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EXT turbomolecular pumps

EXT turbomolecular pumps

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VIEW OUR INVENTORY

EXT TURBOMOLECULAR PUMPS AND EXC CONTROLLERS



Our range of EXT turbomolecular and compound molecular pumps and EXC Controllers uses state-of-the-art technology to provide reliable, hydrocarbon-free, high and ultra high vacuum.

Key performance factors

A turbomolecular pump (TMP) is a multi-stage axial-flow turbine in which high speed rotating blades provide compression by increasing the probability of gas molecules moving in the pumping direction. The turbomolecular pump is optimized for molecular flow conditions and requires a suitably sized two stage rotary vane pump or an oil free scroll pump to exhaust to atmosphere.

A compound molecular pump (CMP) is based on the concept of combining bladed turbomolecular stages with molecular drag stages on the same rotor. This design allows:

- High critical foreline pressures (typically up to 10 mbar)
- Options to use smaller backing pumps or dry diaphragm backing pumps

Pumping speed (volume flow rate) is determined by the rotor diameter, inlet flange size and rotational speed. The pumping speed reduces at high inlet pressures to a value determined by the size of the backing pump.

As the inlet pressure rises, the motor power dissipation and pump temperature increase. **Maximum continuous inlet pressure** sets the maximum throughput limit for steady state pumping and depends on the cooling method used. Above this pressure, the rotational speed of the pump reduces as temperature sensors limit the pump power. With a water-cooled pump, the actual **maximum throughput** depends on the size of the backing pump.

Quiescent electrical power is the nominal power dissipated by a pump operating normally at full rotational speed and with low gas throughput (inlet pressure below the 10^{-3} mbar range). During the run-up time, or when operating at high gas throughput or above the critical backing pressure, the pump power dissipation will rise and approach the maximum power output for the EXC Controller used. Critical backing pressure for conventional turbomolecular pumps is approximately 0.1 to 0.2 mbar.

Compression ratio is determined by the rotational speed, the number of pump stages and the molecular weight of the pumped gas. It is higher for heavier gases which explains why the suppression of hydrocarbon backstreaming is so effective and why the ratio for hydrogen is important for ultra high vacuum applications.

Ultimate pressure measured according to Pneurop standards, is the lowest pressure achieved in the test system, 48 hours after bakeout. The system is backed only by a two-stage rotary vane pump. Fluoroelastomer inlet seals are used with ISO-flanged pumps and metal seals are used with CF-flanged pump models.

Bearing and suspension technologies

We use two basic technologies: magnetic bearings and mechanical ceramic ball bearings.

Ceramic bearings, which are lubricated for life by either grease or oil, have replaced conventional steel bearings. The silicon nitride ceramic balls are lighter, harder and smoother than steel equivalents, leading to longer life and lower vibration characteristics. Reliability is increased because the ball and race materials are different, which prevents micro pitting.

Magnetic bearings further increase reliability. Our EXT turbomolecular pumps up to 540 l s^{-1} use a hybrid bearing arrangement with a permanent magnet upper bearing and an oil or grease lubricated ceramic lower bearing.

The EXT range also includes the EXT250M where the rotor is entirely supported by magnetic bearings. This offers additional advantages:

- Oil free - No hydrocarbon contamination from the turbomolecular pump
- Low maintenance - No bearing contact eliminates mechanical wear
- Low vibration - Typically an order of magnitude lower than conventional bearings
- Reduced cooling - Ambient cooling is sufficient for many applications
- Any orientation - Pump can be mounted in any position

Rotor technologies

We use two basic technologies:

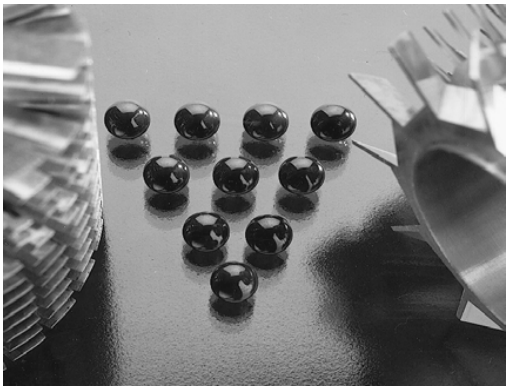
- conventional full stack turbomolecular (typically 12 stages)
- compound molecular (combining turbomolecular and drag stages)

In addition, EXT pumps up to 540 l s^{-1} use monobloc rotors machined from solid bar by computer controlled high speed milling machines. This technology produces stable, rigid rotors and allows virtually unlimited design flexibility for optimum vacuum performance.

Motor technology

EXT pumps use brushless d.c. motors and are available in 24 and 80 volt variants. For the 24 volt pumps the TIC line of controllers are available with the added benefit of integrated instrument controllers. For the 80 volt pumps you can choose from our EXC line of controllers to optimize the performance and cost options for your application. (The EXT250M must use the EXC300M controller).

The Controllers incorporate a regenerative back-up supply which provides power in the event of electrical supply failure to keep the vent-valve closed for several minutes (and, in the case of the EXC300M, to ensure safe run-down of the EXT250M magnetic bearing).



Ceramic ball bearings

Corrosive applications

For maximum life and reliability in the exacting process conditions encountered in semiconductor wafer processing applications, we recommend that you use turbomolecular pumps from our BOC Edwards STP-C and STPH-C series (see page 4-5). These Maglev pumps have magnetic bearings and are ideal for these harsh duty applications.

Purge port

The EXT pumps (with the exception of the EXT70 and EXT70H) all have purge-ports which can be used to purge the motor and bearing cavity with an inert gas (such as nitrogen). We recommend that you purge the pump when you pump corrosive and abrasive gas mixtures or those with an oxygen content over 20%. You can use our PRX10 purge-restrictor to set the purge gas flow rate. This typically adds up to 25 sccm to the total gas load and the backing pump must be sized accordingly.

Venting

To maintain the cleanliness of your vacuum system, we recommend that you vent a turbomolecular pump at or above half rotational speed, when the rotor is still spinning fast enough to suppress any backstreaming of hydrocarbons from the backing line.

The vent port on the EXT pump is part way up the rotor stack to ensure maximum cleanliness even with fluoroelastomer sealed vent-valves. Each pump is supplied with a manual vent-valve. If you use this manual valve care must be taken not to open it too quickly, especially if the system volume is small (typically less than the approximate volume of the turbomolecular pump), because if the rate of pressure rise is too high, the pump bearing life may be reduced.

In a small volume system, the rate of pressure rise will be greater than in a large volume for a given vent flow rate, and it may be necessary to restrict the vent gas flow. We offer the VRX range of vent restrictors which you can fit to your EXT pump, (see page 5-27).

Since the rate of pressure rise cannot be accurately controlled by the manual vent-valve, we recommend that, unless you fit a suitable VRX restrictor to the vent port, you must wait until the turbomolecular pump has slowed down to 50% speed, as indicated by the controller, before you open the manual vent-valve.

The maximum rate of pressure rise varies by pump model, and the Instruction Manual supplied with an EXT pump gives further guidance on this, and the size of vent restrictor needed to meet the fastest pressure rise allowed.

Control of the rate of venting is particularly important with pumps using fully magnetic bearings, otherwise the safety bearings may be damaged.

The manual vent-valve can be replaced with a TAV solenoid valve driven by the EXC Controller to allow venting after a 2 second delay on shut-off, or delaying vent until the rotational speed has dropped to 50%. The EXC Controller can also control the TAV vent-valve in the event of power or pump failure.

You can choose from two solenoid vent-valve options; the TAV5 which covers most auto-venting applications, and the TAV6 which has a higher conductance than the TAV5 and is designed either for use on larger chambers (typically with a volume greater than 10 liters), or when you want to use a two-stage venting procedure for the fastest possible vent times.

For two-stage venting you need two TAV valves. By using the appropriately restricted flow for the first stage vent-valve you can start venting when the EXT pump is still at full rotational speed. Once the pump has slowed to half rotational speed you can then introduce higher flow rates from the second stage vent-valve.

Inlet-screen

An inlet-screen is fitted as standard to all EXT pumps. The inlet-screen prevents debris from falling into the pump-inlet. In addition, the inlet-screen prevents you from coming into contact with the blades of the pump when it is disconnected from your vacuum system.

Cooling

For most applications, we recommend that you use forced-air cooling with the appropriate ACX air-cooler connected to your EXT pump. If the ambient temperature is below 30 °C, the EXT70, EXT70H and EXT250M pumps can be cooled by free convection (dependent on gas load and backing pressure). NB: high gas load, high backing pressure and rapid cycling require more cooling.

However, if the ambient temperature is above 35 °C (or above 40 °C for the EXT250M), you must water-cool the EXT. The barbed connectors on the water-cooler are suitable for 6 mm internal diameter hose.

Water cooling reduces the running temperature of the pump motor and bearings and is particularly recommended when you operate the EXT with a continuous high throughput (that is, inlet pressure above 1×10^{-3} mbar) or when you bake the EXT pump to above 70 °C (measured at the inlet flange).

Scope of supply

For end users desiring front panel controls and indications when using an 80 volt pump a minimum operating system requires you to order an EXT pump, an EXC controller and a pump to controller cable. For a 24 volt pump a minimum operating system requires you to order an EXT pump, a TIC controller and an EXDC controller. (The EXDC controller is not required when using an EXT75DX or EXT255DX).

Each EXT pump is supplied with an inlet-screen, elastomer inlet seal or copper gasket (as appropriate), manual vent valve and water-cooler. EXT75DX, EXT255DX and EXT555M require a water-cooler accessory in addition (if required).

Each EXC/TIC controller is supplied with a 2 m unterminated electrical supply cable.

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EXT75DX TURBOMOLECULAR PUMP



Features & benefits

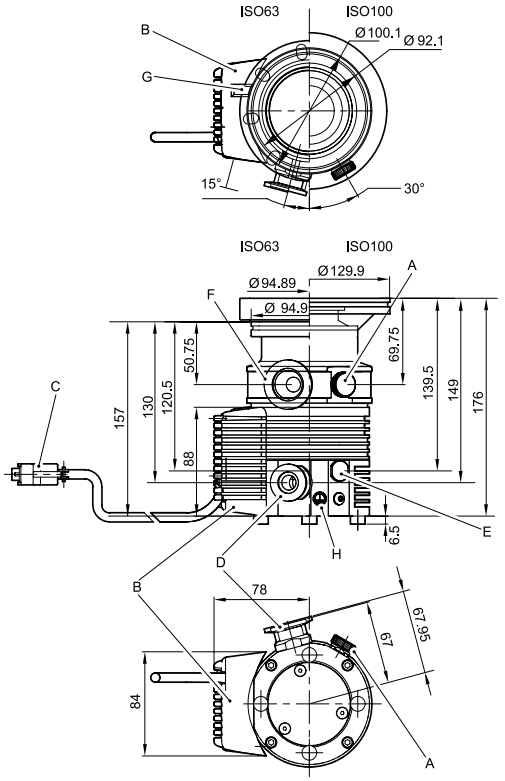
- Compatible with TIC Turbo and Instrument Controller
- Multiple communication modes available
  - Parallel mode allows traditional control signal interface
  - Serial mode allows RS-232 interface
- Numerous user configurable parameters via RS-232 interface
  - Vent valve control settings
  - Normal speed indication
  - Stand-by running speed
  - Programmable power settings
  - Power consumption
  - Pump temperature
- Enhanced monitoring capability including pump speed, power and temperature

TECHNICAL DATA

Inlet flange	DN63ISO-K, DN63CF or DN40NW
Compression ratio	
N_2	>1 × 10^{11}
He	1 x 10^{6}
H_2	5 x 10^{4}
Outlet flange	DN16NW
Interstage port (Hi variants)	DN25NW
Recommended backing pump*	E2M0.7
Vent port	⅛ inch BSP
Purge port	⅛ inch BSP
Maximum continuous inlet pressure (light gas pumping) †	
water cooling (water at 15 °C, ambient temp at 40 °C)	2 × 10^{-2} mbar
forced air cooled, 35 °C ambient	1 × 10^{-2} mbar
Nominal rotational speed	90000 rpm
Standby rotational speed	Variable from 49500 to 90000 rpm (63000 rpm default)
Start time 90% speed‡	110 s
Cooling method	Forced air / water
Ambient air temperature for forced air cooling	5-35 °C
Minimum cooling water flow rate (water 15 °C)	15 l h^{-1}
Water temperature range	10-20 °C
Maximum inlet flange temperature	100 °C
Operating attitude	Vertical and upright, through to horizontal
Noise level at 1 metre	<50 dB(A)
Maximum magnetic field	5 mT
Recommended controller	TIC100 turbo or turbo and instrument controlled
Quiescent electrical power	10 W
Interstage pumping speed (Hi variants)	10

INLET FLANGE	ISO63/100	63CF	DN40NW
Pumping speed (l s^{-1})‡			
N_2	61	61	42
He	57	57	49
H_2	53	53	48
Ultimate pressure (mbar)			
With rotary vane backing pump***	<5 × 10^{-9}	<5 × 10^{-10}	<5 × 10^{-9}
With diaphragm backing pump****	<5 × 10^{-8}	<5 × 10^{-9}	<5 × 10^{-8}
Weight (kg)	3.0	4.9	2.9

* A larger backing pump may be required for maximum throughput. A suitable diaphragm pump with ultimate <5 mbar may also be used.
† Above this inlet pressure, rotational speed drops to below nominal.
‡ Power limit set to 80 W.
*** Ultimate pressure 48 hours after bakeout with 2 stage rotary vane backing pump.
**** Ultimate pressure 48 hours after bakeout with P_b <5 mbar (500 Pa)



A Manual vent valve in vent port
B Podule
C Logic interface connector
D Backing Port
E Purge Port (blanked off)
F Interstage port (EXT75iDX only)
G Podule connector socket
H Earth Connection

ORDERING INFORMATION

PRODUCT DESCRIPTION		ORDERING NUMBER
Pump	Inlet flange	
EXT75DX ISO63	DN63ISO	B72241000
EXT75DX CF63	DN63CF	B72242000
EXT75DX NW40	DN40NW	B72243000
EXT75DX ISO100	DN100ISO	B72245000
EXT75iDX ISO63 (interstage)	DN63ISO (main) DN25NW (interstage)	B72238000

ACCESSORIES	ORDERING NUMBER
ACX75 air cooling accessory	B58053075
WCX500 water cooling accessory	B73600121

EXT255DX TURBOMOLECULAR PUMP



INLET FLANGE	DN100ISO-K	DN100CF
Pumping speed (l s^{-1})‡		
N_2	220	220
He	230	230
H_2	180	180
Ultimate pressure (mbar)		
With rotary vane backing pump***	<5 × 10^{-9}	<5 × 10^{-10}
With diaphragm backing pump****	<5 × 10^{-8}	<5 × 10^{-9}
Weight (kg)	6.25	8.6

* A larger backing pump may be required for maximum throughput. A suitable diaphragm pump with ultimate <5 mbar may also be used.

