

Instruction Manual

EXDC Turbomolecular Pump Drive Modules

Description	Item Number	Description	Item Number
EXDC80 Turbomolecular Pump Drive Module	D396-40-000	EXDC160 Turbomolecular Pump Drive Module	D396-41-000

Original Instructions





Declaration of Conformity

We, Edwards Limited,
Crawley Business Quarter,
Manor Royal,
Crawley,
West Sussex, RH10 9LW, UK

declare under our sole responsibility, as manufacturer and person within the EU authorised to assemble the technical file, that the product(s)

EXDC80 Drive Modules	D396-40-000 D396-40-508 D396-40-800
EXDC160 Drive Modules	D396-41-000 D396-42-508 D396-42-800

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

EN61010-1: 2010	Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use. General Requirements
EN50581:2012	Technical Documentation for the Assessment of Electrical and Electronic Products with respect to the Restriction of Hazardous Substances
CAN/CSA-C22.2 No.61010-1-04	Safety requirements for electrical equipment for measurement, Control and laboratory use - Part 1: General requirements
UL61010-1, 2 nd Edition	Safety requirements for electrical equipment for measurement, Control and laboratory use - Part 1: General requirements

and fulfils all the relevant provisions of

2014/35/EU	Low Voltage Directive
2014/30/EU	Electromagnetic Compatibility (EMC) Directive
2011/65/EU	Restriction of Certain Hazardous Substances (RoHS) Directive

Note: This declaration covers all product serial numbers from the date this Declaration was signed onwards.

Larry Marini, Senior Technical Manager

19.08.2015, Eastbourne

Date and Place

This product has been manufactured under a quality management system certified to ISO 9001:2008

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 Label	Meaning
D39640000 EXDC80 Drive Modules D39640508 EXCD80 Drive Modules D39640800 EXDC80 Drive Modules D39641000 EXDC160 Drive Modules D39642508 EXDC160 Drive Modules D39642800 EXDC160 Drive Modules		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)
印刷电路组件 (PCA) Printed Circuit Assembly (PCA)	X	O	X	O	O	O
电缆/电线/连接器 Cable/wire/connector	X	O	O	O	O	O
机械部件 Mechanical Components	X	O	O	O	O	O

O: 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。
O: 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 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
- 7(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

This page intentionally blank.

Contents

Section	Page
1 INTRODUCTION	1
1.1 Scope and definitions	1
1.2 Description	1
1.3 Logic interface	1
1.4 Indicator LEDs	2
2 TECHNICAL DATA	3
2.1 Operating and storage data	3
2.2 Mechanical data	3
2.3 Electrical data	3
3 INSTALLATION	7
3.1 Unpack and inspect	7
3.2 Adjust the electrical connector position (optional)	7
3.3 Fit the EXDC to the EXT pump	7
3.4 Electrical connections	8
3.4.1 Introduction	8
3.4.2 Connect the logic interface to your control equipment	8
3.4.3 Connect the electrical supply	10
4 OPERATION	11
4.1 Start-up	11
4.2 Operation with high inlet pressure or temperature	11
4.3 Normal shutdown	11
4.4 Shutdown due to pump under or over-speed	12
4.5 Electrical supply failure	12
5 MAINTENANCE	13
5.1 Introduction	13
5.2 EXDC LED fault finding	13
6 STORAGE AND DISPOSAL	15
6.1 Storage	15
6.2 Disposal	15
Index	17

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

Illustrations

Figure		Page
1	The EXDC	2
2	Dimensions (mm)	4
3	Schematic diagram of the logic interface connections	9

Tables

Table		Page
1	Logic interface connector pins	8
2	EXDC LED fault finding	13

Associated publications

Publication title	Publication number
EXT Pump Accessories	B580-66-880
EXT70 and EXT250 Turbomolecular Pumps	B722-01-880
EXT351 and EXT501 Turbomolecular Pumps	B727-20-880
EXT70H, EXT70Hi, EXT250H and EXT250Hi Compound Molecular Pumps	B740-01-880
EXT255H and EXT255Hi Compound Molecular Pumps	B753-03-880

1 INTRODUCTION

1.1 Scope and definitions

This manual provides installation, operation and maintenance instructions for the Edwards EXDC80 and EXDC160 Turbomolecular Pump Drive Modules (abbreviated to EXDC in the remainder of this manual). You must use the EXDC as specified in this manual. If you do not, the protection provided by the EXDC may be impaired, or you may damage the EXDC, or cause injury to people.

