connector identification
9	b1
10	Protective Earth
11	a2
12	a1

7. Fit the earth (ground) wire to the Protective Earth connection on the connector block as shown in [Figure 10](#) using the following procedure:
  - Prepare the end of the 6 mm<sup>2</sup> earth wire to a strip length of 10 mm and twist the strands.
  - Insert the wire into the earth terminal block.
  - Tighten the connection using a flat blade screwdriver.
8. Refit the outer cover to the connector block then tighten the cable gland.



**Figure 11 - Method for connecting phase wires**



9. Connect the mating half to the electrical supply connector of the dry pump system (Figure 4, item 12) by following the procedure in Section 3.7.2.

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 (M5). See Figure 12.

**Figure 12 - Protective Earth (PE) connection**



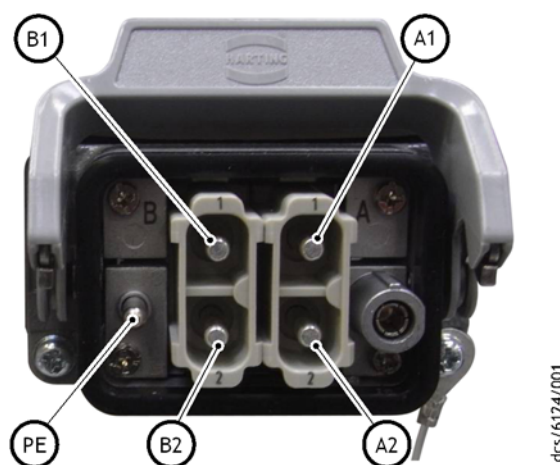
### 3.7.2 Electrical connector locking mechanism

This product is approved permanently connected equipment and must be used as described below:

The pumping system has an electrical connector locking mechanism (Figure 4, item 13) that requires the use of a suitable screwdriver to release. The pumping system is supplied with a protective cover (Figure 14, item 4) fitted and the locking mechanism (item 1) may be applied. Follow the following instructions to fit the electrical supply cable.

- Slacken off the locking screws (item 2) by a few turns to loosen the locking mechanism if necessary.
- Move the locking mechanism (item 1) to the left as far as possible.
- Push up the lever (item 3) to release the protective cover.
- Remove the protective cover and fit the electrical supply cable.
- Pull the lever downwards to lock the electrical supply cable connector in place.
- Push the locking mechanism as far as possible to the right so that it prevents the lever from actuating.
- Tighten the locking screws (item 2) to firmly hold the locking mechanism in place.
- Connect the other end of the electrical supply cable to the electrical supply through a suitable isolator.

Figure 13 - Mains connector on Pump bulkhead

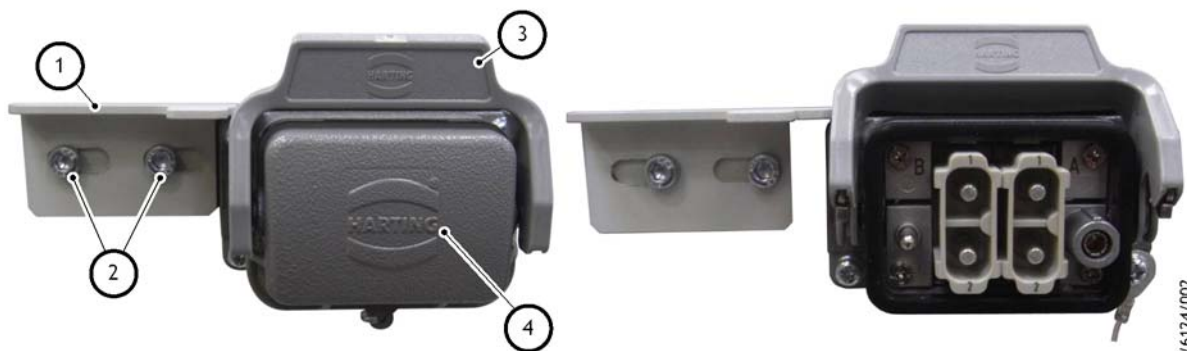


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Pin identification

Pin A1	Phase 1
Pin A2	Phase 2
Pin B1	Phase 3
Pin B2	Not connected
Pin PE	Protective Earth

Figure 14 - Electrical connector locking mechanism



Locking mechanism in locked position

Locking mechanism in unlocked position

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Item	Control/connector identification
1	Electrical connector locking mechanism
2	Locking screws
3	Lever
4	Protective cover

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

If the system will be operated in an area subject to high RF (radio frequency) emissions, in accordance with good RF installation practice, Edwards recommends:

- Using a star washer to connect the end of the earth (ground) cable (Figure 3, item 6), connected to the system inlet, to one of the bolts used to secure the inlet flange.
- Connecting an additional earth (ground) cable to the RF earth (ground) stud (M6) (Figure 4, item 20). Use a suitable low-impedance cable (for example, use braided cable).

Figure 15 - RF Earth connection



### 3.9 Connect to the emergency stop circuit

The EMS (Emergency Stop) button on the front panel of the system (Figure 2, item 1) is used to stop the pump in an emergency.

**Note:** *Used on its own, the EMS does not isolate the electrical supply to the pumping system and so does not provide an EMO (Emergency Off) function. This function can be provided by using an Edwards Disconnect Box available as an accessory, see Section 7.3.*

The pumping system has an emergency stop circuit that can be connected to the customer control equipment. (In this case, the emergency stop control should be compliant with IEC 60947-5-1, a red self-latching mushroom push button on a yellow background).

If operating the pumping system without connecting it to the customer control equipment, fit the external EMS link plug (supplied) to the EMS connection on the rear of the system (Figure 4, item 10). If the EMS link plug is not fitted, the system will not operate.

#### 3.9.1 Semi S2 requirements

If EMO functionality is required (for example, to satisfy the requirements of Semi S2), install the pumping system in combination with an Edwards Disconnect Box (available as an accessory, refer to Section 7.3). The Disconnect Box, when fitted, is used to energise and isolate the power supply to the system. It also allows isolation of the electrical supply for maintenance and trouble shooting the system. Refer to the Disconnect Box manual for installation instructions and information about the different ways the pumping system can be shut down in an emergency.

For pumps that are installed into an integrated system and receive power from that system, an emergency off can be achieved by connecting the emergency stop circuit on the pump into the integrated system's emergency off circuit.

Refer to Section 4.6 for more information about pump behaviour after an emergency stop.

## 3.10 Connect and set up the cooling water

### CAUTION

Water only flows if the pump is running or for about 10 seconds when the pump is first energised. The water circulation system may be damaged if it cannot tolerate a no flow condition.

- Notes:**
1. For optimum water cooling, ensure that the cooling water supply meets the specification given in [Section 2.6](#). Ensure water supplies are connected in parallel. Refer to [Figure 4](#), items 15 and 18. Edwards recommends that quick connectors be used to reduce the risk of water spillage during connection/disconnection.
  2. For minimum water consumption, regulate the cooling water flow to the system. For this purpose, a Constant Flow control water valve kit is available as an accessory. Refer to [Section 7.3](#).

Use the following procedure to connect the cooling water supply and ensure that the system is receiving the correct water flow rate. Before starting the procedure, ensure that the electrical power supply to the system is switched off.

1. Connect the supply and return hoses to the pump.
2. Turn on the cooling water supply.
3. Switch on the electrical power to the system. The water valves in the pump cooling system will automatically open in a pre-determined sequence.
4. Inspect the water hoses, pipelines and connections and check that there are no leaks.

Turn off the water supply while completing the remainder of the installation procedure.

## 3.11 Accessories

The accessories available for use with the system are described in [Section 7.3](#). Refer to the individual accessories manuals for information about installation.

## 3.12 Commission the system

### WARNING



During some application cycles it is possible that the system may exceed OSHA 1910.95 Occupational Noise Exposure Limits, the EU noise directive 2003/10/EC or other regional noise limits dependent upon the process, duty cycle, installation or environment in which the pumping system is 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.