† Above this inlet pressure, rotational speed drops to below nominal.

‡ Power limit set to 160 W.

*** Ultimate pressure 48 hours after bakeout with 2 stage rotary vane backing pump.

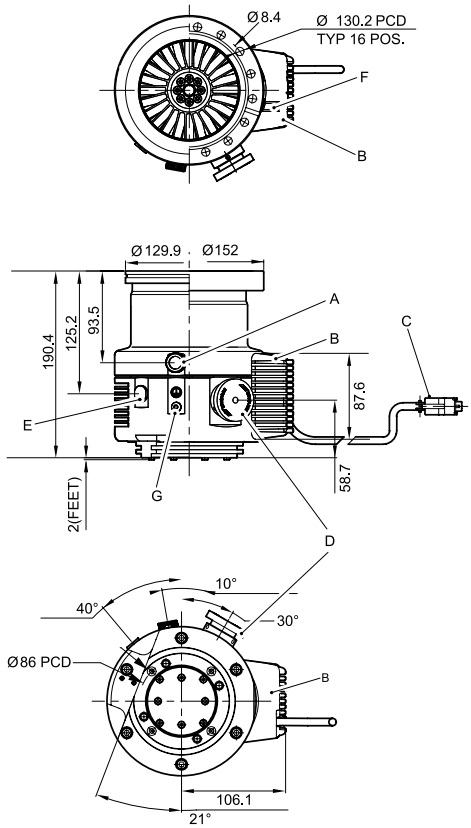
**** Ultimate pressure 48 hours after bakeout with P_b <5 mbar (500 Pa)

Features & benefits

- Compatible with TIC Turbo and Instrument Controller
- Multiple communication modes available
  - Parallel mode allows traditional control signal interface
  - Serial mode allows RS-232 interface
- Numerous user configurable parameters via RS-232 interface
  - Vent valve control settings
  - Normal speed indication
  - Stand-by running speed
  - Programmable power settings
  - Power consumption
  - Pump temperature
- Enhanced monitoring capability including pump speed, power and temperature

TECHNICAL DATA

Inlet flange	DN100ISO-K, DN100CF
Compression ratio	
N_2	>1 × 10^8
He	4 × 10^5
H_2	1.6 x 10^4
Outlet flange	DN25NW
Interstage port (Hi variants)	DN25NW
Recommended backing pump*	RV3
Vent port	⅛ inch BSP female
Purge port	⅛ inch BSP female
Maximum continuous inlet pressure (light gas pumping) †	
water cooling (water at 15 °C, ambient temp at 40 °C)	5 × 10^{-3} mbar
forced air cooled, 35 °C ambient	5 × 10^{-3} mbar
Nominal rotational speed	60000 rpm
Standby rotational speed	Variable from 33000 to 60000 rpm (42000 rpm default)
Start time 90% speed‡	80 s
Cooling method	Forced air / water
Ambient air temperature for forced air cooling	5-35 °C
Minimum cooling water flow rate water 15 °C)	15 l h^{-1}
Water temperature range	10-20 °C
Maximum inlet flange temperature	100 °C
Operating attitude	Vertical and upright, through to horizontal
Noise level at 1 metre	<50 dB(A)
Maximum magnetic field	5 mT
Recommended controller	TIC200 turbo or turbo and instrument controlled
Quiescent electrical power	25 W
Interstage pumping speed (Hi variants)	10



A Manual vent valve in vent port
B Podule
C Logic interface connector
D Backing Port
E Podule connector socket
F Allowance for right-angle cable connector
G Earth bond point

ORDERING INFORMATION

PRODUCT DESCRIPTION		ORDERING NUMBER
Pump	Inlet flange	
EXT2555DX ISO100	DN100ISO-K	B75311000
EXT255DX CF100	DN100CF	B75312000
EXT2555iDX ISO100 (interstage)	DN100ISO-K (main) DN25NW (interstage)	B75313000

ACCESSORIES	ORDERING NUMBER
ACX250H air cooling accessory	B58053160
WCX500 water cooling accessory	B73600121

EXT70 TURBOMOLECULAR PUMP



EXT70 with DN63ISO-K, DN63CF, NW40 and NW50 inlet flanges

TECHNICAL DATA

Inlet flange	DN40NW, DN50NW, DN63CF or DN63ISO-K
Compression ratio	
N_2	>1 × 10^8
He	6000
H_2	500
Outlet flange	DN16NW
Recommended backing pump*	E2M0.7
Vent-port	⅛ inch BSP female
Maximum continuous inlet pressure †	
water cooling at 15 °C, 40 °C ambient	3 × 10^{-2} mbar
air cooling at 35 °C ambient	1 × 10^{-2} mbar
free convection at 30 °C ambient	6 × 10^{-3} mbar
Nominal rotational speed	90000 rpm
Standby rotational speed	63000 rpm
Run-up time 90% speed	90 s
Cooling method	Free convection or forced air, or water
Maximum inlet flange temperature	100 °C
Ambient air temperature operating range	
with free convection cooling	0-30 °C
with forced air cooling	0-35 °C
Water temperature range (for water cooling)	10-20 °C
Minimum water flow rate (at 15 °C)	15 l h^{-1}
Operating attitude	Vertical and upright, through to horizontal
Noise level at 1 metre	<50 dB(A)
Maximum magnetic field	5 mT
Recommended Controller	EXC100 or EXC120
Quiescent electrical power	10 W

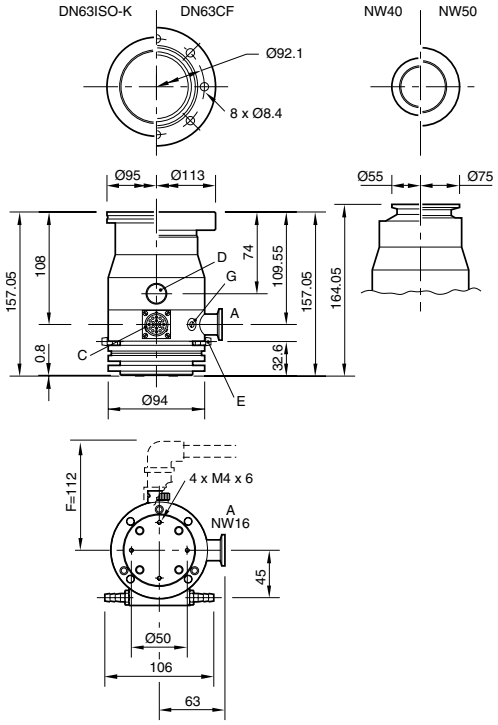
INLET FLANGE	DN40NW	DN50NW	DN63CF	DN63ISO-K
Pumping speed (l s^{-1})‡				
N_2	52	60	65	65
He	53	56	60	60
H_2	46	48	50	50
Ultimate pressure (mbar)**	<5 × 10^{-9}	<5 × 10^{-9}	<5 × 10^{-10}	<5 × 10^{-9}
Weight (kg)	1.4	1.4	3.4	1.5

* A larger backing pump may be required for maximum throughput.

† Above this inlet pressure, rotational speed drops to below nominal.

‡ Pumping speeds are without an inlet screen. Inlet screens are supplied fitted and reduce speed by about 10%.

** Ultimate pressure 48 hours after bakeout with 2 stage rotary pump.



A Backing port (outlet flange)
C Electrical supply connector
D Vent-valve
E Cooling-water connector
F Allowance for right-angle cable connector
G Earth bond point

ORDERING INFORMATION

PRODUCT DESCRIPTION		ORDERING NUMBER
Pump	Inlet flange	
EXT70	DN40NW	B72203000
EXT70	DN50NW	B72204000
EXT70	DN63CF	B72202000
EXT70	DN63ISO-K	B72201000

EXT70H COMPOUND MOLECULAR PUMP



EXT70H with DN63ISO-K inlet flange

TECHNICAL DATA

Inlet flange	DN40NW, DN63CF or DN63ISO-K
Outlet flange	DN16NW
Recommended backing pump*	E2M0.7
Vent-port	⅛ inch BSP female
Compression ratio	
N_2	$>1 \times 10^8$
He	4×10^5
H_2	3×10^4
Maximum continuous inlet pressure†	
water cooling at 15 °C	9×10^{-1} mbar
air cooling at 35 °C	9×10^{-2} mbar
free convection at 30 °C	9×10^{-3} mbar
Nominal rotational speed	90000 rpm
Standby rotational speed	63000 rpm
Run-up time 90% speed	90 s
Cooling method	Free convection or forced air, or water
Maximum inlet flange temperature	100 °C
Ambient air temperature operating range	
with free convection cooling	0-30 °C
with forced air cooling	0-35 °C
Water temperature range (for water cooling)	10-20 °C
Minimum water flow rate (at 15 °C)	15 l h^{-1}
Operating attitude	Vertical and upright, through to horizontal
Noise level at 1 metre	<50 dB(A)
Maximum magnetic field	5 mT
Recommended Controller (80 V)	EXC100 or EXC120
(24 V d.c.)	EXDC80 & TIC
Quiescent electrical power	10 W
Interstage pumping speed (Hi variants)	
N_2	6 l s^{-1}

INLET FLANGE	DN40NW	DN63CF	DN63ISO-K
Pumping speed (l s^{-1})‡			
N_2	52	65	65
He	53	60	60
H_2	46	50	50
Ultimate pressure (mbar)			
Rotary vane pump**	$<5 \times 10^{-9}$	$<5 \times 10^{-10}$	$<5 \times 10^{-9}$
Diaphragm pump††	$<5 \times 10^{-8}$	$<5 \times 10^{-8}$	$<5 \times 10^{-8}$
Weight (kg)	2.8	4.7	2.8

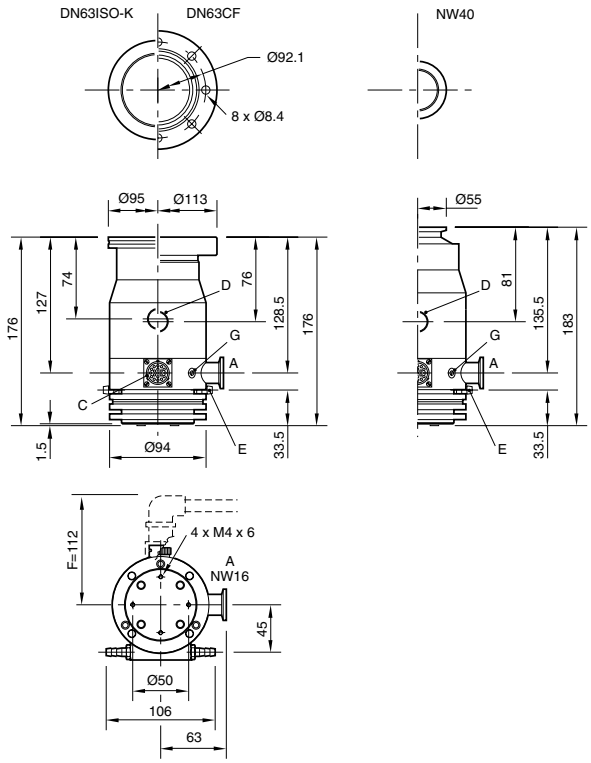
* A larger backing pump may be required for maximum throughput. A suitable diaphragm backing pump with ultimate <5 mbar may also be used.

† With backing pressure <0.1 mbar. Above this inlet pressure, rotational speed drops to below nominal.

‡ Pumping speeds are without an inlet screen. Inlet screens are supplied fitted and reduce speed by about 10%.

** Ultimate pressure 48 hours after bakeout with 2 stage rotary pump.

†† Using diaphragm pump with ultimate <5 mbar.



A Backing port (outlet flange)
C Electrical supply connector
D Vent-valve
E Cooling-water connector
F Allowance for right-angle cable connector
G Earth bond point

ORDERING INFORMATION

PRODUCT DESCRIPTION		ORDERING NUMBER
Pump	Inlet flange	
EXT70H	DN40NW	B72223000
EXT70H	DN63CF	B72222000
EXT70H	DN63ISO-K	B72221000
EXT70Hi	DN63CF	B72228000
EXT70Hi	DN63ISO-K	B72229000
TIC compatible packages* (24 V d.c.)		
EXT70H	DN63-ISOK	B72221991
EXT70H	DN63CF	B72222991
EXT70H	DN40NW	B72223991

* EXDC-80 control module (P/N D39645000) also required See the entry for the TIC Turbo/Instrument controller at the end of this section for more information.