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



WARNING

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

CAUTION

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

The following IEC warning labels appear on the EXDC:



Warning - refer to accompanying documentation.



Warning - hot surfaces.

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

1.2 Description

The EXDC controls the electrical supply for an Edwards EXT70, EXT70H, EXT250, EXT255H, EXT351 or EXT501 turbomolecular pump.

The EXDC has no manual controls and can only be operated through the logic interface. To operate the EXT pump, you must therefore connect the EXDC to your own control equipment and electrical supply (see [Figure 3](#)).

Two models of EXDC are available, the only difference between the two models is the output power provided to the EXT pump: see [Section 2](#).

1.3 Logic interface

The EXDC has a 9-way logic interface connector on the end of the logic interface cable ([Figure 1](#), item 3). You must use a suitable connector mating half (not supplied) to connect the EXDC to your own equipment: refer to [Section 2.3](#) for the connector mating half type and to [Section 3.4](#) for the electrical connections.

Refer to [Table 1](#) and [Figure 3](#) for detailed information about the logic interface connector pins and their uses.

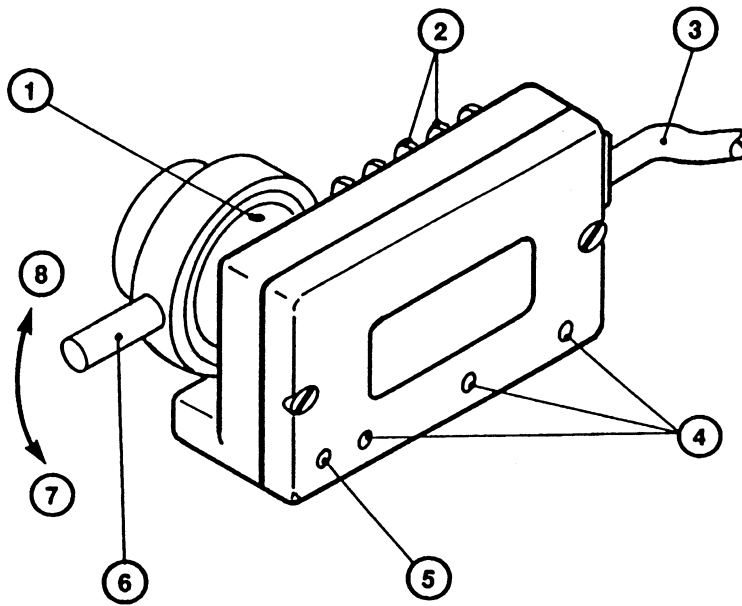
1.4 Indicator LEDs

Refer to Figure 1. The EXDC has four indicator LEDs, as follows:

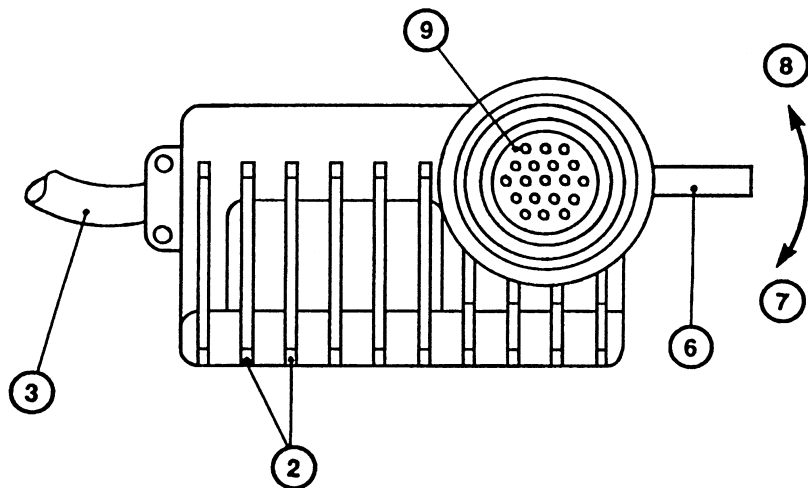
- Phase LEDs (4) These red LEDs are on when the corresponding phase output to the EXT pump motor is on.
- TMP Normal LED (5) This green LED is on when the EXT pump is 80% or more of full rotational speed.