1. Switch on the external electrical supply and check that the POWER LEDs ([Figure 2](#), item 7 and [Figure 4](#), item 4) go on. If the LEDs do not go on, contact Edwards.
2. Switch on the cooling water and nitrogen supplies.
3. Ensure that the exhaust extraction system is not blocked (for example, that valves in the exhaust extraction system are open).
4. Ensure that all openings to atmospheric pressure in the foreline vacuum system are closed.
5. Press the LOCAL CONTROL button ([Figure 2](#), item 5) and check that the green LOCAL CONTROL LED ([Figure 2](#), item 6) comes on and then remains continuously illuminated.

6. Press the START button (Figure 2, item 3)
7. If the system starts and continues to operate, continue at Step 8. If a warning or alarm condition is indicated:
  - Shut down the system: refer to Section 4.3.
  - Contact Edwards.
8. For N variant pumps fitted with a gas module, the nitrogen purge flow should be checked as follows:
  - Check the reading on the gas module flow meter which is located at the rear of the pump (Figure 16) and confirm the flow is 10 slm for iXL600N/iXL1000N and iXL600N/iXL1000N MFT variants (factory default setting). The centre of the ball should be aligned to the appropriate marking on the flow tube. If NOT then proceed as follows:
    - Insert the screw driver into hole 1 and adjust variable restrictor until the flow tube indicates the required flow rate. If a different nitrogen flow rate is required please contact Edwards for further advice.
9. Look at the pressure gauge in the inlet pipeline.
  - If the pressure is increasing, immediately shut down the system, and contact Edwards.
  - If the pressure is decreasing continue at Step 10.
10. After the system has been commissioned:
  - To continue to operate the system, refer to Section 4.1.
  - To shut down the system, refer to Section 4.3.

Figure 16 - Nitrogen flow meter



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### 3.13 Install additional safety equipment



#### **WARNING**

If the Process Tool/control system needs to know the total flow rate of nitrogen to the system for safety reasons, install suitable measurement equipment in the nitrogen supply pipeline.



#### **WARNING**

If using nitrogen purge to dilute dangerous gases to a safe level, ensure that the system shuts down if the nitrogen supply to the system fails.

If the sensors or microprocessors fail, the total flow rate of nitrogen displayed or output by the pumping system may be incorrect. If the total flow rate of nitrogen to the dry pump is required for safety reasons, fit suitable measurement equipment in the nitrogen supply pipeline. If a rotameter is fitted, ensure that it is suitable for use with nitrogen and that it is correctly calibrated.

If the nitrogen supply to the pumping system fails (iXL600N/iXL1000N MFT variant only), a warning LED will illuminate and a message will be shown on the Pump Display Terminal (if fitted) and will be sent to any interfacing system connected to the pumping system. Ensure that the installation is configured so that it remains safe if there is a failure of the nitrogen supply to the pumping system.

If an alarm condition is detected (and the pumping system is not configured to 'run til crash' refer to [Section 4.4](#)) the pumping system will shut down automatically. Ensure that the installation remains safe if the pumping system shuts down automatically.

## 4 Operation



### 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. In accordance with Semi S2, hot surface warning labels are applied to the panels where appropriate because testing has shown that accessible temperatures can exceed 65 °C in small areas at worst case pressure conditions at an ambient temperature of 40 °C. Under normal process operating conditions and an ambient below 25 °C, accessible enclosure temperatures are unlikely to reach this level.



### WARNING

Do not operate the system with any enclosures removed or damaged. If the system is operated with enclosures removed or damaged, there may be a risk of an electric shock.

### 4.1 Start-up



### WARNING

Ensure that it is safe to start the system. Failure to ensure a safe start (for example, if maintenance is being performed on components downstream of the system) may result in injury to people and damage to equipment.



### WARNING

After the power is applied, all mains circuits will be energised.

### CAUTION

The system is designed to ride through transient term power interruption and to automatically restart once the power is restored.

### CAUTION

Do not operate the pump if the pipeline is restricted or blocked as the pump will not operate correctly and may be damaged.

1. Switch on the electrical supply.
2. Switch on the cooling water supply.
3. Switch on the nitrogen supply if connected.
4. Check that the exhaust extraction system is not restricted, and that any valves in the exhaust extraction system are open.

The pump can be started using the front panel control, or the Pump Display Terminal (PDT) accessory, or the MicroTim accessory (refer to [Section 7.3](#)).



### 4.1.1 Front panel control operation

To operate the system using the front panel controls (refer to [Figure 2](#)):

- Press and hold the 'Local Control' button (item 5). The Green 'Local Control' LED (item 6) will illuminate continuously when control is taken. The message 'Keys in Control' will be displayed on the PDT if connected.
- Press and hold the Start button (item 3) until the pumps starts. The Running LED (item 2) will flash whilst the pump is coming on and will remain illuminated continuously when the pump is running normally.

### 4.1.2 PDT operation

If the system is to be operated using the PDT:

- Connect the PDT to the required PDT connection, front ([Figure 2](#), item 11) or rear ([Figure 4](#) item 5).
- Control must be taken with the PDT - press 'Control' button. The message 'PDT2 IN CONTROL' will be displayed if the front connection is used and the message 'PDT1 IN CONTROL' will be displayed if the rear connection is used.
- Press START button.
- Press ENTER.
- The system will start and the Running LEDs will be illuminated.

**Note:** For a list of PDT accessories refer to [Section 7.3](#).

### 4.1.3 MicroTIM operation

If the system is to be operated by the customer control equipment using a MicroTIM, ensure that no other devices have control of the pumping system. If other devices have control, first release control before starting the pump using the MicroTIM.

- Use the customer control equipment to set the pump start/stop signal to the interface connector and check that the Running LEDs are illuminated.
- The MicroTIM takes control. The message 'MTIM IN CONTROL' will be displayed on the PDT if connected. The green 'Tool Control' LED ([Figure 4](#), item 9) on the rear panel will illuminate.

**Note:** For a list of MicroTIM accessories refer to [Section 7.3](#).

## 4.2 Status indicators

If the pump encounters a problem, warning/alarm LEDs (refer to [Figures 2](#) and [4](#)) will illuminate to indicate system status. Also refer to [Appendix A2](#) for corrective actions should the system develop a problem.



## 4.3 Manual shut-down



### WARNING

If the system is shut down and is not isolated from the electrical supply, do not release control. If control is released, the system could be started by another Module.



### 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

If the pump is stopped without the nitrogen purge cycle, for example by using the EMS button, on processes that have condensable or solid by-products, then the pump may not restart.

The pump can be shut down using the front panel controls, the MicroTIM or the PDT. Note that only the item in control can stop the pump (refer to [Section 1.4](#)).

**Note:** The EMS button will always stop the pump. It does not matter which item has control. Refer to [Section 4.6](#).

If the pump is not going to be required for some time, switch off the electrical supply and the cooling water supply.

### 4.3.1 Shut-down modes

**Auto shut-down** introduces a nitrogen purge cycle (N variant pumps) which lasts for 15 minutes before the pump is shut down. This is the recommended shut-down mode.

**Fast shut-down** immediately stops the pump without gas purge.

### 4.3.2 Front panel control operation

Press and hold the stop button ([Figure 2](#), item 4) for 5 seconds to stop the pump in Auto shut-down mode (recommended, refer to [Section 4.3.1](#) above). Repeat within 10 seconds to stop the pump in Fast shut-down mode. The running LED ([Figure 2](#), item 2) flashes whilst the pump is slowing down and will then turn off when the pump has shut down.

### 4.3.3 PDT operation

Press the stop button on the PDT (refer to [Appendix A1](#) for more information). Select either Auto or Fast shut-down mode.

### 4.3.4 MicroTIM operation

Use the customer control equipment to reset the pump start/stop signal to the interface connector. The Running LEDs will then go off, and the pump running status output signal will open.

## 4.4 Automatic shut-down

### CAUTION

If 'Run 'til crash' is selected, the pump(s) can be damaged and warranties may be invalidated.

Normally, if an alarm condition exists, the control system will shut down the system.