EXT255H COMPOUND MOLECULAR PUMP



EXT255H with DN100ISO-K inlet flanges

TECHNICAL DATA

Inlet flange	DN100ISO-K or DN100CF
Outlet flange	DN25NW
Vent-port	⅛ inch BSP female
Purge-port	⅛ inch BSP female
Pumping speed*	
N_2	220 l s^{-1}
He	230 l s^{-1}
H_2	180 l s^{-1}
Compression ratio	
N_2	>1 × 10^8
He	4 × 10^5
H_2	1.6 × 10^4
Recommended backing pump†	RV3
Maximum continuous inlet pressure‡	
water cooling at 15 °C, 40 °C ambient	5 × 10^{-3} mbar
air cooling at 35 °C ambient	5 × 10^{-3} mbar
free convection at 40 °C ambient	4 × 10^{-4} mbar
Nominal rotational speed	60000 rpm
Standby rotational speed	42000 rpm
Run-up time to 90% speed	
EXC100E	190 s
EXC120	130 s
EXC300	100 s
Cooling method	Forced air or water
Maximum inlet flange temperature	100 °C
Ambient air temperature operating range with forced air cooling	0-35 °C
Water temperature range (for water cooling)	10-20 °C
Minimum water flow rate (at 15 °C)	15 l h^{-1}
Operating attitude	Vertical and upright, through to horizontal
Noise level at 1 metre	<50 dB(A)
Maximum magnetic field	5 mT
Recommended Controller (80 V)	EXC100, EXC120 or EXC300
(24 V d.c.)	EXDC80 and EXDC160
Other compatible Controller	EXC300
Quiescent electrical power	25 W
Interstage pumping speed (Hi variant)	
N_2	10 l s^{-1}
H_2	10 l s^{-1}

INLET FLANGE	DN100ISO-K	DN100CF
Ultimate pressure (mbar)		
Rotary vane pump**	<5 × 10^{-9}	<5 × 10^{-10}
Diaphragm pump††	<5 × 10^{-8}	<5 × 10^{-9}
Weight (kg)	5.6	8.2

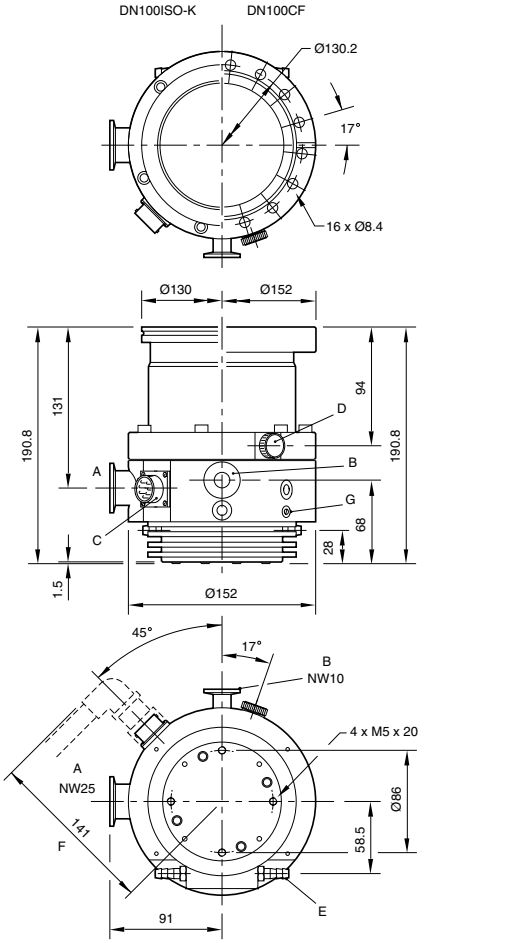
* Pumping speeds are without an inlet screen. Inlet screens are supplied fitted and reduce speed by about 10%.

† A larger backing pump may be required for maximum throughput. A suitable diaphragm backing pump with ultimate <5 mbar may also be used.

‡ With backing pressure <0.1 mbar. Above this inlet pressure, rotational speed drops to below nominal.

** Ultimate pressure 48 hours after bakeout with 2 stage rotary pump.

†† Using a diaphragm pump with ultimate <5 mbar.



A Backing port (outlet flange)
B Purge-port (adaptor shown fitted)
C Electrical supply connector
D Vent-valve
E Cooling-water connector
F Allowance for right-angle cable connector
G Earth bond point

ORDERING INFORMATION

PRODUCT DESCRIPTION		ORDERING NUMBER
Pump	Inlet flange	
EXT255H	DN100ISO-K	B75301000
EXT255H	DN100CF	B75302000
EXT255Hi	DN100ISO-K	B75303000
TIC compatible packages* (24 V d.c.)		
EXT255H	DN100ISO-K	B75301991
EXT255H	DN100CF	B75302991
EXT255Hi	DN100ISO-K	B75303991

* EXDC-160 control module (P/N D39646000) also required. See the TIC Turbo/Instrument controller entry at the end of this section for more information.

EXT250M TURBOMOLECULAR PUMP



EXT250M with DN100CF and DN100ISO-K inlet flanges

TECHNICAL DATA

Inlet flange	DN100ISO-K or DN100CF
Outlet flange	DN25NW
Vent-port	⅛ inch BSP female
Purge-port	⅛ inch BSP female
Pumping speed*	
N_2	240 l s^{-1}
He	250 l s^{-1}
H_2	190 l s^{-1}
Compression ratio	
N_2	>1 × 10^8
He	2 × 10^4
H_2	1500
Ultimate pressure (mbar)†	<5 × 10^{-9} (ISO-K) or <5 × 10^{-10} (CF)
Recommended backing pump‡	RV5
Maximum continuous inlet pressure**	
EXC300M, water cooling at 15 °C	3 × 10^{-1} mbar
air cooling at 35 °C	3 × 10^{-2} mbar
Nominal rotational speed	60000 rpm
Standby rotational speed	42000 rpm
Run-up time to 90% speed	90 s
Braking time	
with venting	1 min
without venting††	11 min
Cooling method	Free convection or forced air, or water
Maximum inlet flange temperature	100 °C
Ambient air temperature operating range	
with free convection cooling	0 - 35 °C
with forced air cooling	0 - 40 °C
Water temperature range (for water cooling)	5 - 30 °C
Minimum water flow rate (at 15 °C)	15 l h^{-1}
Operating attitude	Any orientation
Weight DN100ISO-K inlet	8.5 kg
Weight DN100CF inlet	11 kg
Noise level at 1 metre	<50 dB(A)
Maximum magnetic field	5 mT
Controller	EXC300M
Quiescent electrical power	15 W

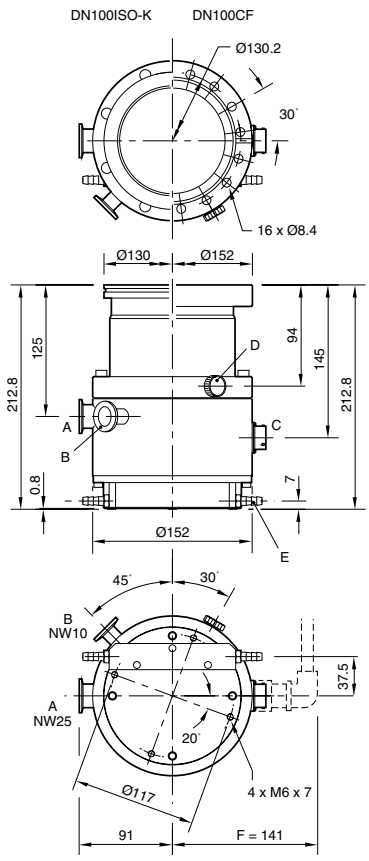
* Pumping speeds are without an inlet screen. Inlet screens are supplied fitted and reduce speed by about 10%.

† Ultimate pressure 48 hours after bakeout with 2 stage rotary pump.

‡ A larger backing pump may be required for maximum throughput.

** Above this pressure, rotational speed drops to below nominal.

†† The braking time without venting will be reduced if the EXC300M controller provides the electrical supply for an air-cooler or vent-valve.



A Backing port (outlet flange)
B Purge-port (adaptor shown fitted)
C Electrical supply connector
D Vent-valve
E Cooling-water connector
F Allowance for right-angle cable connector

The EXT250M is supplied in a kit, together with an EXC300M controller and a pump-to-controller cable.

ORDERING INFORMATION

PRODUCT DESCRIPTION	ORDERING NUMBER
EXT250M pump, EXC300M controller and cable	
DN100ISO-K flange, 1 m cable	B73521010
DN100ISO-K flange, 3 m cable	B73521030
DN100ISO-K flange, 5 m cable	B73521050
DN100CF flange, 1 m cable	B73522010
DN100CF flange, 3 m cable	B73522030
DN100CF flange, 5 m cable	B73522050

EXT555H COMPOUND MOLECULAR PUMP



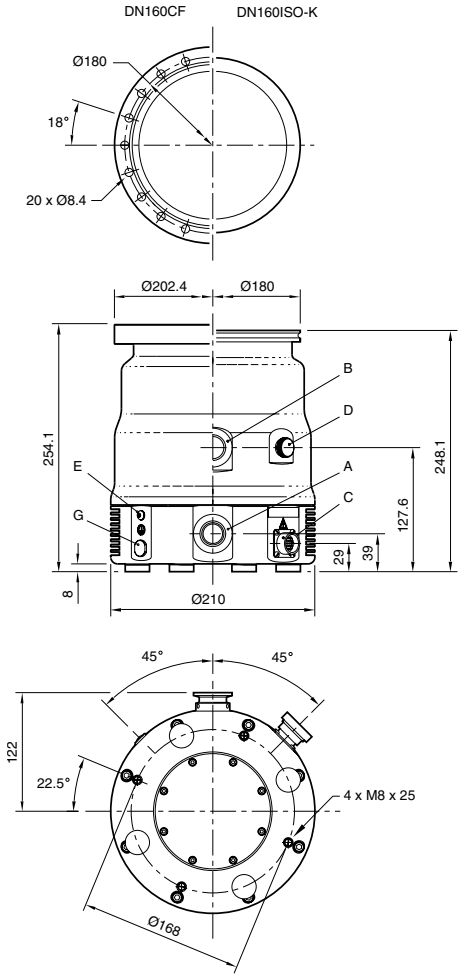
EXT555H with DN160ISO-K inlet flange

TECHNICAL DATA

Main inlet flange	DN160ISO-K / DN160CF
Outlet flange	DN25NW
Interstage port (Hi variants)	DN25NW
Vent port	1/8 inch BSP
Purge port	1/8 inch BSP
Inlet pumping speed*	
N_2	540 l s^{-1}
He	580 l s^{-1}
H_2	500 l s^{-1}
Ar	510 l s^{-1}
Interstage pumping speed (Hi variants)	
N_2	8 l s^{-1}
He	6 l s^{-1}
H_2	8 l s^{-1}
Compression ratio	
N_2	$>10^{10}$
He	10^{8}
H_2	10^{6}
Ar	$>10^{10}$
Ultimate pressure (CF variant)	$<10^{-10}$ mbar
Recommended backing pump	RV12
Maximum continuous inlet pressure (N_2, He, H_2)**	
forced air cooled, 30 °C ambient	$1x10^{-3}$ mbar
forced air cooled, 35 °C ambient	$5x10^{-4}$ mbar
water cooling at 15 °C	$2x10^{-3}$ mbar
Nominal rotational speed	50000 rpm
Start time to 90% speed	
EXC250	5 min
EXC300	6.5 min
EXDC160	8 min
Cooling method	forced air / water
Ambient air temperature for forced air cooling	0 °C - 35 °C
Recommended cooling water flow rate (water at 15 °C)	15 l h^{-1}
Water temperature	10 - 20 °C
Maximum inlet flange temperature	80 °C
Noise level at 1m	<60 dBA
Maximum magnetic field (standard envelopes)	
Axial	< 7 mT
Radial	< 3 mT
Maximum magnetic field (martensitic envelopes)	
Axial	< 50 mT
Radial	< 50 mT
Recommended controllers	EXC250, EXC300
Quiescent power consumption	35 W

* Measured without inlet screen. Inlet screens are supplied fitted and reduce speed by up to 20%

** With backing pressure < 0.3 mbar. Above this inlet pressure rotational speed drops.



A Exhaust port
B Interstage port
C Electrical connector
D Vent port
E Earth bond point
F Allowance for right-angle cable connector
G Purge point

ORDERING INFORMATION

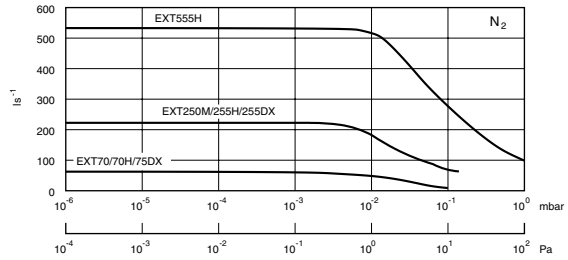
PRODUCT DESCRIPTION		ORDERING NUMBER
Pump	Inlet flange	
EXT555H	DN160ISO-K	B77701000
EXT555H	DN160CF	B77702000
EXT555Hi	DN160ISO-K (shown)	B77705000
Martensitic envelope		
EXT555HF	DN160ISO-K	B77707000
EXT555HF	DN160CF	B77708000