You can use these LEDs as an aid to fault finding; refer to Section 5.2.

Figure 1 - The EXDC



AG2576/A



- 1. Grub screw
- 2. Cooling fins
- 3. Logic interface cable
- 4. Phase LEDs (red)
- 5. TMP Normal LED (green)
- 6. Connector lock
- 7. Unlocked position
- 8. Locked position
- 9. EXT pump connector

2 TECHNICAL DATA

2.1 Operating and storage data

Ambient operating temperature range	0 to 40 °C
Ambient storage temperature range	-20 to 70 °C
Maximum ambient operating humidity	10 to 95% RH (non-condensing to DIN 40040)
Maximum operating altitude	3000 m
Cooling	Natural convection

2.2 Mechanical data

Dimensions	See Figure 2
Mass	0.35 kg
Enclosure protection	IP20
Pollution degree	EN 61010-1 degree 2

2.3 Electrical data

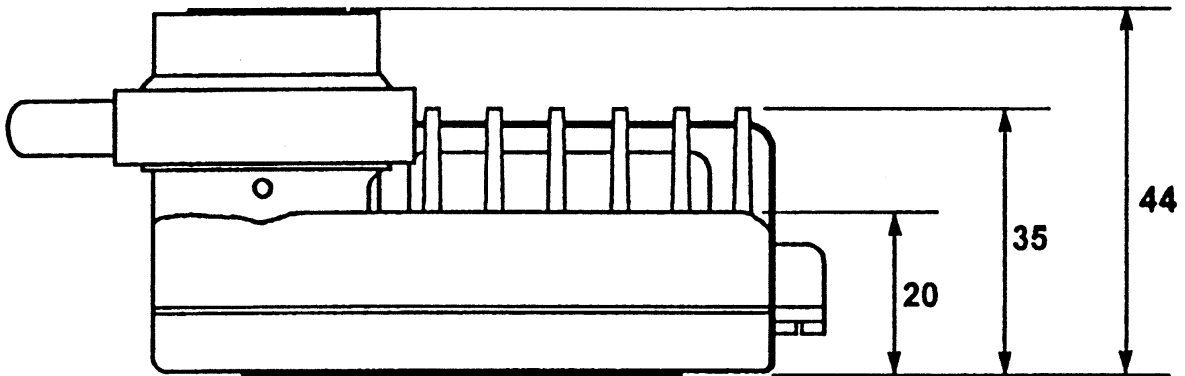
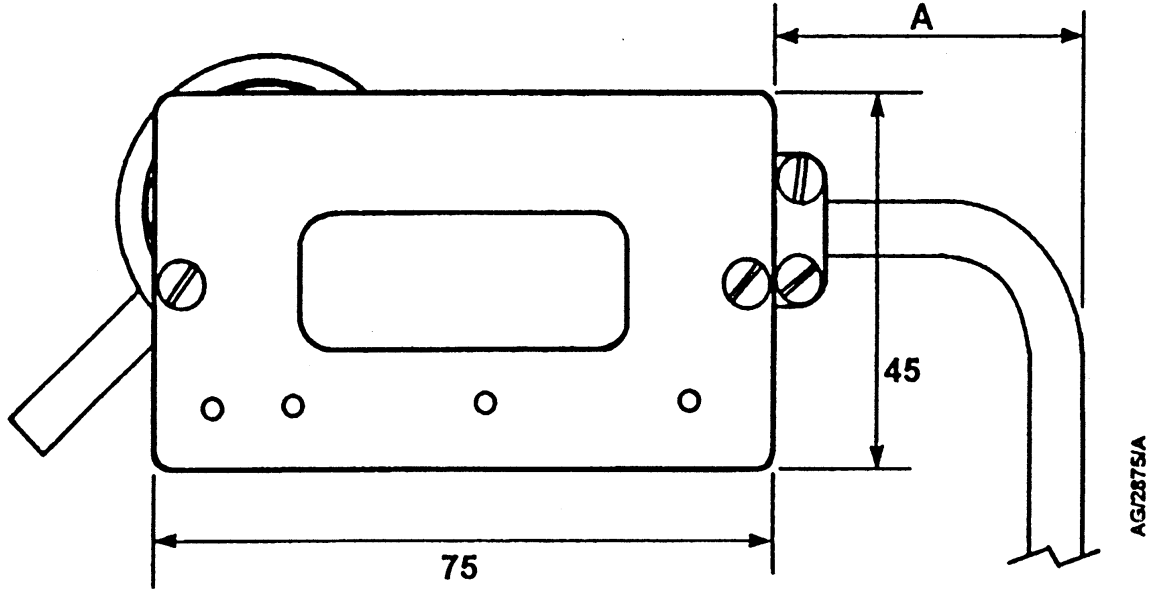
Electrical supply requirements:

- The EXDC electrical supply must meet the requirements of BS EN 61010-1/C22.2 1010-1.
- The safety earth (ground) impedance must be $< 0.1 \Omega$.
- The EXDC 0 V is not referenced to earth (ground). Ensure that the electrical supply offers a path ($\leq 22 \text{ k}\Omega$) between 0 V and earth (ground).

Maximum continuous output power

EXDC80 80 V	80 W
EXDC160 80 V	160 W

Figure 2 - Dimensions (mm)



A. Cable bend radius (≥ 30)

Logic interface

Connector mating half *	9-way D-type male
EXDC electrical supply	
Allowable voltage range	70 to 85 V d.c.
Undervoltage lock-out voltage	> 63 V
Maximum voltage ripple	2 V r.m.s.
Fuse (or equivalent current limiting device) rating	3.15 A type 'T' IEC approved or 3.2 A time delay fuse UL/CSA approved
Maximum input current	1.1 A (EXDC80) 2.2 A (EXDC160)
Start/stop control input signal	
Start control voltage: low (close)	< 0.8 V d.c.
Stop control voltage: high (open)	4 to 24 V d.c.
Speed analogue output	
Output voltage	0 to +10 V d.c. (directly proportional to pump speed, that is 0 to 10 V \cong 0 to 100% of pump speed)
Output impedance	0.1 Ω
Minimum Load	$\geq 5 \text{ k}\Omega$
TMP Normal status output	
Type	Open collector transistor
< 80%	Off (pull up to 15 V d.c.)
$\geq 80\%$	On (< 0.8 V d.c.)
Rating	20 mA

* *Not supplied*

This page has been intentionally left blank.

3 INSTALLATION

3.1 Unpack and inspect

Remove all packing materials and check the EXDC. If the EXDC is damaged, notify your supplier and the carrier in writing within three days; state the Item Number of the EXDC together with your order number and your supplier's invoice number. Retain all packing materials for inspection. Do not use the EXDC if it is damaged.

If the EXDC is not to be used immediately, store the EXDC in suitable conditions, as described in [Section 6](#).

3.2 Adjust the electrical connector position (optional)

CAUTION

Do not turn the pump electrical connector more than 180° from its orientation as supplied. If you do, you may damage the connections inside the EXDC.

CAUTION

Do not overtighten the grub screw (sequence 3 of operation 3.2) when securing the connector and connector lock. The grub screw is to be just flush or slightly under flush of the connector body surface.

Refer to [Figure 1](#). Use the following procedure to adjust the position of the EXT pump connector (9) and connector lock (6) with respect to the EXDC body.