- Notes:**
1. If required, 'Run 'til crash' operation can be selected. In this mode of operation, most alarm conditions will be ignored and the pump(s) will continue to operate. For safety reasons, some alarms cannot be overridden and the system will automatically shut down even if 'Run 'til crash' has been selected. Refer to [Table 13](#).
  2. 'Run 'til crash' is automatically reset to 'off' when the electrical supply is removed.
  3. The Tool Interface overrides the 'Run 'til crash' state selected provided it has control of the pump.

Table 13 - Alarm actions

Alarm Description	Alarm stops dry pump	Alarm stops booster pump	Alarm overrides 'Run 'til crash'
EMS or System Configuration (set-up) fault	Yes	Yes	Yes
Booster Stator or End Cover Temperature	No	Yes	No
Dry Pump Stator or End Cover Temperature	Yes	Yes	No
Booster status	No	Yes	Yes
Dry Pump status	Yes	Yes	Yes

## 4.5 Unplanned shut down and alarms

The system is fitted with a number of pump protection sensors that will give warnings and alarms, refer to [Table 14](#). Once an alarm is triggered, the power to the motors is shut off. This will only occur in extreme fault conditions.

Table 14 - Pump protection sensors

Sensor	Warning condition triggered	Alarm condition triggered
Dry pump body temperature	104 °C	112 °C
Booster pump body temperature	120 °C	130 °C
Booster pump end cover temperature	100 °C	110 °C

Refer to [Section 4.4](#) for information about alarms and automatic shut-down conditions.

If the system has an unplanned shut-down, ensure that the cause of the shut-down is identified and rectified before restarting. If a PDT is connected to the pump, note and record any warning or alarm codes that are displayed (see [Appendix A2](#)) to assist with identifying the root cause of the shut-down or alarm. If in any doubt, contact an Edwards Service Engineer.

- Note:** The high temperature alarms on Edwards vacuum pumping systems are system protection trips and should be considered as an abnormal running condition. If a system has tripped due to any high temperature alarm the system should be investigated and the reason for the alarm established. Once the fault has been remedied the system should be left for a minimum of 30 minutes before attempting to restart.

## 4.6 Emergency stop

**Note:** *The emergency stop switch is not an electrical isolator.*

To shut down the system in an emergency, press the emergency stop switch (Figure 2, item 1). Alternatively, if the customer emergency stop circuit was connected to the system as described in Section 3.9, operate the emergency stop controls in the customer control system.

When emergency stop is selected:

- The dry pump and/or the booster pump is switched off.
- The solenoid valve(s) in the Gas Module (if fitted) close, to switch off the supply of nitrogen to the pump.
- The solenoid valve(s) in the temperature control manifold(s) de-energise with loss of temperature control.
- The Pump Display Terminal will display '1.01 ALARM/STOP ACTIVATED' (if connected) or it may display 'ALARM 186.01 / DP INV 0040 000 / EMS'
- The Running LED will go off.
- The Alarm LED illuminates.

## 4.7 Restart the pump after an emergency stop or automatic shut-down

**Note:** *If the system has automatically shut down because of high pump power, check that the pump is free to rotate before restarting the system. Contact Edwards.*

If the emergency stop switch on the front panel was used to shut down the system, the emergency stop switch must be reset before restarting the system. Turn the emergency stop switch to reset it, then restart the system as described in Section 4.1.

If the system has been automatically shut down because of an alarm condition, the alarm condition must be rectified before the system can be restarted. Restart the system as described in Section 4.1.

## 4.8 Advanced control and monitoring

FabWorks-iMS is a tool that can be used to monitor pumping systems over a network. Contact Edwards for more information.

For advanced applications, Edwards has a tool that allows the pumping system configuration to be changed. Contact Edwards for more information.

## 5 Maintenance



### WARNING

Only personnel specially trained to perform electrical maintenance should attempt troubleshooting inside electrical enclosures. These enclosures contain hazardous voltages and are not operator areas.



### WARNING

Leak test the system after maintenance and seal any leaks found to prevent leakage of dangerous substances out of the system and leakage of air into the system.

### 5.1 Safety and maintenance frequency



### WARNING

Obey the safety instructions in this Section and take note of appropriate precautions. Failure to observe these instructions may result in injury to people and damage to equipment.



### WARNING

Electrical, nitrogen and water supplies are all potentially hazardous energy sources. Before carrying out any maintenance, the supply of these sources should be locked and tagged out.



### WARNING

Do not touch the pump exhaust and check valve (if fitted) whilst the pump is running since the temperatures of these parts can cause burns. These parts will remain hot after the pump has stopped.



### WARNING

Personal protective 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 fluorinated materials which may have been exposed to temperatures greater than 260 °C. Refer to Edwards Material Safety Data Sheets for detailed information.

- Ensure that the maintenance technician is familiar with the safety procedures which relate to the products pumped.
- Allow the pumps to cool to a safe temperature before fitting lifting eye bolts or starting maintenance work.
- Vent and purge the dry pumping system with nitrogen before starting any maintenance work.
- Isolate the dry pumping system and other components in the process system from the electrical supply so that they cannot be operated accidentally. Note that the emergency stop switch on the dry pumping system is not an electrical isolator, unless a disconnect box accessory is installed.

- Wait for at least four minutes after switching off the electrical supply before touching any electrical component on the dry pumping system.
- Route and secure cables, hoses and pipelines during maintenance to avoid possible risk of trips or entrapment.
- Ensure that any oil or water collected in the secondary containment drip tray is removed before moving the system.
- The enclosure panels should only be removed with the use of a special tool, when the pump system has been stopped and allowed to cool sufficiently (as an indication the system should be left for one hour with cooling water still connected with flow characteristics as defined in [Section 2](#)).
- Wear the appropriate safety clothing when coming into contact with contaminated components. Dismantle and clean contaminated components inside a fume cupboard.
- O-ring replacement intervals vary depending on the application.
- Dispose of components, grease and oil safely.
- 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 system has been overheated to 260 °C and above. These breakdown products are very dangerous. Fluorinated materials in the system may include oils, greases and seals. The system may have overheated if it was misused, if it malfunctioned or if it was in a fire. Edwards Material Safety Data Sheets for fluorinated materials used in the pump are available on request.

The system requires little user maintenance. Pump protection sensors fitted to the system do not require routine maintenance. The maintenance operations that can be carried out by the customer are described in the following sections; other maintenance must be carried out by Edwards service centres (refer to [Section 7](#)). The frequency of maintenance operations depends on the process. Adjust the frequency of maintenance operations according to customer experience.

When maintaining the system, use replacement parts, seals and fittings supplied by Edwards, refer to [Section 7](#). Ensure that nitrogen and cooling water supplies are connected in parallel and that they meet the specifications given in [Section 2](#). Contact Edwards for more information.

## 5.2 Relocate the system for maintenance



### WARNING

The substances that accumulate in the exhaust pipe, elbow and check valve can be dangerous. Do not allow these substances to come into contact with skin or eyes. Do not inhale vapours from these substances. Fit blanking caps to the inlet and outlet flanges when moving the exhaust pipe, elbow or check valve around the workplace.

The majority of synthetic oils/grease can cause inflammation of the skin (dermatitis). Safety precautions must be taken to prevent prolonged skin contact with these substances. Use of suitable protective gloves and clothing along with a respirator is recommended if contact with the substance is anticipated. System process gases and residue can be highly toxic. Take all necessary precautions when handling components that have, or could have, come into contact with them, including O-rings, lubricants and all exhaust accessories.



### WARNING

Use suitable lifting equipment to move the system. Failure to do so can cause injury to people and damage to the equipment.



### WARNING

Do not exceed the topple angle of 10 ° when moving the pump. Wheel the system on its castors to move it into its operating position. The system should only be wheeled short distances over flat surfaces. If the floor surface is uneven or has obstacles the system should be lifted with suitable lifting equipment. If lifting the system is impractical, or there are other site difficulties, please consult Edwards for further advice.

### CAUTION

Drain the cooling water from the system if it will transported or stored in conditions where the cooling water could freeze. If the cooling water is not drained from the system, it may freeze in the system and damage the pump(s) and/or the cooling water pipelines.

If removing the system from its operating location and moving it to another location for maintenance, use the following procedure.