ACCESSORIES		ORDERING NUMBER
For safe and reliable operation, the EXT555H requires one of the following external cooling accessories		
ACX555	Air cooling accessory	B58053561
WCX555	Water cooling accessory	B58067003

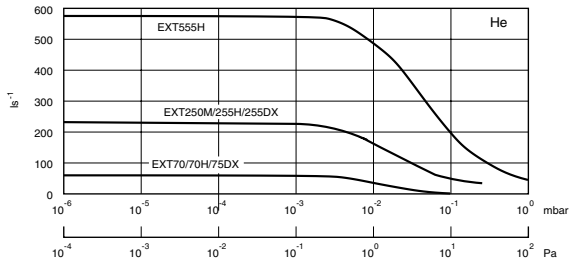
EXT PERFORMANCE GRAPHS

Pumping speed (pumping speed vs inlet pressure)

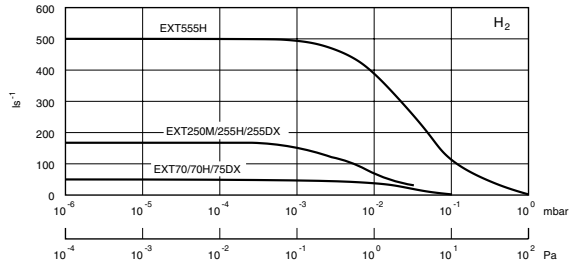
Nitrogen



Helium

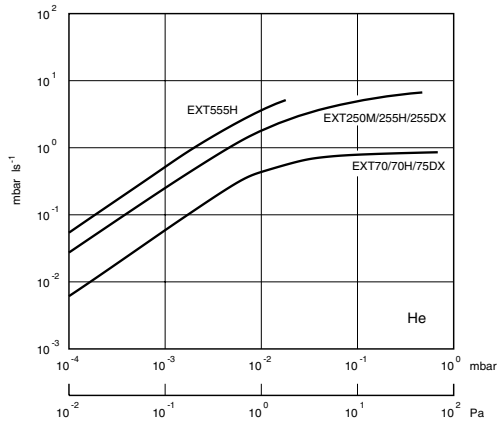


Hydrogen

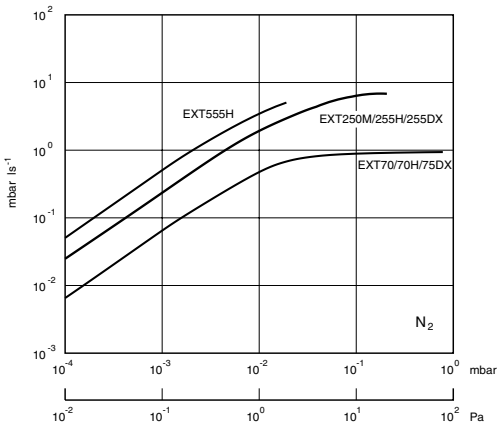


Throughput (throughput vs inlet pressure)

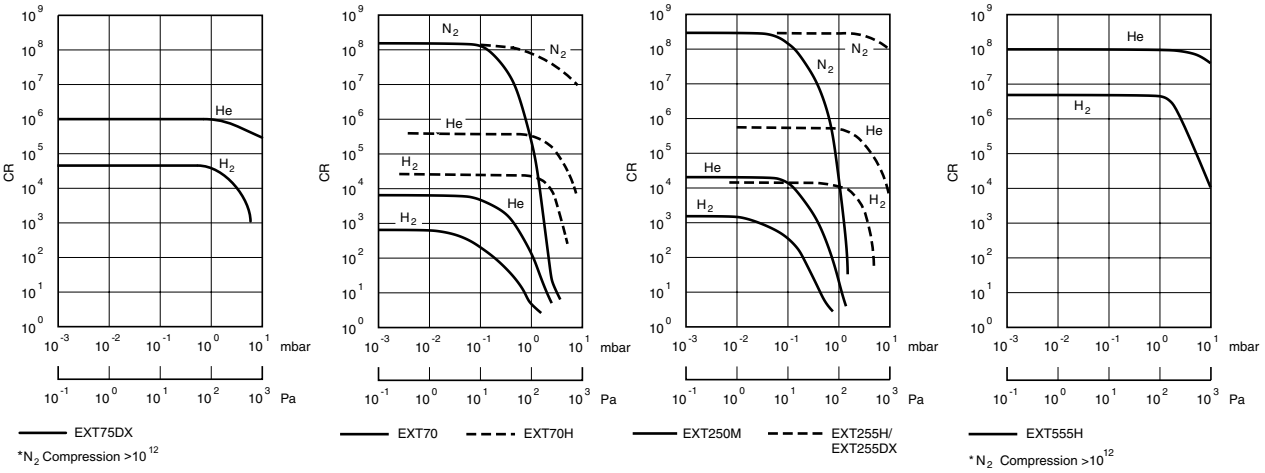
Helium



Nitrogen



Compression ratio (compression ration CR vs backing pressure)



EXC CONTROLLERS



EXC100E, EXC100L, EXC120, EXC300M and EXC300 controllers

EXC controller range

Our electronic drive EXC Controllers provide power and control for EXT pumps and accessories. There are seven Controllers: EXC100E, EXC100L, EXC250E, EXC250L, EXC120, EXC300 and EXC300M. All of these controllers, except the EXC300M, are compatible with our 80 V d.c. EXT turbomolecular pumps with brushless d.c. motors. The EXC300M is compatible with our magnetic bearing pump, the EXT250M.

The EXC120 with a maximum power output of 120W covers most pumping applications. The EXC300 is a high power version of the EXC120 and will run EXT pumps up to full speed faster than the EXC120 and will maintain pump performance at higher inlet pressures.

The EXC100 and EXC250 range of controllers have no front panel controls, and are intended for remote control only. The EXC100E and EXC250E have an external connector for use with the 1M, 3M and 5M pump-to-controller cables listed in the EXT accessories. The EXC100L and EXC250L are equipped with an integral 1M pump-to-controller cable.

Front panel controls and indicators

With the exception of the EXC100 and EXC250 range, all controllers have the following front panel controls and indicators:

- Start/Stop - to switch the pump on and off
- Standby - to switch the pump into standby mode, at 70% of full speed
- Heater - to switch the bakeout band on and off
- Fail indicator LED - is lit when the turbomolecular pump has tripped due to over-temperature or overload.
- Electrical supply indicator LED - is lit when the EXC is switched on.
- Speed indicator bar graph - has a four segment display to show when the turbomolecular pump is operating and has reached 25%, 50% and 75% of nominal speed.

Rear panel connections

All of the EXC Controllers have rear panel connectors for logic interface (for remote control), air-cooler, vent-valve and Active vacuum gauge. In addition, the EXC120, EXC300 and EXC300M have connectors for bakeout band electrical supply and rotary pump electrical supply switching.

The logic interface facilities are:

- Remote control of Start, Stop and Standby.
- Vacuum system interlocks to prevent incorrect operation of the turbomolecular pump.
- Normal and fault condition outputs
- 0-5 V d.c. analog output proportional to turbomolecular pump speed (0-10 V d.c. for EXC100 and EXC250 range)

The air-cooler and vent-valve electrical supplies are 24 V d.c. outputs which are suitable for use with BOC Edwards EXT accessories. The Active gauge connector is suitable for use with the BOC Edwards Active vacuum gauge heads, allowing the operation of the gauge head and the turbomolecular pump to be interlocked.

Features & benefits

- Controllers can drive different pumps (except the EXC300M which is dedicated to the EXT250M pump).
- Switched-mode power supplies which automatically adjust to any electrical supply.
- Electromagnetic compatibility which exceeds the requirements of the European generic immunity and emission standards.
- Regenerative power supply which provides vent-valve control options.
- Rear panel sockets for vent-valve, air-cooler and Active vacuum gauge.
- Full remote control.
- Standby and bakeout band control from front panel (except EXC100E, EXC100L, EXC250E and EXC250L).
- User selectable 'normal' speed and time-out settings.
- 0-5 V d.c. analog output proportional to turbomolecular pump rotational speed. (0-10 V d.c. for EXC100E and EXC100L).

FEATURE	EXC100E/L	EXC250E/L	EXC120	EXC300	EXC300M
Control functions available:					
Manual control			●	●	●
Remote control	●	●	●	●	●
Standby	●	●	●	●	●
Bakeout band front panel switch			●	●	●
Rotary pump switching relay			●	●	●
Hours counter				●	
Display functions available:					
Electrical supply			●	●	●
Speed (4 segment bar graph)			●	●	●
Pump on			●	●	●
Pump awaiting interlock			●	●	●
Pump fail			●		●
Pump axial emergency					●
Standby on			●	●	●
Bakeout band on (pump normal)			●	●	●
Compatible turbomolecular pumps:					
EXT70, EXT70H	●		●		
EXT255H	●	●	●	●	
EXT250M					●
EXT555H series		●		●	
Direct connection possible for:					
ACX air cooler	●	●	●	●	●
TAV vent-valve	●	●	●	●	●
BX bakeout band			●	●	●
Rotary pump switching			●	●	●
Active gauge	●	●	●	●	●

ORDERING INFORMATION

The EXC300M Controller is supplied in a kit with an EXT250M pump and a pump-to-controller cable: for ordering information, see page 5-9.

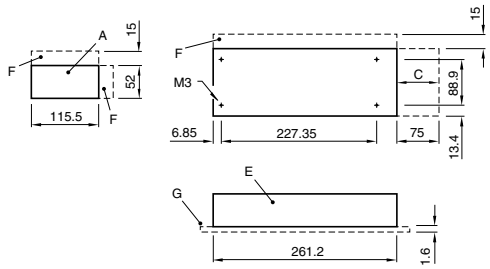
PRODUCT DESCRIPTION	ORDERING NUMBER
EXC100E	D39620000
EXC100L	D39622000
EXC250E	D39635000
EXC250L	D39636000
EXC120	D39616000
EXC300	D39614000
Electrical supply cables	
2 m no plug	D40013020
2 m UK plug	D40013025
2 m USA plug	D40013120
2 m Northern European plug	D40013030

TECHNICAL DATA

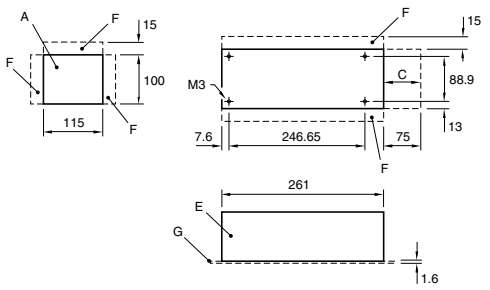
	EXC100E/L	EXC250E/L	EXC120	EXC300	EXC300M
Electrical supply voltage (V)	90-264	90-264	90-264	90-132 and 180-264	90-132 and 180-264
Electrical supply frequency (Hz)	47-63	47-63	47-63	47-63	47-63
Maximum input power (VA)					
Including bakeout band	-	-	410	700	700
With no bakeout band	260	440	260	550	550
Maximum power output (W)	100‡	250	110	290	290
Ambient temperature range (°C)	0-40	0-40	0-40	0-40	0-40
Enclosure protection rating	IP20	IP20	IP20	IP20	IP20
Electromagnetic emissions	EN61326 class B	EN61326 class B	EN61326 class B	EN61326 class B	EN61326 class B
Electromagnetic immunity	EN61326	EN61326	EN61326	EN61326	EN61326
Rotary pump contact rating*					
Maximum current (A)	-	-	15	15	15
Maximum voltage (V a.c.)	-	-	250	250	250
Weight (kg)	0.9	2.0	2.0	4.6	4.6
Set-points					
Timeout range on <50% speed (min)	1-30	1-30	1-30	1-30	1-30
Factory set timeout (speed rising) (min)	8	8	8	8	8
Timeout on speed falling (Y/N option) factory setting	no	no	no	no	no
Normal speed set-point range (%)†	65-95	65-95	65-95	65-95	65-95
Factory set normal speed (%)‡	80	80	80	80	80
Vent options, factory settings					
Vent on Controller Stop, at	50% speed	50% speed	50% speed	50% speed	50% speed
Vent on electrical supply fail, at	50% speed	50% speed	50% speed	50% speed	50% speed
Vent on pump fail, at	50% speed	50% speed	50% speed	50% speed	50% speed
Vent on axial emergency	-	-	-	-	2 s
Vent options, alternative selectable options					
Vent on Controller Stop, after	2 s	2 s	2 s	2 s	2 s
Vent on pump fail, after	2 s	2 s	2 s	2 s	2 s
Vent on axial emergency	-	-	-	-	No vent

* Inductive load with power factor of 0. † % of pump nominal rotational speed. ‡ 80 W pump + 20 W accessories

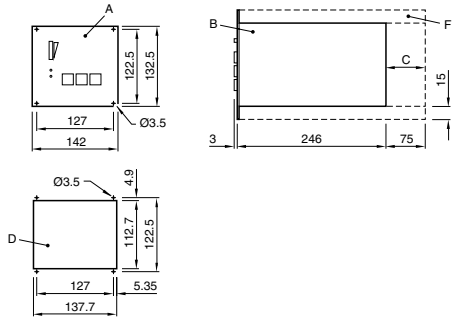
EXC100E/L



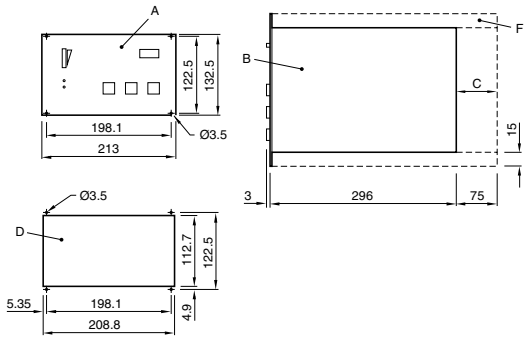
EXC250E/L



EXC120



EXC300/EXC300M



A Front panel
B View from top
C Allowance for cable bend
D Panel cut-out
E View from side
F Clearance for ventilation
G Optional adaptor plate, to fit EXC100E in place of EXC120E

TIC TURBO & INSTRUMENT CONTROLLER



A compact turbo and instrument controller with a large clear graphical display, an intuitive user interface and serial communications providing full remote control and data logging functions via a new Windows™ based PC program.