1. Use a hexagonal key to loosen the grub screw (1).
2. Turn the connector (9) and lock (6) to the required orientation: you can turn the connector and lock up to 180° clockwise or anticlockwise.
3. Tighten the grub screw (1) to secure the connector and connector lock.

3.3 Fit the EXDC to the EXT pump

1. Refer to [Figure 1](#). Look at the front of the EXDC (that is, with the LEDs (4,5) towards you), then turn the connector lock (6) fully anticlockwise (in direction 7).
2. Fit the connector (9) directly to the pump to Controller connector on the EXT pump: refer to the EXT pump instruction manual.
3. Turn the lock (6) fully clockwise (in direction 8) to lock the connectors and secure the EXDC in position.

3.4 Electrical connections

3.4.1 Introduction

Use a suitable connector mating half (not supplied) to connect the electrical supplies and your control equipment to the connector on the logic interface cable (Figure 1, item 3). When you make the electrical connections to the EXDC described in the following sections, refer to Table 1 for full details of the logic interface connections and to Figure 3 for a schematic diagram of the connections.

Table 1 - Logic interface connector pins

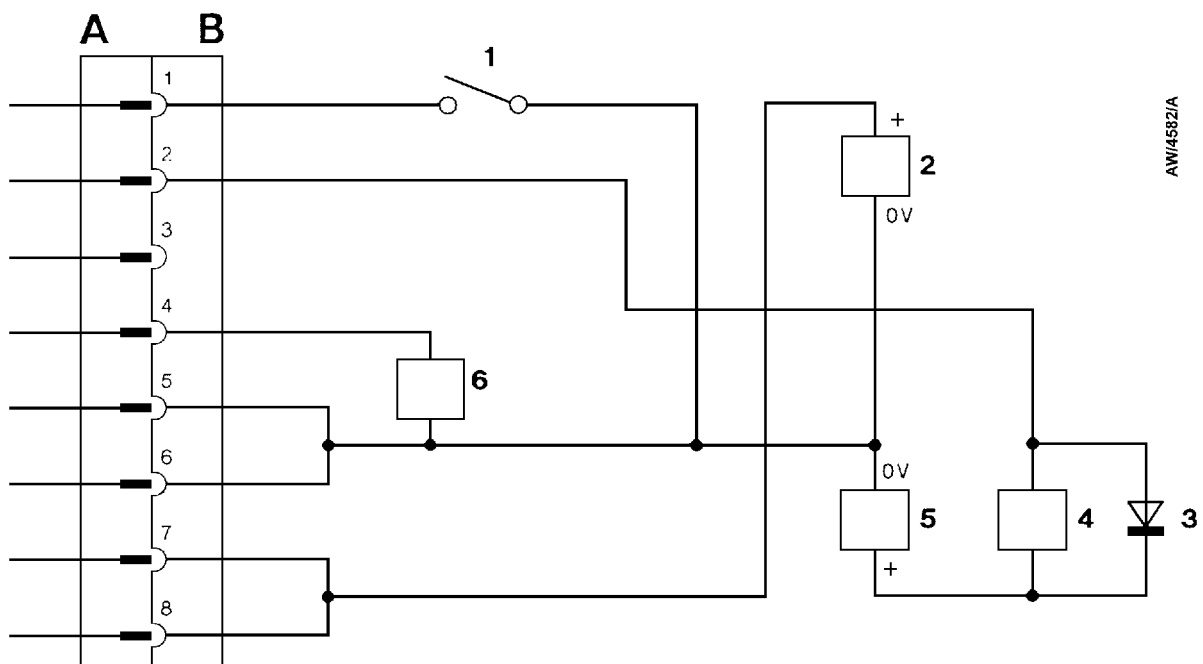
Pin number	Signal	Polarity	Use
1	Start/Stop control input	-	Close * to start EXT pump. Closed * when EXT pump speed is 80% or more of full rotational speed.
2	TMP Normal status output	-	
3	Earth (ground)	-	
4	Pump speed analogue output	Positive	
5,6	Electrical supply: 0 V	-	
7,8	Electrical supply: 80 V	Positive	

* With respect to pins 5 or 6.