1. Purge the system and shut down as described in [Section 4](#) and allow the system to cool down.
2. Isolate the power and then disconnect the mating-half from the electrical supply connector, then isolate the water and the gas purge supply.
3. Switch off the nitrogen and cooling water supplies. Disconnect the nitrogen supply, taking care as any trapped gas under pressure is released. Disconnect the cooling water supply followed by the cooling water return.
4. Disconnect the inlet and outlet from the vacuum and exhaust systems and fit sealed blanking caps.
5. If necessary, disconnect the air extraction port from the factory extraction system.
6. If necessary disconnect any accessories from the system.
7. Adjust the levelling feet so that the system rests on the castors.
8. Move the system to the maintenance location.

After maintenance is complete, re-install the system as described in [Section 3](#).

## 5.3 Draining the cooling water

### WARNING



Use of suitable protective gloves and eye protection is recommended when carrying out this procedure. Personal protective equipment should be checked and used as specified by its supplier.

1. Relocate the system for maintenance as stated in [Section 5.2](#).
2. Connect a regulated clean dry air supply (5 barg or 73 psig) to the cooling water supply connection ([Figure 4](#), item 15). Do not turn on the air supply yet.
3. Connect a drain hose to the cooling water return connection ([Figure 4](#), item 18). Position the open end of the drain hose in a suitable collection container.
4. Turn on the clean dry air supply.

5. Fit the external EMS link plug (supplied) to the EMS connection on the rear of the system (Figure 4, item 10). If the plug is not fitted, the water system cannot be purged effectively.
6. Monitor the drain hose outlet.
7. Connect the system to a suitable mains electrical supply. The control system will now open each temperature control valve, purging the cooling water from all flow paths. After two minutes, remove the electrical supply. Wait for 10 seconds and then re-connect the electrical supply and repeat the entire process. Continue repeating until no further cooling water is purged from the system.
8. The cooling water drain procedure is now complete. Disconnect the air supply, electrical supply and the drain hoses. Dispose of the drained cooling water appropriately.

## 5.4 General maintenance

### CAUTION

Do not use cleaning materials based on strong alkalis, aggressive or chlorinated solvents. Do not use cleaning materials containing abrasives.

The pumping system is given a charge of oil before leaving the factory. There is no requirement to check and adjust the oil level between major overhauls.

Edwards recommends that carrying out a monthly visual inspection of the system in situ. Check that the cables, hoses and pipelines bringing services to the pump are in good condition and ensure that all connections are secure.

The following maintenance can also be carried out on the system. Contact Edwards for details and training.

- Inspect the connections, pipelines, cables and fittings inside the pump enclosure, refer to Section 5.5.
- Inspect and clean exhaust pipe, elbow, and check valve.

**Note:** The system is supplied with either a trapped O-ring or a metal seal for the exhaust connection, depending on pump type and anticipated exhaust temperatures. Ensure that seals are always replaced with the same type.

## 5.5 Inspect the connections, pipelines, cables and fittings



### WARNING

Electrical, nitrogen and water supplies are all potentially hazardous energy sources. Before carrying out any maintenance, the supply of these sources should be locked and tagged out.

If the system is not relocated for maintenance, ensure all supplies are locked out and tagged out before starting the following procedure.

1. Remove the enclosure side and top panels.
2. Check that all the connections are secure; tighten any loose connections. Inspect all cables, pipelines, hoses and connections and check that they are not corroded or damaged and do not leak; repair or replace any pipelines, hoses and connections that are corroded or damaged, or which leak.
3. Refit the enclosure side and top panels.

## 5.6 Gas module configuration

The gas module has no user-configurable options but it is recommended to periodically check the nitrogen flow on an N variant pump and adjust if necessary. Contact Edwards for process specific requirements.

## 6 Transportation, storage and disposal

### 6.1 Transportation



#### WARNING

Do not drain the oil from the pump(s) whether dangerous substances have been pumped or not. Fit blanking plates to seal all vacuum inlet and outlet ports (to prevent possible oil leakage). Ensure that the system is correctly labelled. If in doubt, contact Edwards.

Follow the procedure laid out in [Section 6.2](#) and then read form HS1 and fill out form HS2, which can be found at the back of this manual.

### 6.2 Storage

Drain the cooling water from the system if it will be transported or stored in conditions where the cooling water could freeze (refer to [Section 5.3](#)). If the cooling water is not drained from the system, it may freeze in the system and damage the pump(s) and/or the cooling water pipelines.

Store the system as follows:

1. Follow the procedure set out in [Section 5.2](#).
2. Store the system in clean dry conditions until required.
3. When required for use, prepare and install the system as described in [Section 3](#) of this manual.

### 6.3 Disposal



#### WARNING

Dispose of the system and any components safely and in accordance with all local and national safety and environmental requirements.

This equipment may contain a lithium manganese dioxide battery which, under California law, requires notification for the presence of perchlorate: Perchlorate Material - special handling may apply, refer to [www.dtsc.ca.gov/hazardouswaste/perchlorate/](http://www.dtsc.ca.gov/hazardouswaste/perchlorate/).

Edwards products are supported by a world-wide network of Edwards Service Centres. Each Service Centre offers a wide range of options including disposal. Refer to [Section 7.2](#) for more information.

Pump system materials suitable for recycling include cast iron, steel, PTFE, stainless steel, brass, aluminium, zinc alloy, nickel, mild steel, ABS, polyamide.

Take particular care with the following:

- Fluoroelastomers which may have decomposed as the result of being subjected to high temperatures.
- Components which have been contaminated with dangerous process substances.
- Lithium battery.



## 7 Service, spares and accessories

### 7.1 Introduction



#### WARNING

When returning the system to an Edwards Service Centre or other Edwards company, comply with the requirements of [Section 7](#) and with the requirements of the Return of Edwards Equipment Procedure (refer to forms HS1 and HS2 at the rear of this manual).

**Note:** Do not drain the oil from the pumping system. Clearly state the pump is full of oil when completing form HS2.

Edwards products, spares and accessories are available from Edwards companies in Belgium, Brazil, China, France, Germany, Israel, Italy, Japan, Korea, Singapore, 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 the nearest Edwards company or distributor. When ordering, state for each part required:

1. Model and Item Number of the equipment
2. Serial number
3. Item Number and description of part.

### 7.2 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. The local Service Centre can also provide Edwards engineers to support on-site maintenance, service or repair of the equipment. For more information about service options, contact the nearest Service Centre or other Edwards company.

## 7.3 Accessories

The accessories available for use with the iXL 600 and iXL1000 dry pump systems are described in the following sections. Figure 17 shows how the accessories connect to the dry pump systems.

### 7.3.1 Disconnect box

The disconnect box ensures full compliance with SEMI S2 by providing true EMO functionality and also provides interlock with photohelic switch.

Table 15 - Disconnect box

Item	Item number
Disconnect box 200 - 230 V 50 - 60 Hz 3 Phase, 25 A	Contact Edwards

### 7.3.2 Accessory modules

Two accessory modules are available for the dry pump system. The Active Accessory Module (AAM) provides connectivity for up to three directly connected accessories including a gate valve, abatement and water flow sensor, plus up to two supported active accessories, two thermocouples and the pump status output. The Passive Accessory Module (PAM) allows up to 3 accessories to be connected to the accessory module interface.

An accessory module extension cable allows the AAM or PAM to be mounted up to 5 m away from the dry pump system.

Table 16 - Accessories modules

Accessory module	Item number
AAM	D37480500
PAM	D37480550
Accessory module extension cable (5 m)	D37491502

### 7.3.3 Pump Display Terminal (PDT)

The PDT allows control and monitoring of the dry pump system.

Table 17 - PDT

Item	Item number
PDT	D37280700

### 7.3.4 PDT holster

The PDT holster retains the PDT and is attached to the pump or tool frame.

Table 18 - PDT holster

Item	Item number
PDT holster	D37209800

### 7.3.5 PDT extension cable

The PDT extension cable allows a PDT to be used away from the pump.

Table 19 - PDT extension cable

PDT extension cable	Item number
3 m	D37370591
5 m	D37370592
10 m	D37370595
15 m	D37370596
25 m	D37370597

### 7.3.6 Water flow control valve (2 lpm) & monitor assembly

The water flow control valve controls the flow of water through the pump to 2 lpm. The water flow monitor provides flow rate and displays on PDT.