The controller automatically recognizes and supports up to three gauges from the BOC Edwards range (excluding IGC and Barocels), and one 24 V turbomolecular pump from the EXT range. Cooling and vent valve support is provided directly from the controller. Backing pump control is provided either for a compact 24 V diaphragm pump (on 200 W versions only), or where greater pumping speeds are required, mains backing pumps (up to E2M28) may be controlled via an optional relay box. The relay box also controls a mains heater band and backing line isolation valve and may include three 250 V a.c. 3 A changeover relays, which are activated by the gauge open collector set point outputs.

High pressure gauges may be used to initiate turbo pumps and low pressure gauges; alternatively, time delays and normal signals may be used to control events such as turbo and instrument start. There is a comprehensive selection of protection and safety interlock features.

The TIC turbo and instrument controller may be either rack or bench mounted and provides a useful hub for the flexible operation of a wide range of vacuum system configurations.

Features & benefits

Universal turbo & instrument controller

- TIC automatically recognizes and controls up to three active gauges and one 24 V turbomolecular pump from either the DX or EXDC ranges. The 200 W version provides sufficient power to ensure optimum performance of larger 255 turbos. DX turbos have full serial communication with TIC and may be both configured and report status via TIC.

Backing pump support

- Both mains and 24 V backing pumps may be controlled by TIC. The 200 W version supports the new XDD1 dry diaphragm pump. For larger vacuum systems both the 100 W and 200 W versions may control mains backing pumps, including XDS10 and up to RV12, via the optional relay box.

Relay options

- Three optional relay boxes are available for use with TIC. These include a version with three 250 V 3 A changeover relays, activated by the TIC internal open collector set point outputs. Another version controls a mains backing pump, turbo heater band and backing line isolation valve. The final relay box combines these features to provide 250 V changeover relays, backing pump and auxiliary controls.
- All relay boxes include a logic bypass facility for further system integration.

Simple system configuration

- In most instances, TIC systems may be simply and quickly configured using the range of standard cables on offer, there is therefore no need for the customer to prepare loom assemblies or relay boxes and special interfaces.

Direct pressure readout

- TIC includes lookup tables for a range of commonly encountered process gasses (N_2, He, Ar, CO_2, Kr & Ne). Selecting the appropriate gas enables direct readout of the correct pressure without the need to apply conversion factors.

Compact instrument

- TIC is packaged in a compact case and may be panel or rack (¼ 19" rack 3U) mounted. With the addition of the bezel it becomes an attractive bench-top instrument.

Clear, easy to use graphical user interface

- The large 128 x 64 pixel backlit graphics LCD and mobile phone style menu system simplifies programing and with a choice of summary screens excellent visibility of displayed parameters is assured.

Universal power supply

- TIC will operate from mains supplies with voltages between 90 and 264 V a.c., and frequencies between 47 and 63 Hz. No user intervention being required.

Serial communications

- To enable complete integration into PC and PLC controlled processes, all TIC variants include RS232 and RS485 interfaces as standard.

Windows™ PC program

- TIC is supplied with a new Windows™ PC program which enables full setup and control from a PC, using the RS232 interface.

Software upgrades

- As new compatible products are released, TIC software may be simply upgraded using the special utility supplied with the Windows™ PC program.

TIC software upgrades will be made available via e-mail and the Internet.

TECHNICAL DATA

TURBO PUMP OPTIONS	TURBO PUMP 24 V TIC VARIANT 100 W	200 W
EXT75DX	Fast	Fast
EXT70H & EXDC80	Fast	Fast
EXT255H & EXDC80*	Slow	Slow
EXT255H & EXDC160	N/A	Fast
EXT255DX	Slow**	Fast

* Ramp speed is limited by the use of the EXDC80

** When configured to low power start

Logic Interface	The logic interface connector includes the functions listed below. It may be used either to link to system relays, a higher-level control system, or an optional relay box. By utilizing the relay box pass-through connector, a combination of a higher-level control system and relay box may be used.
Control inputs	
Turbo start/stop*	Closed when low: < 0.5 V d.c. Open when High: 4 to 24 V d.c.
Turbo standby	Closed when low: < 0.5 V d.c. Open when High: 4 to 24 V d.c.
Gauge enable 1, 2, 3	Closed when low: < 0.5 V d.c. Open when High: 4 to 24 V d.c.
Backing pump start/stop*	Closed when low: < 0.5 V d.c. Open when High: 4 to 24 V d.c.
System interlock SYSI	Closed when low: < 0.5 V d.c. Open when High: 4 to 24 V d.c.

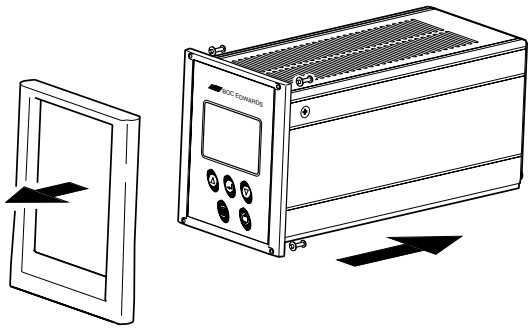
Control outputs	
Vent valve control	O/C 24 V d.c. 100 mA
Heater band control	O/C 24 V d.c. 50 mA
Backing pump control	O/C 24 V d.c. 100 mA
Air cooler	O/C 24 V d.c. 200 mA
Status outputs	
Analog output	0-10 V d.c.
Set point A, B, C	O/C 24 V d.c. 50 mA
Turbo normal speed	O/C 24 V d.c. 50 mA
Alarm	O/C 24 V d.c. 50m A
Serial interface	The TIC has two built-in communications protocols, RS232 and RS485. These may be used either to interface to a PLC or, using the Windows™ PC software package supplied connected to a PC for full monitoring and control of a TIC system.

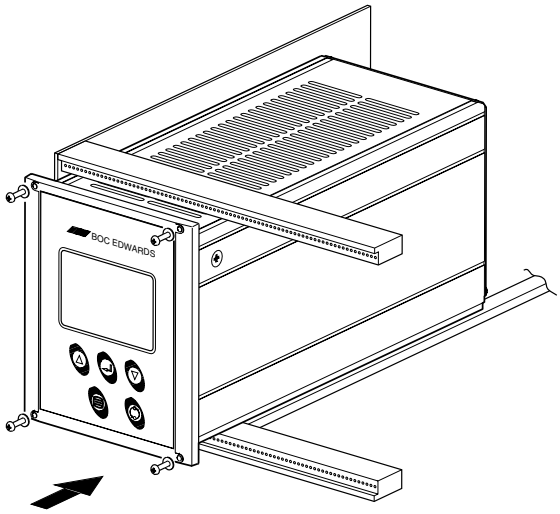
* Start/stop commands are 'edge triggered'.

	TIC TURBO CONTROLLER INSTRUMENTS 100 W RS232	TIC TURBO CONTROLLER INSTRUMENTS 200 W RS232
Mains input		
Electrical supply	90 to 264 V a.c. 47 to 63 Hz	
Power consumption (max)	215 VA	350 VA
Peak inrush current	10.3 A @ 110 V a.c. 23.0 A @ 230 V a.c.	
Fuse	TIC is self-protecting and has no user replaceable fuse. The unit will recover when the overload is removed	
Earth stud	M4	

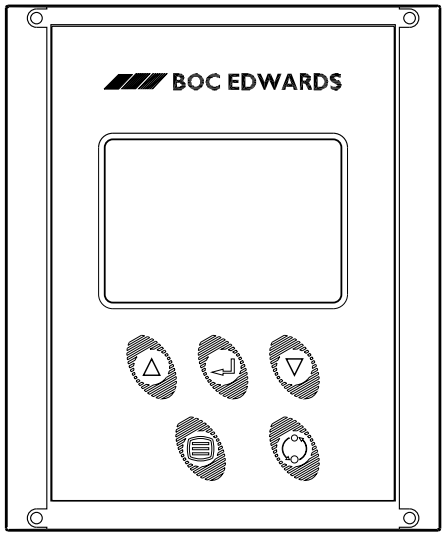
Auxiliary terminals	
Air cooling fan	24 V d.c. 3 W max, ACX70, ACX75 & ACX250H
Vent valve	24 V d.c. 2 W max, TAV5 & TAV6
Interface cables	Use cables as specified in 'ordering information'
Dimensions	
Electronics housing	110 mm high x 105 mm wide x 245 mm deep
Front panel	106 mm wide x 128 mm high
Weight	
Turbo & instrument controller 100 W RS232	2.75 kg
Turbo & instrument controller 200 W RS232	3.5 kg
Operating temperature	+0 ° to +40 °C
Storage temperature	-30 ° to +70 °C
Maximum ambient operating humidity	90% RH non-condensing at 40 °C
Maximum operating altitude	3000 m
Electronic Design	EN 61010-1
Electromagnetic Compatibility	EN 61326 Industrial Location, Class B Emissions
Enclosure rating	IP20

Bench and rack mounting options (1/4 19" 3U sub rack)





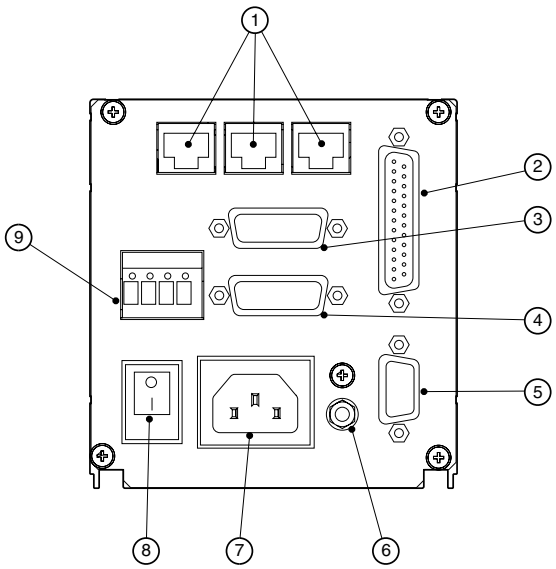
External interfaces



Display - 128 x 64 pixel backlit graphics LCD

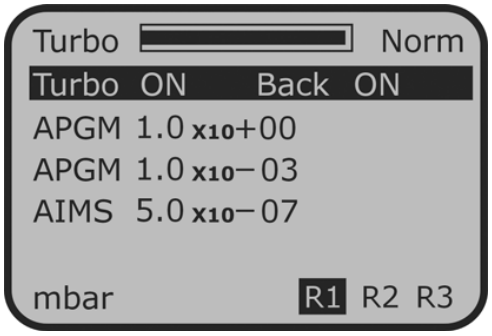
Front panel keypad control functions include:

- △ Scroll up button
- ▽ Scroll down button
- ↵ Enter/Select button
- Menu/Back button
- Cycle button



1	Gauge inputs	FCC68 (RJ45)
2	Logic Interface	25-way 'D' socket
3	Backing pump 24 V	15-way 'D' socket *
4	Turbo pump 24 V	15-way 'D' socket
5	RS232/485	9-way 'D' socket
6	Earth stud	M4
7	Mains input	CEE/IEC 320 plug
8	Mains on/off switch	
9	Auxiliary vent valve and fan terminals (24 V supply)4 -way screw term	
*	Available on 200 W versions only	

Display interface



TIC software is structured through a series of easily accessible screens, similar to a mobile telephone.

TIC automatically recognizes which gauges and turbo are connected and displays the appropriate information on the default summary screen. Scrolling and selecting accesses the control and set-up menus for that item.

Turbo speed is shown as a proportion of full speed by a bar graph. 'Norm' indicates that the turbo has reached its Normal Speed, whilst forward or reverse facing chevrons indicate acceleration and deceleration.

Pump status is displayed, which combined with gauge outputs and relay status gives a clear indication of what is currently happening in the vacuum system.

There are a number of display options for maximum clarity. In addition, two levels of password protection may be applied, effectively restricting or preventing unauthorized intervention.

In the event of an error occurring, TIC will display either a WARNING or flash an ALARM. A warning advises of a condition outside normal parameters, requiring no action, but an alarm must be cleared before normal operation may resume.

Display units may be in mbar, Torr, Pa or Volts.

The three set point relays which are highlighted when tripped, may be linked to any gauge.

Gauge inputs

Instrument supporting TIC variants recognize and control the following gauges:

APG, APGX, ATC, ASG, AIM, WRG & AIGX*

* No more than one AIGX gauge may be connected to TIC at a time.

Backing pump 24 V

(For mains backing pump support, see below.)

200 W turbo supporting TIC variants recognize and control the following 24 V backing pumps:

XDD1

Relay box (optional)

General description A range of relay boxes has been developed to allow TIC to operate three 250 V a.c. 3 A (non-inductive) changeover relays, mains backing pumps and accessories.

The changeover relays are activated by the TIC set point outputs. The mains backing pump relay controls a backing line isolation valve, such that when the backing pump is switched off the isolation valve closes.

The relay box is connected to the TIC via the logic interface connector, which is also provided with a bypass connector for interfacing with OEM equipment.