3.4.2 Connect the logic interface to your control equipment

1. Connect your control equipment to the start / stop control input pins of your logic interface mating half to start/stop the EXT pump as required:
 - Link (close) the start / stop control input (pin 1) to pins 5 or 6 to start the EXT pump.
 - Unlink (open) the start / stop control input (pin 1) from pins 5 or 6 to stop the EXT pump.
2. Connect your control equipment to the pump speed analogue output (pin 4) and to pins 5 or 6 of your logic interface mating half to monitor the speed output of the EXDC.
3. Connect your control equipment to the TMP normal status output (pin 2) and to pins 5 or 6 of your logic interface mating half. You can use the output to control other devices in your pumping system. The output can drive a low power relay of up to 24 V coil rating.

Figure 3 - Schematic diagram of the logic interface connections



AWI/4582/A

A. EXDC logic interface plug
 B. Mating half to EXDC logic interface plug

- | | |
|--|----------------------------------|
| 1. Start/stop switch | 4. D.C. relay (optional) |
| 2. Electrical supply | 5. Relay power supply (optional) |
| 3. Back EMF suppression diode (optional) | 6. Voltmeter |

3.4.3 Connect the electrical supply



WARNING

Ensure that the EXDC is earthed (grounded) as required by all local legislative requirements, and observe all appropriate safety precautions for the safe installation and handling of electrical equipment. If you do not, there will be a danger of injury or death to people by electric shock.



WARNING

Incorporate a suitable isolation device in the electrical supply, close to the EXDC. If you do not, you will not be able to switch off the EXDC in an emergency.



WARNING

Incorporate suitable fuses or current limiting devices in the electrical supply circuit. If you do not and a fault develops, the EXDC may be damaged and there will be a danger of injury or death to people by electric shock.

Connect suitable electrical supplies to pins 5 to 8 of your connector mating half. When you connect the supplies:

- Incorporate a suitable fuse or current limiting devices in your external electrical supply: the rating of the fuse or current limiting device must be suitable for your electrical supply.
- Incorporate suitable fuses or current limiting devices in the nominal 80 V lines: refer to [Section 2](#) for the fuse/current limiting device rating.
- Incorporate an isolation switch.

4 OPERATION



WARNING

Do not disconnect the EXDC from the EXT pump when the pump is operating. At full speed, the EXT pump motor generates 48 V RMS which is accessible at the pump to Controller electrical connection, and there may be a risk of injury by electric shock.

CAUTION

Do not disconnect the EXDC from, or reconnect the EXDC to, the EXT pump if the electrical supply to the EXDC is on, or if the EXT pump is rotating. If you do, you can damage the EXDC.

4.1 Start-up

Note: You can start the backing pump and the EXT pump at the same time; the EXT pump will not be damaged and can operate as an effective baffle. However, if the system pressure remains too high, the EXT pump may not reach 80% of full rotational speed and the TMP Normal status output signal will not be set.

Use the following procedure to start up your system. This procedure assumes that you will manually operate the vent-valve and the backing pump.

1. Switch on the electrical supply to the EXDC.
2. Close the vent-valve (if fitted) and start the backing pump.
3. Start the EXT pump: close the Start/Stop control input on the logic interface connector.

4.2 Operation with high inlet pressure or temperature

If the EXT pump inlet pressure rises, the power supplied by the EXDC to the pump-motor will increase to counteract the gas frictional load. The pump rotational speed will remain constant until the EXDC peak power level is reached; beyond this power level, the speed of the pump will start to reduce.

Temperature sensors in the EXDC and the EXT pump are monitored by the EXDC. If the EXDC detects that the pump temperature or its own temperature is too high, the power supplied to the pump-motor is reduced; the pump may not therefore be able to maintain full rotational speed if it is too hot.

Refer to the EXT pump instruction manual for the maximum allowable inlet pressure and for the pump operating temperature ranges, and refer to [Section 2.3](#) for the maximum EXDC output power.

4.3 Normal shutdown

Use the following procedure to shut down your system. This procedure assumes that you will manually operate the vent-valve and the backing pump. Refer to the Instruction Manual for the EXT pump for details of the maximum allowable vent rate.