Table 20 - Water flow monitor assembly

Item	Item number
Water flow control valve kit	A50739000
Water flow monitor assembly	A50799000

### 7.3.7 Earth leakage circuit breaker

Installations requiring an Earth leakage circuit breaker.

Table 21 - Earth leakage circuit breaker

Item	Item number
Earth leakage circuit breaker (ELCB)	Contact Edwards

### 7.3.8 Seismic restraint brackets

Installations requiring seismic restraints.

Table 22 - Seismic brackets

Item	Item number
Seismic brackets (4 off)	A50911016

### 7.3.9 Photohelic gauge chimney

Monitors flow of extracted air from pump enclosure to satisfy SEMI S2 requirements. If flow drops below set level, disconnect box stops pump.

Table 23 - Photohelic gauge assembly

Item	Item number
Extraction port chimney	A50798010
Photohelic switch/gauge	Contact Edwards

### 7.3.10 Nitrogen flow switch assembly

Provides a signal when flow is within limits and may be used as an interlock.

Table 24 - Nitrogen switch assembly

Item	Item number
Nitrogen flow switch assembly	A50797000

### 7.3.11 Interface modules

#### 7.3.11.1 MicroTIM

Tool specific control & monitoring via parallel interface (except for LAM-LON & RS232 Micro-TIM's which are serial interface devices).

Table 25 - MicroTIM modules

MicroTIMs	Item number
SPI	D37360310
MCM	D37360320
TEL	D37360330
Semi E73	D37360340
LAM Alliance	D37360350
C3	D37360360
Hitachi	D37360370
Config Storage	D37360390
eTIM	D37361500
LAM-LON	D37362000
RS232	D37370385

#### 7.3.11.2 EMS modules

Tool specific emergency stop interfaces.

Table 26 - EMS modules

EMS Modules	Item number
SPI	D37370310
MCM	D37370320
TEL	D37370330
Semi E73	D37370340
LAM Alliance	D37370350
C3	D37370360
Hitachi	D37370370

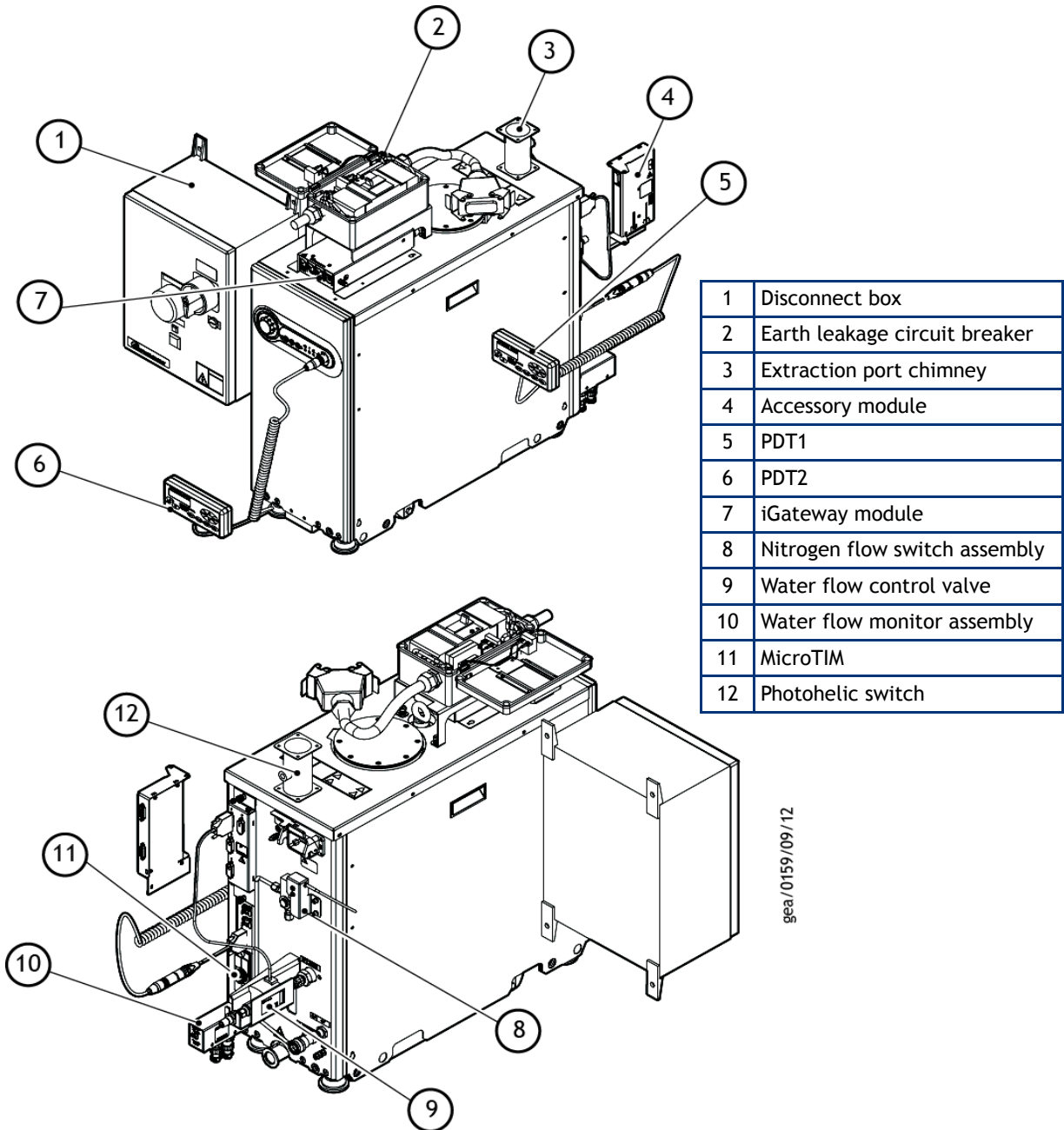
### 7.3.11.3 iGateway modules

Provides pump serial to pump LON + 2 SIM ports.

Table 27 - iGateway modules

Item	Item number
iGateway Module	D37376500

Figure 17 - Accessories



# Appendix A1 Pump display terminal

The PDT accessory provides pump on/off and status reporting. Warnings and alarms are also indicated to the user. Up to two PDTs may be fitted to the pump.

Figure A1 - Pump display terminal



## A1.1 LEDs

**Local Control** Green illuminates continuously when this PDT has control of the pump.

**Pump ON** Green (within the Pump Start button) illuminates to indicate that the pump is running.

**Warning** Yellow illuminates to indicate that a pump warning is present. It flashes when a new warning occurs until it is acknowledged by pressing 'ENTER' when it goes continuous until the warning clears.

**Alarm** Red illuminates to indicate that a pump alarm is present. It flashes when a new alarm occurs until it is acknowledged by pressing 'ENTER' when it goes continuous until the alarm clears.

## A1.2 Pump start / stop and control

To Start or Stop the pump the PDT must be in control, indicated by the **Local Control** LED being illuminated.

To take or release control briefly press **Control**.

If something else is in control, error message 'Control locked' appears, refer to 'Control Holder' in the **Status** menu.

Press **Start**  button PDT displays:

Table A1 - Pump start control

Pump State	Local Control LED	PDT display	Operator	Pump response
Stopped	On	START MENU Start Pump	Press <b>ENTER</b> to confirm	Pump Starts
Running	On	Pump Running Press <b>CANCEL</b>	Press <b>CANCEL</b>	No change (running)
Stopped or Running	Off	No PDT Control Press <b>CANCEL</b>	Press <b>CANCEL</b>	No change

Press **Stop**  button PDT displays:

**Table A2 - Pump stop and control**

Pump State	Local Control LED	PDT display	Operator	Pump response
Stopped	On	PUMP Stopped Press CANCEL	Press <b>CANCEL</b>	No change (stopped)
Running	On	STOP MENU Fast Shutdown	If Auto Shutdown is required press down arrow. Press <b>ENTER</b> to confirm	Pump Stops
Stopped or Running	Off	No PDT Control Press CANCEL	Press <b>CANCEL</b>	No change

### A1.3 Warning / Alarm display and acknowledgement

Each new warning / alarm is displayed when it occurs, overwriting any text already present unless another unacknowledged warning / alarm is currently being displayed. The corresponding **Warning / Alarm** LED flashes to indicate a new warning / alarm.