Relay box options

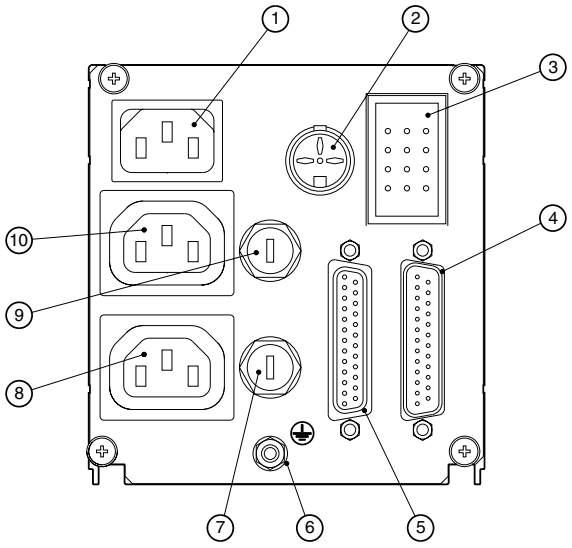
	Changeover relays (3 off 250 V a.c. 3 A)	Heater band & backing line isolation valve	Small backing pump
TIC Relay Box Instruments	✓		
TIC Relay Box Small Backing pump		✓	✓
TIC Relay Box Inst & Small Backing pump	✓	✓	✓

Compatible mains backing pumps and accessories

Small backing pumps: E2M0.7 & 1.5, RV3, 5, 8 & 12, XDS5C & 10C, XDS5 & 10 & ESDP12

Heater band: BX70 & BX250

Backing line isolation valve: LCPV16EKA & LCPV25EKA



1	Mains input	CEE/IEC 320 plug ‡
2	Backing line isolation valve	3-way DIN socket ‡
3	250 V 3 A changeover relays	12-way Positronic plug *
4	Logic interface (from TIC)	25-way 'D' socket *‡
5	Logic bypass (to PC, PLC etc.)	25-way 'D' socket *‡
6	Earth stud	M4 *‡
7	Heater band fuse ‡	
8	Heater band	CEE/IEC 320 socket ‡
9	Mains backing pump fuse ‡	
10	Mains backing pump	CEE/IEC 320 socket ‡

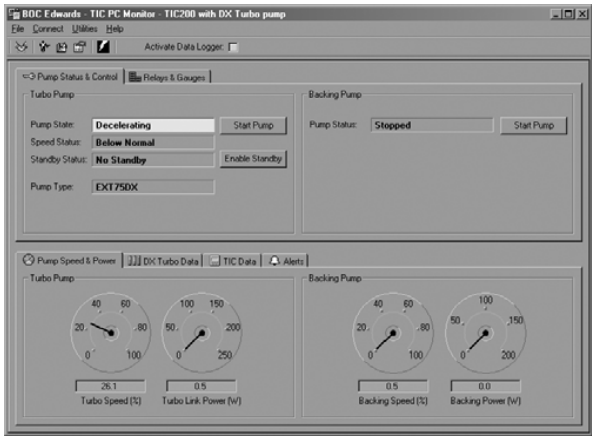
* Available on TIC Relay Box Instruments

‡ Available on TIC Relay Box Small Backing

Note: Combined instrument and small backing pump variant shown.

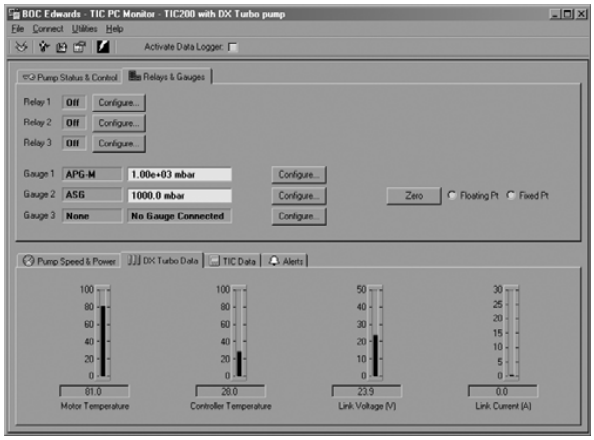
Windows™ PC program

TIC is supplied with fully functional Windows™ based PC software, which replicates and adds to the TIC control menus.



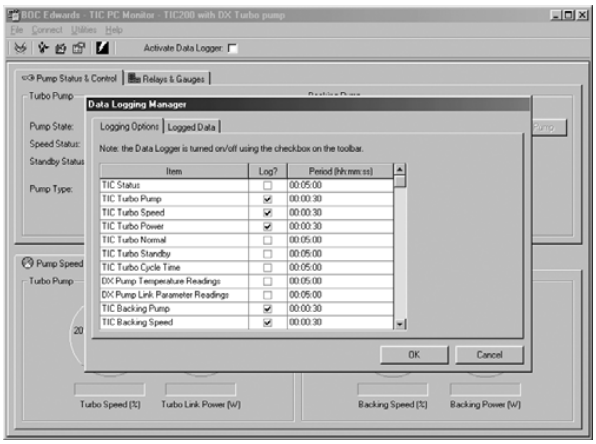
The PC software enables TIC systems to be configured, controlled and monitored from a single PC.

A useful data logging facility is also included, which saves user selectable parameters to file (in .csv format) for later analysis using suitable software.



TIC system configurations may be created and saved for use at a later date, thus saving programing time.

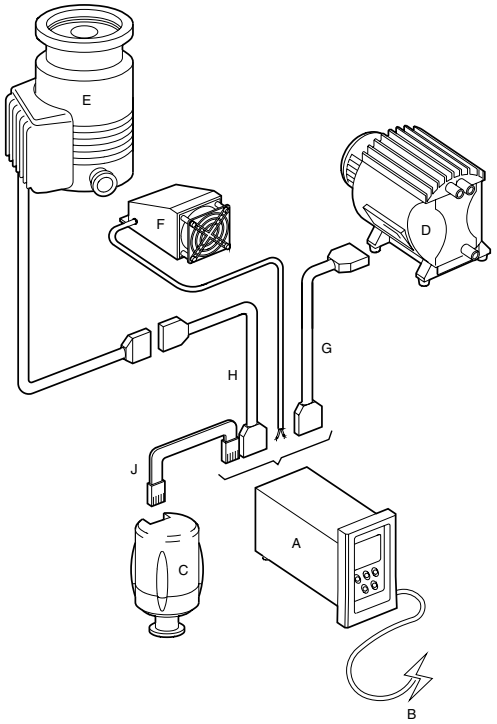
The PC software includes an upgrade utility, which enables the TIC software to be upgraded over the serial link from files supplied electronically.



Configuration examples

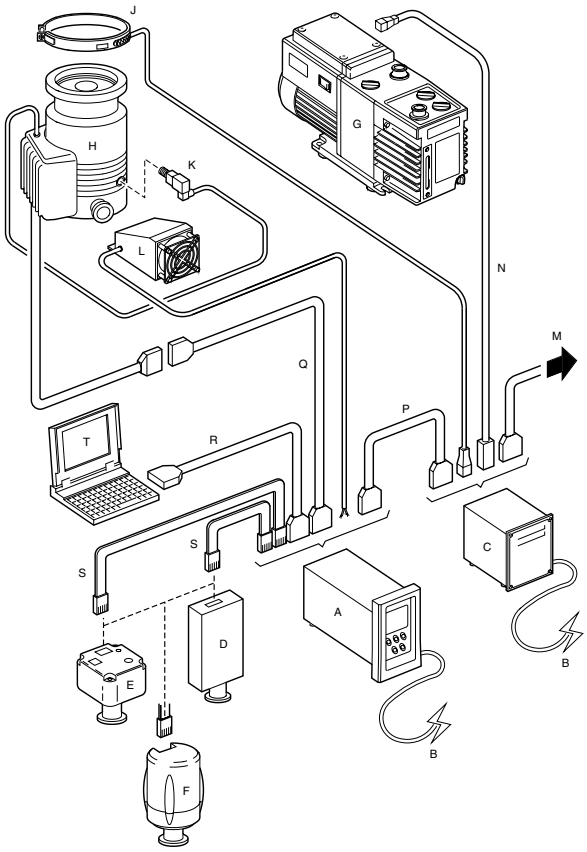
ITEM	ORDERING NUMBER	DESCRIPTION
A	D39722000	TIC turbo/inst cont 200 W RS232*
B	D40013025	2 m UK mains cable
C	D14701000	WRG-S-NW25
D	A74601991	XDD1 24 V d.c. diaphragm pump
E	B72241000	EXT75DX ISO63
F	B58053075	ACX75 air-cooler
G	D39700836	XDD/DX/EXDC extension cable 2 m
H	D39700836	XDD/DX/EXDC extension cable 2 m (optional)
J	D40001005	0.5 m active gauge cable

* When using an XDD1 pump, the turbo should be either controlled by a gauge or be subjected to a start delay.

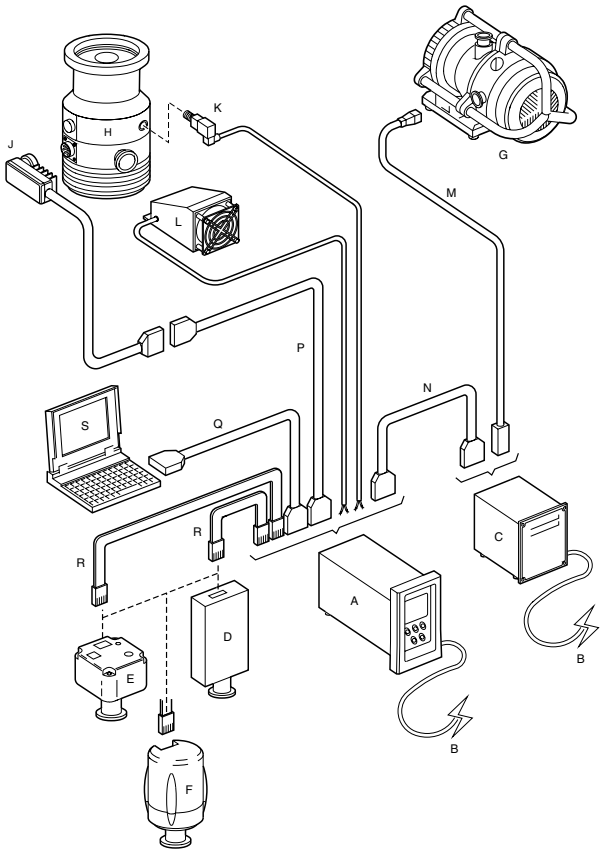


ITEM	ORDERING NUMBER	DESCRIPTION
A	D39721000	TIC turbo/inst cont 100 W RS232
B	D40013025	2 m UK mains cable
C	D39711805	TIC relay box small backing
D	D02372000	APGX-M-NW25 STST
E	D04850000	AIGX-S-NW25
F	D14701000	WRG-S-NW25
G	A65201903	RV3 pump 1-phase
H	B72241000	EXT75DX ISO63
J	B58052060	BX70 heater band 240 V 60 W*
K	B58066010	TAV5 vent valve
L	B58053075	ACX75 air-cooler
M	D39700833	TIC logic interface cable 2 m
N	D39700831	TIC mains cable IEC320 M/F 2 m
P	D39700833	TIC logic interface cable 2 m
Q	D39700836	XDD/DX/EXDC extension cable 2 m (optional)
R	D39700834	TIC RS232 interface cable 2 m (optional
S	D40001020	2 m active gauge cable
T	N/A	PC with RS232 interface (optional)

* For use with water cooled pumps only.



Configuration examples



ITEM	ORDERING NUMBER	DESCRIPTION
A	D39722000	TIC turbo/inst cont 200 W RS232
B	D40013025	2 m UK mains cable
C	D39711805	TIC relay box sml backing
D	D02371000	APGX-M-NW16 AL
E	D04850000	AIGX-S-NW25
F	D14701000	WRG-S-NW25
G	A72701903	XDS10
H	D75301991	EXT255H DN100ISO-K 24 V
J	D39646000	EXDC160 24 V
K	B58066010	TAV5 vent valve
L	B58053160	ACX250H air-cooler
M	D39700831	TIC mains cable IEC320 M/F 2 m
N	D39700833	TIC logic interface cable 2 m
P	D39700836	XDD/DX/EXDC extension cable 2 m (optional)
Q	D39700834	RS232 interface cable 2 m (optional)
R	D40001010	1 m active gauge cable
S	N/A	PC with RS232 interface (optional)

ORDERING INFORMATION

PRODUCT DESCRIPTION	ORDERING NUMBER
Controllers (supplied with manuals and software)	
TIC turbo & instrument controller 100 W RS232	D39721000
TIC turbo & instrument controller 200 W RS232	D39722000
Relay boxes (supplied with a set of mating connectors)	
TIC relay box instruments (3 x 250 V a.c. 3 A changeover relays)	D39700804
TIC relay box small backing pump	D39711805
TIC relay box instruments & small backing pump	D39721806
Cables	
Mains cables (TIC and relay box supply)	
2 m UK plug	D40013025
2 m USA plug	D40013120
2 m Northern European plug	D40013030
Mains cables (relay box to RV and XDS type pumps)	
2 m TIC mains cable IEC320 m/f	D39700831
5 m TIC mains cable IEC320 m/f	D39700832
Interface cables	
2 m TIC logic interface cable	D39700833
2 m TIC RS232 interface cable	D39700834
24 V pump extension cables (use with EXDC, DX & XDD1 type pumps)	
1 m XDD/DX/EXDC extension cable	D39700835
2 m XDD/DX/EXDC extension cable	D39700836
5 m XDD/DX/EXDC extension cable	D39700837
Active gauge cables (include FCC68 compatible connections at both ends)	
0.5 m active gauge cable	D40001005
1 m active gauge cable	D40001010
3 m active gauge cable	D40001030
5 m active gauge cable	D40001050
10 m active gauge cable	D40001100
15 m active gauge cable	D40001150
15 m active gauge cable (24 AWG)	D40005150
25 m active gauge cable	D40001250
30 m active gauge cable (24 AWG)	D40005300
50 m active gauge cable	D40001500
100 m active gauge cable	D40001999
Other accessories and supporting products	
TIC front bezel kit (spare)	D39700803

TIC TURBO CONTROLLER



A compact turbo controller with a large clear graphical display, an intuitive user interface and serial communications providing full remote control and data logging functions via a new Windows™ based PC program.