1. Select Stop: open the Start / Stop control input on the logic interface connector.
2. Open the vent-valve after the EXT pump speed has fallen to below 50% of full rotational speed.
3. Switch off the backing pump.

4.4 Shutdown due to pump under or over-speed

CAUTION

Shut down the EXT pump if its speed falls to below 50% of full rotational speed. If you do not, the EXT pump may be damaged.

You must use the speed analogue output to monitor the speed of the EXT pump. If the pump speed falls to below 50% of its full rotational speed, this means that there is high inlet pressure or temperature, or that there is a fault in the EXT pump (for example, the bearings may have failed).

If the pump speed falls to below 50% of its full rotational speed, you must therefore switch off the EXT pump (open the start / stop control input) to prevent damage to the pump.

The EXDC has an electronic EXT pump speed control system. This control system prevents operation of the EXT pump at over 100% of its normal full rotational speed (as operation above this speed reduces bearing operational life).

If required, you can monitor the speed analogue output and configure your control equipment to switch off the EXT pump if its speed exceeds 100% of full rotational speed.

4.5 Electrical supply failure



WARNING

If the Start / Stop control signal on the logic interface connector is set to Start, the EXDC will automatically restart the EXT pump when the electrical supply is restored after an electrical supply failure. Ensure that people cannot be injured by the rotating rotor blades of the EXT pump.

If the electrical supply to the EXDC fails when the EXT pump is rotating, the motor of the EXT pump acts as a generator and the power generated can be used as the electrical supply for the associated control logic connected to the EXDC.

You can connect a suitable d.c. to d.c. converter to the 80 V supply pins (pins 7,8) on your logic interface mating half; the voltage on these pins is maintained at 50 V d.c. during external electrical supply failure.

5 MAINTENANCE

5.1 Introduction

The EXDC has no parts which can be serviced by the user. If necessary, return the EXDC to your supplier or Edwards for repair or replacement.

5.2 EXDC LED fault finding

Table 2 - EXDC LED fault finding

Symptom	Check	Action
None of the LEDs are on.	Has the EXDC electrical supply failed?	Ensure that the electrical supply is switched on and that the fuses (and current limiting devices) have not been tripped.
The Normal LED does not go on.	Is there a leak in the vacuum system?	Inspect the vacuum system and seal any leaks found.
	Is the EXT pump faulty?	Inspect the EXT pump and check that it operates correctly with another EXDC or EXC Turbomolecular Pump Controller. If necessary, replace the EXT pump.
Only one phase LED is on.	Is the EXT pump faulty?	Inspect the EXT pump and check that it operates correctly with another EXDC or EXC Turbomolecular Pump Controller. If necessary, replace the EXT pump.
(Any of the above).	-	If all the previous checks and actions have been made and the fault symptom is still present, the EXDC may be faulty: contact your supplier or Edwards.

This page has been intentionally left blank.

6 STORAGE AND DISPOSAL

6.1 Storage

Fit protective covers over the electrical connections and store the EXDC in clean dry conditions until required. When required for use, prepare and install the EXDC as described in [Section 3](#) of this manual.

6.2 Disposal

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

This page has been intentionally left blank.

Index

A

Adjust the electrical connector position7

C

Cautions1
Connect the electrical supply 10
Connect the logic interface to your control equipment
.....8

D

Description1
Dimensions (mm)4

E

Electrical connections8
Electrical data3
Electrical supply failure 12
EXDC LED fault finding 13

F

Fit the EXDC to the EXT pump7

I

Indicator LEDs2
INSTALLATION7
Introduction1

L

Logic interface1
Logic interface connector pins8

M

MAINTENANCE 13
Mechanical data3

N

Normal shutdown 11

O

Operating and storage data3
OPERATION 11
Operation with high inlet pressure or temperature 11

S

Scope and definitions1
Start-up 11
STORAGE AND DISPOSAL 15

U

Unpack and inspect 7

W

Warnings 1

This page has been intentionally left blank.