Pressing **ENTER** acknowledges the warning / alarm currently displayed and the **Warning / Alarm** LED stops flashing. If available the display will show the suggested action, press **ENTER** again to clear.

If there is another new warning or alarm the **Warning / Alarm** LED will continue to flash and this is then displayed, otherwise the display will revert to the original text from before the alarm(s) / warning(s) occurred.

If there are warnings / alarms still present, but they are all acknowledged, then the corresponding LED remains continuously illuminated. The text indicating acknowledged warning / alarm conditions still present may be viewed in the **Status** menu, see below. Some Alarms such as 1.01 STOP ACTIVATED remain present until the pump is manually started from the PDT or front panel controls.

Once all warning/alarm conditions have gone away, then the corresponding LED is extinguished.

To avoid a build up of out of date Warnings they are automatically acknowledged after 36 hours.

### A1.4 Menus

There are three menu buttons **Normal**, **Status** and **Setup** described below.

NR in the data part of a parameter indicates No Reading.

NP in the data part of a parameter indicates a parameter that is Not Present.

#### A1.4.1 Normal menu

This menu is displayed when the PDT is first plugged into the pump, or accessed by pressing the **Normal** button. Up to 4 parameters are displayed, scroll by pressing up/down keys.

**Table A3 - Normal menu**

Description	Typical Display
Serial Number	S/N 1234567
Control Holder	NONE IN CONTROL
Dry Pump current	DP CURRENT 1.1A
Booster current	MB CURRENT 1.1A

By default the 4 parameters displayed in the Normal menu are as shown above but these may be changed via the Edit Display attributes menu, accessed from the **SETUP** menu.

### A1.4.2 Status menu

Press the **Status** button to enter. Scroll by pressing up/down keys. Press **CANCEL** to exit back to **Normal** menu.

If a device is not fitted the associated parameters will not be displayed. Parameters displayed:

**Table A4 - Status menu**

Description	Typical Display
Serial Number	S/N 1234567
Control Holder	NONE IN CONTROL
Dry Pump current	DP CURRENT 1.1A
Booster current	MB CURRENT 1.1A
Green Mode state	Green Mode STATE Off
Dry Pump temperature	DP TEMP 100C
Booster Temperature	MB TEMP 100C
Booster MB End Cover temperature	MB E/C TEMP 100C
N <sub>2</sub> Flow Rate	N <sub>2</sub> FLOW 44 slm
Dry Pump Power	DP POWER 1.1 kW
Booster Power	MB POWER 1.1 kW
Dry Pump speed in percent	DP SPEED 100 %
Dry Pump speed in Hz	DP SPEED 100 Hz
Booster speed in percent	MB SPEED 100 %
Booster speed in Hz	MB SPEED 100 Hz
Dry Pump Inverter Temperature	DP INV TEMP 100C
Booster Inverter Temperature	MB INV TEMP 100C
Run Hours	RUN HOURS 1000
Number of Pump Starts	PUMP STARTS 100
Time to Stop (seconds)	TIME TO STOP 900
Active Alarms and Warnings (if present)	

### A1.4.3 SETUP menu

Press the **Setup** button to enter. Menu title is shown at the top of the display. Scroll by pressing up/down keys. Press **ENTER** to open a sub menu or **CANCEL** to exit back to **Normal** menu.

**Table A5 - SETUP menu**

Description	Display
Commands menu *	Command Menu...
Display Inverter Fault History menu	Inv Fault Hist...
Software Version Display menu	S/W Version...
Display Serial Number	Serial Num...
Fit Accessory menu *	Fit Accessory...
Edit IP configuration menu	IP Config...



Table A5 - SETUP menu

Description	Display
Edit Display attributes menu	Display Attr...
Set Time and Date <sup>†</sup>	Set Clock...
Display Pump Type	Show Pump type...

\* This option requires a security code to access it.

<sup>†</sup> Time is set automatically when connected to a Fabworks network.

Each sub menu is described below.

#### A1.4.4 COMMANDS menu

Under the Setup menu. Scroll by pressing up/down keys. Press **ENTER** to open a sub menu or **CANCEL** to exit back to the **SETUP** menu.

Table A6 - COMMANDS menu

Gate Valve (Open/Shut)*
MB Pump (On/Off) <sup>†</sup>
PB Pump (On/Off) <sup>†</sup>
Green Mode State (On/Off) <sup>†</sup>

\* This option requires a security code to access it.

<sup>†</sup> The PDT must be in control to perform these functions.

Press the up/down keys to select the new settings and press **ENTER** to accept or **CANCEL** to exit back to the **COMMANDS** menu.

#### A1.4.5 INV FAULT HIST (Display Inverter Fault History) menu

Under the Setup menu. Scroll by pressing up/down keys. Press **ENTER** to open a sub menu or **CANCEL** to exit back to the **Setup** menu.

Table A7 - INV FAULT HIST (Display Inverter Fault History) menu

DP Inv Fault Hist (Dry Pump Inverter Fault History)
MB Inv Fault Hist (Booster Inverter Fault History)

Each inverter fault history contains up to 32 entries, each contains one alarm and one warning, where 1 is the most recent. Scroll by pressing up/down keys. Press **CANCEL** to exit back to the Inverter Fault History menu.

The inverter fault information is displayed in the following format:

DP Inv Fault nn  
 A:aaaa W:www

where nn is the number, aaaa is the alarm code, and www is the warning code.

Refer to [Section A2.3](#) for more information about inverter warnings and alarms.

#### A1.4.6 SOFTWARE VERSION Display menu

Under the Setup menu. Scroll through the software version loaded in the processors by pressing up/down keys. Press **CANCEL** to exit back to the **SETUP** menu.

### A1.4.7 FIT ACCESSORY menu

Under the Setup menu. Scroll by pressing up/down keys. Press **ENTER** to open a sub menu or **CANCEL** to exit back to the **Setup** menu.

Table A8 - FIT ACCESSORY menu

Gate Valve...	
Water Sensor...	(Analogue water flow)
Active Gauge...	
Exh Gas Temp...	(Exhaust Gas Temperature)

For an accessory press the up/down keys to select Fitted or Not Fitted and press **ENTER** to accept or **CANCEL** to exit back to the **COMMANDS** menu.

**Note:** Gate Valves additionally have an option of Fitted No Feedback for use where there are no position feedback switches fitted to the gate valve.

### A1.4.8 IP Configuration menu

Under the Setup menu. Scroll by pressing up/down keys. Press **ENTER** to open a sub menu or **CANCEL** to exit back to the **Setup** menu.

Table A9 - IP Configuration menu

Host_Name...	(display only)
DHCP Enable...	(Enabled / Disabled)*
IP Address...	(xxx.xxx.xxx.xxx) <sup>†</sup>
Address Mask...	(xxx.xxx.xxx.xxx) <sup>†</sup>
DNS Server...	(xxx.xxx.xxx.xxx) <sup>†</sup>
Gateway...	(xxx.xxx.xxx.xxx) <sup>†</sup>
NTP Server...	(display only)
SMTP Server...	(display only)
MAC Address...	(display only)
Domain Name...	(display only)

\* Press the up/down keys to select Enabled or Disabled and press **ENTER** to accept or **CANCEL** to exit back to the **IP Configuration** menu.

<sup>†</sup> For each address setting press the up/down keys to set the digit, press **ENTER** to accept and move to the next digit or **CANCEL** to move back to the previous digit. Pressing **ENTER** at the end of the line will accept the new setting and exit back to the **Edit IP** menu. Pressing **CANCEL** at the start of the line will cancel and exit back to the **IP Configuration** menu.

Display only items press **CANCEL** to exit back to the **IP Configuration** menu.