The controller automatically recognizes and supports one 24 V turbomolecular pump from the EXT range. Cooling and vent valve support is provided directly from the controller. Backing pump control is provided for a compact 24 V diaphragm pump (on 200 W versions only), or where greater pumping speeds are required, mains backing pumps (up to E2M28) may be controlled via an optional relay box. The relay box can also be used to control a mains heater band and backing line isolation valve.

Time delays and normal speed signals may be used to control events such as turbo start and there is a comprehensive selection of protection and safety interlock features.

The TIC turbo controller may be either rack or bench mounted and provides a useful hub for the flexible operation of a wide range of vacuum system configurations.

Features & benefits

Universal turbo & instrument controller

- TIC automatically recognizes and controls one 24 V turbomolecular pump from either the DX or EXDC ranges. The 200 W version provides sufficient power to ensure optimum performance of larger 255 turbos. DX turbos have full serial communication with TIC and may be both configured and report status via TIC.

Backing pump support

- Both mains and 24 V backing pumps may be controlled by TIC. The 200 W version supports the new XDD1 dry diaphragm pump. For larger vacuum systems both the 100 W and 200 W versions may control mains backing pumps, including XDS10 and up to RV12, via the optional relay box.

Relay options

- The optional external relay box enables mains backing pumps to be controlled and also provides interfaces for a turbo heater band, a backing line isolation valve and a logic bypass.
- All relay boxes include a logic bypass facility for further system integration.

Simple system configuration

- In most instances, TIC systems may be simply and quickly configured using the range of standard cables on offer, there is therefore no need for the customer to prepare loom assemblies or relay boxes and special interfaces.

Compact instrument

- TIC is packaged in a compact case and may be panel or rack (¼ 19" rack 3U) mounted. With the addition of the bezel it becomes an attractive bench-top instrument.

Clear, easy to use graphical user interface

- The large 128 x 64 pixel backlit graphics LCD and mobile phone style menu system simplifies programing and with a choice of summary screens excellent visibility of displayed parameters is assured.

Universal power supply

- TIC will operate from mains supplies with voltages between 90 and 264 V a.c., and frequencies between 47 and 63 Hz. No user intervention being required.

Serial communications

- To enable complete integration into PC and PLC controlled processes, all TIC variants include RS232 and RS485 interfaces as standard.

Windows™ PC program

- TIC is supplied with a new Windows™ PC program which enables full setup and control from a PC using the RS232 interface.

Software upgrades

- As new compatible products are released, TIC software may be simply upgraded using the special utility supplied with the Windows™ PC program.
- TIC software upgrades will be made available via e-mail and the Internet.

TECHNICAL DATA

TURBO PUMP 24 V		
TURBO PUMP OPTIONS	TIC VARIANT	
	100 W	200 W
EXT75DX	Fast	Fast
EXT70H & EXDC80	Fast	Fast
EXT255H & EXDC80*	Slow	Slow
EXT255H & EXDC160	N/A	Fast

* Ramp speed is limited by the use of the EXDC80.

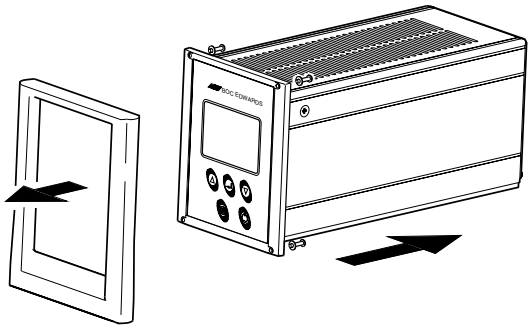
Logic Interface	The logic interface connector includes the functions listed below. It may be used either to link to system relays, a higher-level control system, or an optional relay box. By utilizing the relay box pass-through connector, a combination of a higher-level control system and relay box may be used.
Control inputs	
Turbo start/stop*	Closed when low: < 0.5 V d.c. Open when High: 4 to 24 V d.c.
Turbo standby	Closed when low: < 0.5 V d.c. Open when High: 4 to 24 V d.c.
Backing pump start/stop*	Closed when low: < 0.5 V d.c. Open when High: 4 to 24 V d.c.
System interlock SYSI	Closed when low: < 0.5 V d.c. Open when High: 4 to 24 V d.c.
Control outputs	
Vent valve control	O/C 24 V d.c. 100 mA
Heater band control	O/C 24 V d.c. 50 mA
Backing pump control	O/C 24 V d.c. 100 mA
Air cooler	O/C 24 V d.c. 200 mA
Status outputs	
Analog output	0-10 V d.c.
Set point A, B, C	O/C 24 V d.c. 50 mA
Turbo normal speed/alarm	O/C 24 V d.c. 50m A
Serial interface	The TIC has two built-in communications protocols, RS232 and RS485. These may be used either to interface to a PLC or, using the Windows™ PC software package supplied connected to a PC for full monitoring and control of a TIC system.

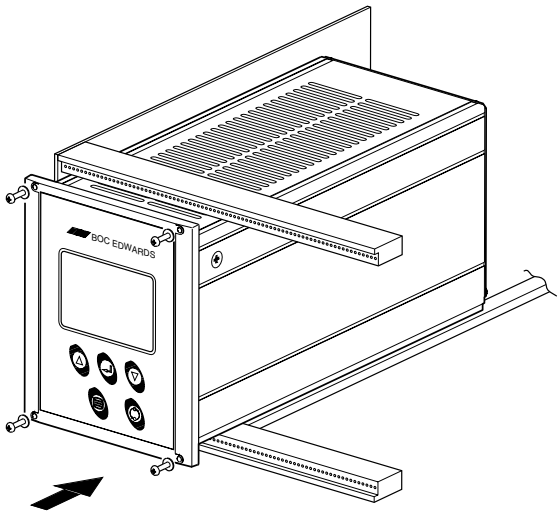
* Start/stop commands are 'edge triggered'.

	TIC TURBO CONTROLLER INSTRUMENTS 100 W RS232	TIC TURBO INSTRUMENTS CONTROLLER 200 W RS232
Mains input		
Electrical supply	90 to 264 V a.c. 47 to 63 Hz	
Power consumption (max)	215 VA	350 VA
Peak inrush current	10.3 A @ 110 V a.c. 23.0 A @ 230 V a.c.	
Fuse	TIC is self-protecting and has no user replaceable fuse. The unit will recover when the overload is removed	
Earth stud	M4	

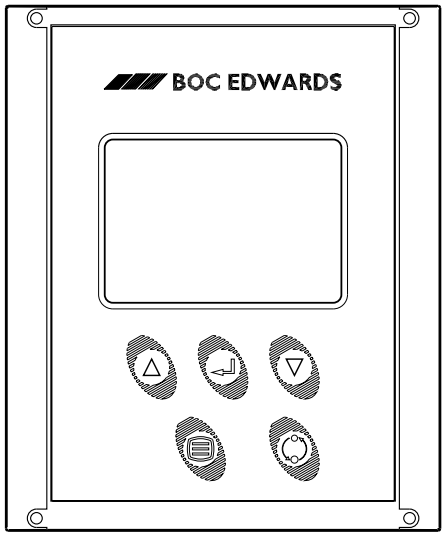
Auxiliary terminals	
Air cooling fan	24 V d.c. 3 W max, ACX70, ACX75 & ACX250H
Vent Valve	24 V d.c. 2 W max, TAV5 & TAV6
Interface cables	Use cables as specified in 'ordering information'
Dimensions	
Electronics housing	110 mm high x 105 mm wide x 245 mm deep
Front panel	106 mm wide x 128 mm high
Weight	
TIC Turbo controller 100 W RS232	2.75 kg
TIC Turbo controller 200 W RS232	3.5 kg
Operating temperature	+0 ° to +40 °C
Storage temperature	-30 ° to +70 °C
Maximum ambient operating humidity	90% RH non-condensing at 40 °C
Maximum operating altitude	3000 m
Electronic design	EN 61010-1
Electromagnetic compatibility	EN 61326 (Industrial Location, Class B Emissions)
Enclosure rating	IP20

Bench and rack mounting options (1/4 19" 3U sub rack)





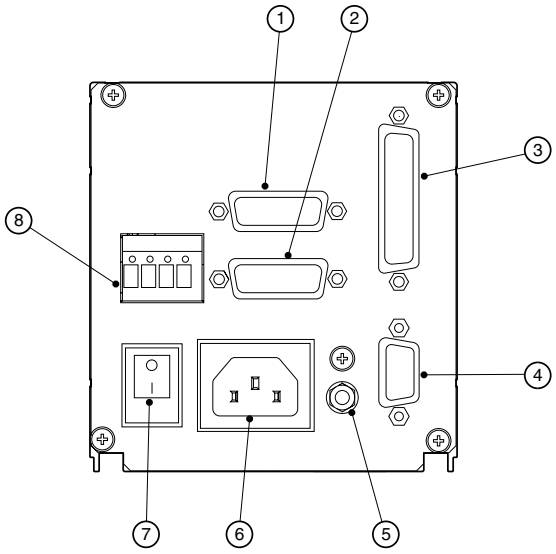
External interfaces



Display - 128 x 64 pixel backlit graphics LCD

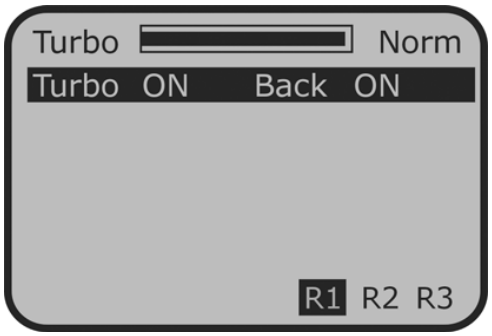
Front panel keypad control functions include:

- △ Scroll up button
- ▽ Scroll down button
- ↵ Enter/Select button
- ☰ Menu/Back button
- ↻ Cycle button



1	Backing pump 24 V	15-way 'D' socket *
2	Turbo pump 24 V	15-way 'D' socket
3	Logic Interface	25-way 'D' socket
4	RS232/485	9-way 'D' socket
5	Earth stud	M4
6	Mains input	CEE/IEC 320 plug
7	Mains on/off switch	valve and fan
8	Auxiliary vent terminals (24 V) supply	4-way screw term
*	Available on 200 W versions only	

Display interface



TIC software is structured through a series of easily accessible screens, similar to a mobile telephone.

TIC automatically recognizes which turbo connected and displays the appropriate information on the default summary screen. Scrolling and selecting accesses the control and set-up menus for that item.

Turbo speed is shown as a proportion of full speed by a bar graph. 'Norm' indicates that the turbo has reached its Normal Speed, whilst forward or reverse facing chevrons indicate acceleration and deceleration.

Two levels of password protection are available, effectively restricting or preventing unauthorized intervention.

Pump status is displayed, giving a clear indication of what is currently happening in the vacuum system.

In the event of an error occurring, TIC will display either a WARNING or flash an ALARM. A warning advises of a condition outside normal parameters, requiring no action, but an alarm must be cleared before normal operation may resume

The three setpoint relays, which are highlighted when tripped, may be linked to turbo speed.

Backing pump 24 V

(For mains backing pump support, see below.)

200 W turbo supporting TIC variants recognize and control the following 24 V backing pumps:

XDD1

Relay box (optional)

General description A range of relay boxes has been developed to allow TIC to operate mains backing pumps and accessories.

The mains backing pump relay controls a backing line isolation valve, such that when the backing pump is switched off the isolation valve closes.

The relay box is connected to the TIC via the logic interface connector, which is also provided with a bypass connector for interfacing with OEM equipment.