### A1.4.9 Display attributes menu

Under the Setup menu. Scroll by pressing up/down keys. Press **ENTER** to open a sub menu or **CANCEL** to exit back to the Setup menu.

**Table A10 - Display attributes menu**

Normal display (Selects the parameters displayed in Normal) Units...
---

#### **SELECT LINE (Normal display selection menu)**

Scroll by pressing up/down keys. Press **ENTER** to open a sub menu or **CANCEL** to exit back to the Display Attributes menu.

**Table A11 - SELECT LINE (Normal display selection menu)**

Top Page 1...
Bottom Page 1...
Top Page 2...
Bottom Page 2...

In each option the **SELECT PARAMETER** menu is opened, scroll through the parameters by pressing up/down keys. Press **ENTER** to select the parameter for display or **CANCEL** to exit back to the **SELECT LINE** menu.

#### **UNITS (Units to display)**

Scroll by pressing up/down keys. Press **ENTER** to open a sub menu or **CANCEL** to exit back to the Display Attributes menu.

**Table A12 - UNITS (Units to display)**

Pressure...	(PSI/kPa)
Temperature...	(Centigrade/Fahrenheit)
Speed...	(RPM/Hz)
Active Gauge...	(mBar/Torr/kPA)

In each option scroll through the units available by pressing up/down keys. Press **ENTER** to select the displayed units or **CANCEL** to exit back to the **UNITS** menu.

**Note:** *The configuration options for the PDT are stored in the PDT itself and are not associated with the pump that the PDT is connected to. This means a user can transfer a PDT between pumps and keep the same settings. It also means that different units could be displayed on two PDTs connected to the same pump.*

## Appendix A2 Troubleshooting

### A2.1 Warnings

The pump controller generates a warning when a problem is encountered. Once the problem that caused a warning has been resolved, the warning is cleared by the pump controller.

#### A2.1.1 LED warning indicators

If the pump encounters a problem, warnings are indicated on the LEDs on the front control panel, the rear panel and on the PDT if fitted.

The warning LEDs on the front control panel and rear panel illuminate continuously when a warning is generated.

If a PDT is fitted, the warning LED flashes to indicate a new warning. Refer to [Appendix A1.3](#) for more information on how warnings are indicated and how they can be acknowledged using the PDT.

Once all the warnings are cleared, the warning LEDs extinguish.

#### A2.1.2 PDT warnings

If a PDT is fitted, each warning triggers a warning message to be displayed. Refer to [Appendix A1.3](#) for more information on how warnings are handled by the PDT.

[Table A13](#) lists the warning messages that might be displayed on the PDT with possible causes and actions that should be taken.

Table A13 - Warnings

Warning Message on PDT	'Action' Message on PDT	Possible Cause	Action
Warning 1.01 Power interrupt	Check pwr supply	There has been a brownout of the electrical supply to the pump lasting more than 1 second.	Check the electrical supply
Warning 31.13 Gas missing	See manual	The gas module is not communicating with the pump controller.	Contact Edwards.
Warning 31.01 SYS CONFIG FAULT	See manual	The wrong type of gas module has been fitted.	Contact Edwards.
Warning 35.10 N2 Purge Low	Check N2 supply	The Nitrogen supply flow rate is too low - the supply might not be connected or switched on - the supply line or filter may be blocked	Check the Nitrogen supply is connected and switched on and that pipelines and filters are not blocked.
Warning 35.11 N2 Purge High	Check Gas Module	The Nitrogen supply flow rate is too high - the gas module and PDT settings do not match - the gas module may be faulty	Check the gas module and PDT settings, refer to <a href="#">Section 5.6</a> . Contact Edwards.
Warning 35.13 Sensor missing	-	The transducer is disconnected or has failed.	Contact Edwards.
Warning 51.13 Sup Missing	See manual	There is a communication problem within the pump controller. Refer to <a href="#">Section A2.4.1</a> for more information.	Cycle the power to the pump. If the warning persists, contact Edwards to replace the pump controller.

**Table A13 - Warnings (continued)**

Warning Message on PDT	'Action' Message on PDT	Possible Cause	Action
Warning 54.11 MB Temp High	See manual	The temperature of the booster pump is too high.	- Check that cooling water is connected, switched on and is to specification given in <a href="#">Section 2.6</a> .
Warning 54.13 Sensor missing	-	The booster temperature sensor may have become disconnected or failed.	- Check that the sensor is fitted and is correctly connected.
Warning 55.11 DP Temp High	See manual	The internal temperature of the pump is too high.	- Check that cooling water is connected, switched on and is to specification given in <a href="#">Section 2.6</a> .
Warning 55.13 Sensor missing	-	The dry pump temperature sensor may have become disconnected or failed.	- Check that the sensor is fitted and is correctly connected.
Warning 62.11 MB E/C Temp High	See manual	The temperature of the booster end cover is too high.	- Check that cooling water is connected, switched on and is to specification given in <a href="#">Section 2.6</a> .
Warning 62.13 Sensor missing	-	The booster end cover temperature sensor may have become disconnected or failed.	- Check that the sensor is fitted and is correctly connected.
Warning 71.13 AC Sup Missing	See manual	The pump controller cannot communicate with the accessory module	- Check that the accessory module is correctly connected to the pump and then cycle the power to the pump. - If this warning persists, contact Edwards.
Warning 176.01 MB INV xxxx yyyy	xxxx yyyy aaaaaaaaaaaaaaaa	Booster Inverter has raised a warning code.	Refer to <a href="#">A2.3</a> for more information.
Warning 176.13 No MB Inv Comms	See manual	The pump controller cannot communicate with the booster inverter.	Check the wiring between the pump controller and the booster inverter.
Warning 186.01 DP INV xxxx yyyy	xxxx yyyy aaaaaaaaaaaaaaaa	Dry pump Inverter has raised a warning code.	Refer to <a href="#">A2.3</a> for more information.
Warning 186.13 No DP Inv Comms	See manual	The pump controller cannot communicate with the dry pump inverter.	Check the wiring between the pump controller and the dry pump inverter.

**Note:** Some of these warnings apply to accessories and may only be encountered if the particular accessory is fitted.

## A2.2 Alarms

The pump controller generates an alarm when a serious problem is encountered.

Depending on the reason for the alarm, the whole system or just the booster will shut down - refer to [Section 4.4](#) and [4.5](#) for more information about alarms.

If the system has shut down due to an alarm, rectify the problem before trying to re-start the pump.

Once the problem that caused the alarm has been resolved, the alarm is cleared by the pump controller.

### A2.2.1 LED alarm indicators

Alarms are indicated on the LEDs on the front control panel, the rear panel and on the PDT if fitted.

The alarm LEDs on the front control panel and rear panel illuminate continuously when an alarm is generated.

If a PDT is fitted, the alarm LED flashes to indicate a new alarm. Refer to [Appendix A1.3](#) for more information on how alarms are indicated and how they can be acknowledged using the PDT.

Once all the alarms are cleared, the alarm LEDs extinguish.

### A2.2.2 PDT alarms

If a PDT is fitted, each alarm triggers an alarm message to be displayed. Refer to [Appendix A1.3](#) for more information on how alarms are handled by the PDT.

[Table A14](#) lists the alarm messages that might be displayed on the PDT with possible causes and actions that should be taken.

Table A14 - Alarms

Warning Message on PDT	'Action' Message on PDT	Possible Cause	Action
Alarm 1.01 Stop Activated	-	- The emergency stop has been activated. - There is a fault with the EMS circuit or the EMS link plug has not been fitted or has come disconnected.	If the EMS button has been used on the pump, refer to <a href="#">Section 4.6</a> to re-set it. Otherwise check and reset the EMS circuit and re-start the pump.  <b>Note:</b> The alarm message will remain on the display until the pumping system is restarted.
Alarm 1.01 Sys Config Fault	-	The pump system type has not been set properly.	Contact Edwards for a service engineer to configure the pump system type correctly or replace the pump controller electronics.
Alarm 54.12 MB Temp High	See manual	The booster temperature has reached the maximum allowed so the booster has stopped.	Refer to <a href="#">Section 4.5</a> to determine the temperature that triggered the alarm. See Warning 54.11 for causes and actions.
Alarm 55.12 DP Temp High	See manual	The dry pump internal temperature has reached the maximum allowed so the system has stopped.	See Warning 63.11 for causes and actions.

Table A14 - Alarms (continued)

Warning Message on PDT	'Action' Message on PDT	Possible Cause	Action
Alarm 62.12 MB E/C Temp High	See manual	The booster end cover temperature has reached the maximum allowed so the booster has stopped.	Refer to <a href="#">Section 4.5</a> to determine the temperature that triggered the alarm. See Warning 62.11 for causes and actions.
Alarm 174.10 Booster Stopped	See manual	Booster speed too low - rotor is probably locked.	Contact Edwards
Alarm 176.01 MB INV xxxx yyyy	xxxx yyyy aaaaaaaaaaaaaaaa	Booster Inverter has raised an alarm and stopped the system.	Refer to <a href="#">A2.3</a> for more information.
Alarm 176.01 MB Not Running	See manual	Booster Inverter will not start up when requested.	Check inverter fault history.
Alarm 176.13 No MB Inv Comms	See manual	The pump controller cannot communicate with the booster inverter during start-up checks.	Check the wiring between the pump controller and the booster inverter.
Alarm 184.10 Dry Pump Stopped	See manual	The dry pump speed is very low. The rotor might be locked.	Cycle the power to the pump and attempt to re-start. If this fails, contact Edwards.
Alarm 186.01 DP INV xxxx yyyy	xxxx yyyy aaaaaaaaaaaaaaaa	Dry Pump Inverter has raised an alarm and stopped the system.	Refer to <a href="#">A2.3</a> for more information.
Alarm 186.01 DP Not Running	See manual	Dry Pump Inverter will not start up when requested.	Check inverter fault history.
Alarm 186.13 No DP Inv Comms	See manual	The pump controller cannot communicate with the dry pump inverter during startup checks	Check the wiring between the pump controller and the dry pump inverter

## A2.3 Inverter warnings and alarms

The inverters used to drive the dry pump and booster can also generate warnings and alarms if problems are encountered. Inverter warning and alarm codes are displayed by the PDT if fitted.

The alarm and warning codes are each reported as a 16-bit word encoded as 4 hexadecimal numbers. The codes are displayed as follows:

1234 5678

Where:

The first 4 digits signify an Alarm code and,

The second 4 digits signify a Warning code,

Digits 1 - 8 are reported as hexadecimal digits from 0 to F.

To determine the cause of a warning or alarm, first decode each hexadecimal number. 0 indicates that there is no alert for that bit. Normally, only codes of 1, 2, 4 or 8 will be displayed for each bit but, if two or more events occur in the same bit, then these will be added together.

For example:

5 = 1 + 4 so if code 5 is displayed it means that alerts 1 AND 4 are active

B = 1 + 2 + 8 so if code B is displayed it means that alerts 1, 2 AND 8 are active.

To decode inverter warning and alarm codes, refer to [Table A15](#) to convert the hexadecimal digits into alert combinations and then refer to [Table A16](#) and [A17](#)).

**Table A15 - Hexadecimal to digital conversion**

BIT SET COMBINATIONS		
HEXADECIMAL	DECIMAL	Combination
F	15	8+4+2+1
E	14	8+4+2
D	13	8+4+1
C	12	8+4
B	11	8+2+1
A	10	8+2
9	9	8+1
8	8	8
7	7	4+2+1
6	6	4+2
5	5	4+1
4	4	4
3	3	2 + 1
2	2	2
1	1	1



Table A16 - Inverter alarm codes

INVERTER ALARMS			
BIT SET	Fault Code Combination	PDT reported fault name	Description
1	8	ACCELERATION_TO	If motor has not accelerated to a minimum speed of 20 Hz for DP and 25 Hz for BP within 60 secs then drive will try to restart 3 times before giving alarm
	4	OVERLOAD_TO	Alarm given when dry pump speed is below 7Hz for 3 minutes or 30 minutes for a booster
	2	SC_MODE_INTERLOCK	Internal fault contact Edwards
	1	SELF_TEST_FAULT	Internal fault contact Edwards
2	8	NO_PARAMETER_SET	Internal fault contact Edwards
	4	Reserved	Reserved
	2	EEPROM_FAULT	Internal fault contact Edwards
	1	PWM_TRIP	Inverter output switched off, active when drive not running. Restart pump or cycle power to reset.
3	8	MISSING_PHASE_TIMEOUT	Indicates a missing input phase - check power connections to pump and fuses in supply. Warning should appear first and then pump trips after 10 minutes.
	4	EMS	EMS has been activated. Check EMS button at front and EMS plug in the back of pump controller.
	2	DESAT_FAULT	Internal fault contact Edwards
	1	UNDERT	Inverter is too cold. See warning register to determine source of problem.
4	8	OVERT	Motor/Drive system over temperature - refer to warning code to determine source. Check cooling.
	4	OVERI	Motor overcurrent
	2	OVERV	Inverter overvoltage
	1	OVERF	Indicates an over speed condition.

Table A17 - Inverter warnings codes

Inverter warnings			
BIT	Fault Code Combination	Name	Description
5	8	SELF_TEST_WARNING	Internal fault contact Edwards
	4	PPREG	Indicates pump operating speed is reduced to protect pump from prolonged roughing.
	2	LOWTW	Condensation warning, indicates that the inverter (water) temperature is lower than expected - possible causes include inverter water valve stuck open.
	1	HIGHTW	Indicates that the inverter temperature is higher than expected - possible causes include no or low cooling water flow, inverter water valve stuck closed or water pipe to inverter blocked.

**Table A17 - Inverter warnings codes (continued)**

Inverter warnings			
BIT	Fault Code Combination	Name	Description
6	8	HIGHTC	Controller temperature above upper limit / Controller temperature sensor open circuit - check water supply
	4	HIGHTS	Inverter heat sink temperature above upper limit / Inverter heat sink temperature sensor open circuit - check water supply
	2	HIGHTM	Motor temperature above upper limit / Motor temperature sensor open circuit - check water supply
	1	MISSING_PHASE	The loss of one of the three input phases has been detected - check mains supply to drive or blown fuses
7	8	UTCREG	Upper controller temperature regulator active - current limit reduced - check cooling
	4	UTSREG	Upper heat sink temperature regulator active - current limit reduced - check cooling
	2	UTMREG	Upper motor temperature regulator active - check motor cooling
	1	LVREG	Lower voltage regulator active - check mains voltage
8	8	LOWVCC	Internal power supply fault - contact Edwards
	4	LOWTC	Low controller temperature - contact Edwards
	2	LOWTS	Low heatsink temperature - contact Edwards
	1	LOWTM	Low motor temperature - contact Edwards

Example:

PDT shows the following:  
 0108 0200

This translates to:

alarm 1 in bit 2 - PWM\_TRIP

alarm 8 in bit 4 - OVERT

warning 2 in bit 6 - HIGHTM.

This means the motor overheated and switched the output off.

## A2.4 Other problems

### A2.4.1 Pump controller communications

The pump controller contains two processors that perform separate functions. Under normal operation the two processors communicate with each other internally but under fault conditions it is possible that the two processors will stop communicating. The behaviour of the system will depend on its mode of operation prior to the communication failure. There may be no change in operation initially.

To minimise impact on process, the system will continue to run normally if it was already running when the communication failure occurred. The gas valves and Gate valves remain in the state that they were in prior to the communication failure and outputs to the MicroTIM are unaffected. It is important to note, however, that control might be released from the device that was 'in control' (for example PDT) and that stop requests will be ignored from all devices apart from the front panel controls.

To stop a system that has suffered a communication failure either use the EMS or use the front panel controls to 'take control' of the system and then stop it. In this situation, the warning LEDs on the pump will flash, the alarm LED will illuminate and the inlet Gate valve will close. It is not possible to use the Auto shut-down mode, the pump will stop immediately without any gas purges. Any requests to start the pump will be rejected until the fault has been rectified. Once the pump has stopped, cycle the power to the pump and attempt to re-start it. Refer to Tables A13 and A14 for actions if any warnings or alarms are generated.