Relay box options

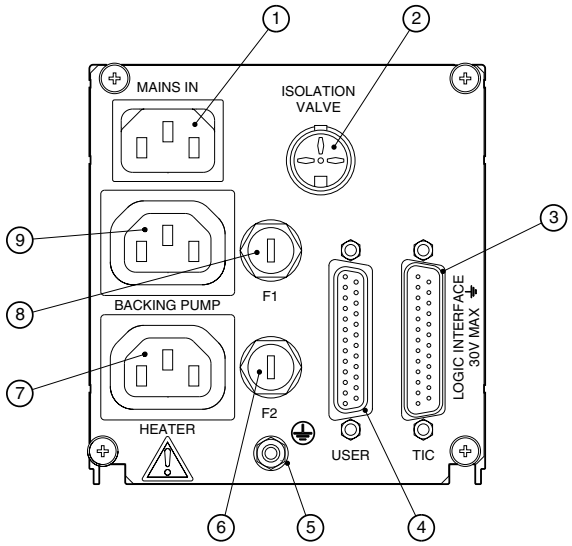
	Changeover relays (3 off 250 V a.c. 3 A)	Heater band & backing line isolation valve	Small backing pump
TIC Relay Box Small Backing pump		✓	✓
TIC Relay Box Inst & Small Backing pump	✓		

Compatible mains backing pumps and accessories

Small backing pumps: E2M0.7 & 1.5, RV3, 5, 8 & 12, XDSC5 & 10, XDS5 & 10, ESDP12

Heater band: BX70 & BX250

Backing line isolation valve: LCPV16EKA & LCPV25EKA

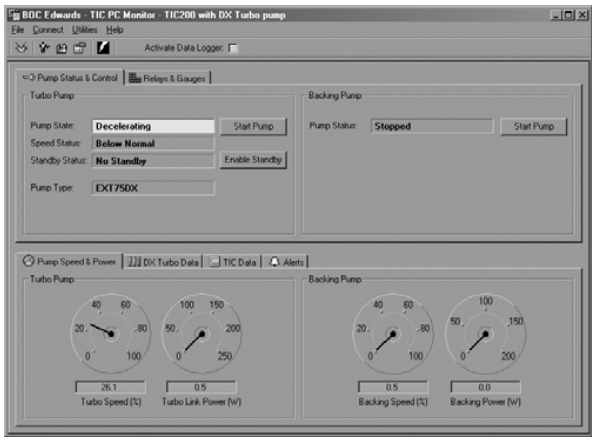


1	Mains input	CEE/IEC 320 plug
2	Backing line isolation valve	3-way DIN socket
3	Logic interface (from TIC)	25-way 'D' socket
4	Logic bypass (to PC, PLC etc.)	25-way 'D' socket
5	Earth stud	M4
6	Heater band fuse	
7	Heater band	CEE/IEC 320 socket
8	Mains backing pump fuse	
9	Mains backing pump	CEE/IEC 320 socket

Shop online at www.bocedwards.com

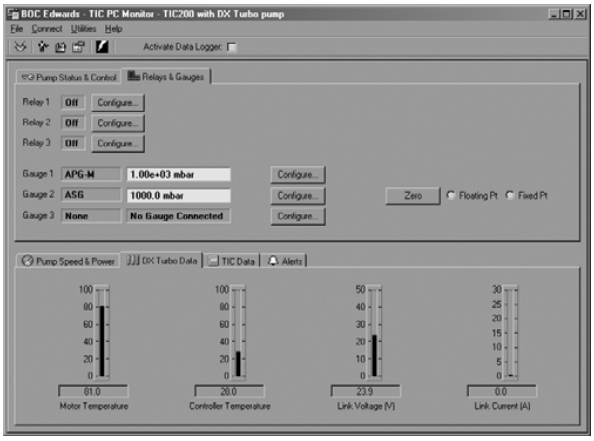
Windows™ PC program

TIC is supplied with a fully functional Windows™ based PC software, which replicates and adds to the TIC embedded control menus.



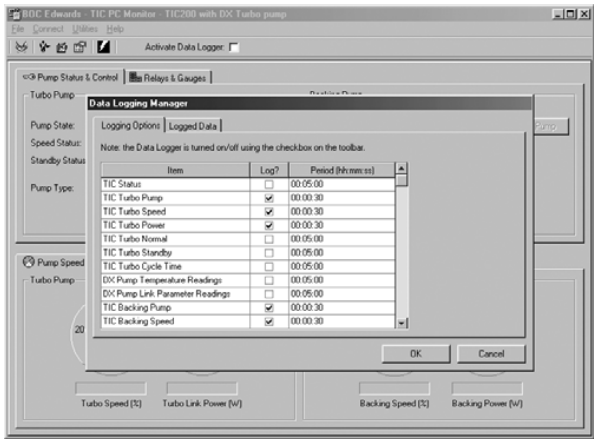
The PC software enables TIC systems to be configured, controlled and monitored from a single PC.

A useful data logging facility is also included, which saves user selectable parameters to file (in .csv format) for later analysis using suitable software.



TIC system configurations may be created and saved for use at a later date, thus saving programing time.

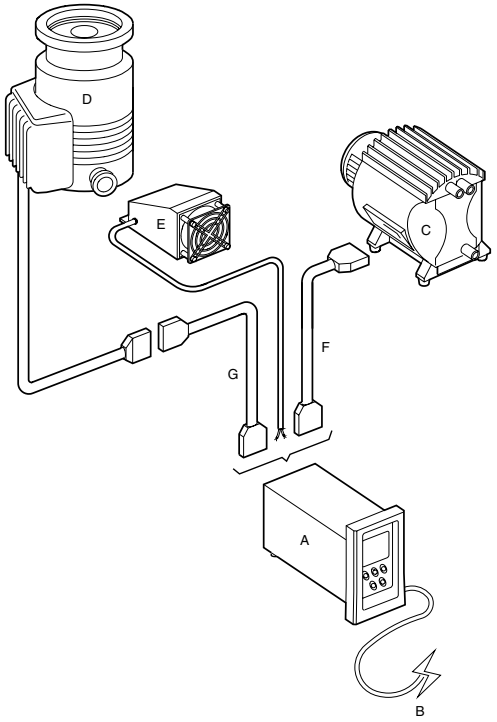
The PC software includes an upgrade utility, which enables the TIC embedded software to be upgraded over the serial link from files supplied electronically.



Configuration examples

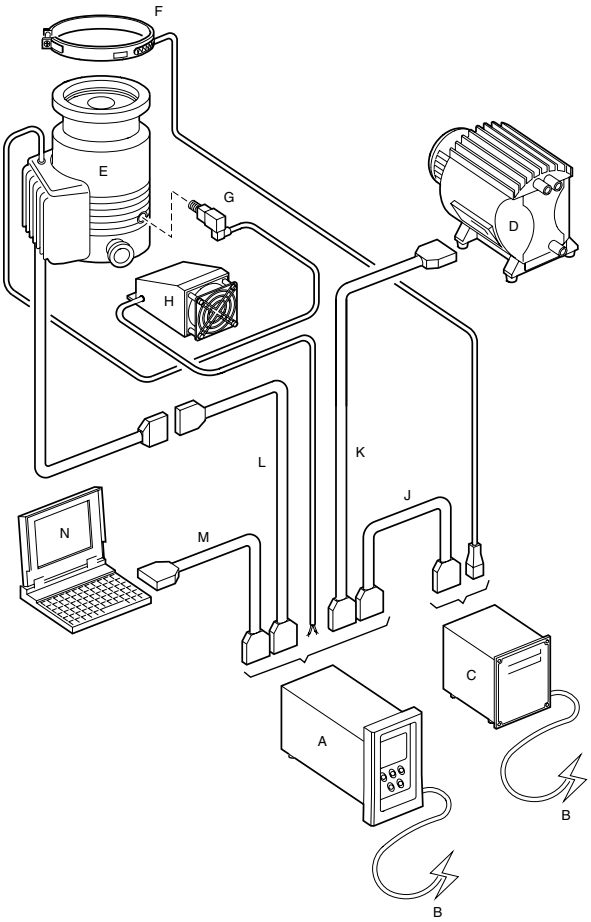
ITEM	ORDERING NUMBER	DESCRIPTION
A	D39712000	TIC turbo 200 W RS232*
B	D40013025	2 m UK mains cable
C	A74601991	XDD1 24 V d.c. diaphragm pump
D	B72241000	EXT75DX ISO63
E	B58053075	ACX75 air-cooler
F	D39700836	XDD/DX/EXDC extension cable 2 m
G	D39700836	XDD/DX/EXDC extension cable 2 m (optional)

* When using an XDD1 pump, the turbo should be subjected to a short delay.



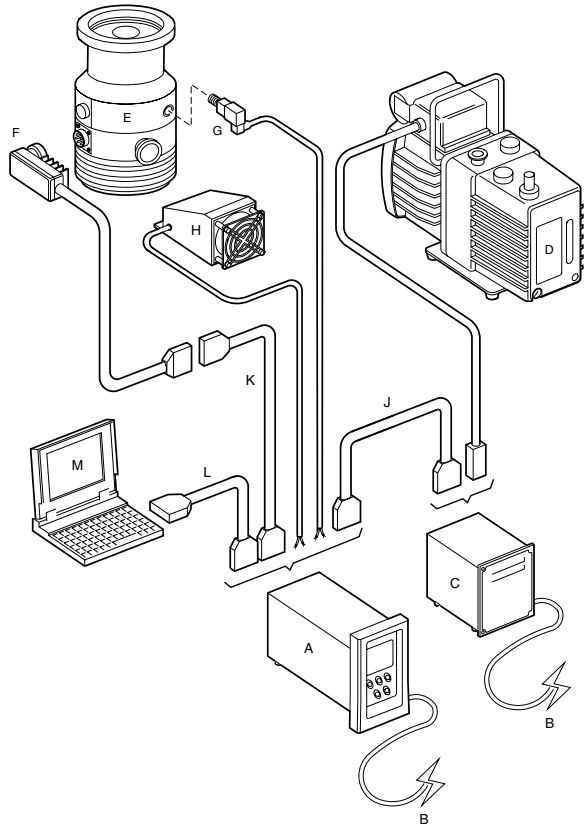
ITEM	ORDERING NUMBER	DESCRIPTION
A	D39712000	TIC turbo cont 200 W RS232
B	D40013025	2 m UK mains cable
C	D39711805	TIC relay box sml bkg
D	A74601991	XDD1 24 V d.c. diaphragm pump
E	B72241000	EXT75DX ISO63
F	B58052060	BX70 heater band 240 V 60 W*
G	B58066010	TAV5 vent valve
H	B58053075	ACX75 air-cooler
J	D39700833	TIC logic interface cable 2 m
K	D39700836	XDD/DX/EXDC extension cable 2 m
L	D39700836	XDD/DX/EXDC extension cable 2 m (optional)
M	D39700834	TIC RS232 interface cable 2 m (optional)
N	N/A	PC with RS232 interface (optional)

* For use with water cooled pumps only.



Shop online at www.bocedwards.com

Configuration examples



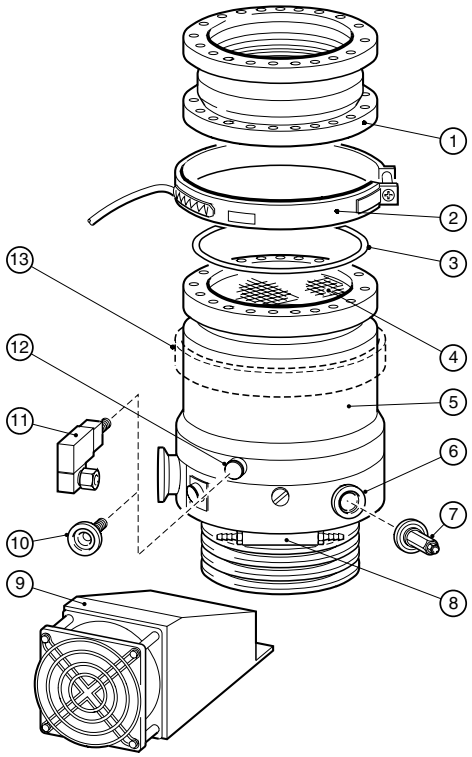
ITEM	ORDERING NUMBER	DESCRIPTION
A	D39711000	TIC turbo cont 100 W RS232
B	D40013025	2 m UK mains cable
C	D39711805	TIC relay box sml bkg
D	A37122919	E2M1.5 pump 1-phase
E	B72221991	EXT70H DN63ISO-K 24 V
F	D39645000	EXDC80 24 V
G	B58066010	TAV5 vent valve
H	B58053075	ACX75 air-cooler
J	D39700833	TIC logic interface cable 2 m
K	D39700836	XDD/DX/EXDC extension cable 2 m (optional)
L	D39700834	TIC RS232 interface cable 2 m (optional)
M	N/A	PC with RS232 Interface (optional)

ORDERING INFORMATION

PRODUCT DESCRIPTION	ORDERING NUMBER
Controllers (supplied with manuals & software)	
TIC turbo controller 100 W RS232	D39711000
TIC turbo controller 200 W RS232	D39712000
Relay boxes (supplied with a set of mating connectors)	
TIC relay box small backing	D39711805
Cables	
Mains cables (TIC and relay box supply)	
2 m UK plug	D40013025
2 m USA plug	D40013120
2 m Northern European plug	D40013030
Mains cables (relay box to RV and XDS type pumps)	
2 m TIC mains cable IEC320 m/f	D39700831
5 m TIC mains cable IEC320 m/f	D39700832
Interface cables	
2 m TIC logic interface cable	D39700833
2 m TIC RS232 interface cable	D39700834
24 V pump extension cables (use with EXDC, DX & XDD1 type pumps)	
1 m XDD/DX/EXDC extension cable	D39700835
2 m XDD/DX/EXDC extension cable	D39700836
5 m XDD/DX/EXDC extension cable	D39700837
Other accessories and supporting products	
TIC front bezel kit (spare)	D39700803

EXT ACCESSORIES

We offer a complete range of accessories and spares for the EXT pumps. A brief description of each of these items is given below.



1 Vibration isolator
2 BX Bakeout band
3 Inlet-flange seal (supplied with pump)
4 Inlet-screen (supplied with pump)
5 EXT pump
6 Purge port (NW10 adaptor fitted)
7 PRX10 purge-restrictor
8 Water-cooler (supplied with pump
9 ACX air-cooler (design varies with pump)
10 NW10 vent-port adaptor
11 TAV vent-valve
12 Vent-port (pump supplied with manual vent-valve)
13 Bakeout band position

PUMP-TO-CONTROLLER CABLE

A pump-to-controller cable must be ordered separately for EXC100E & EXC250E and is available in 1, 3 and 5 m lengths, to suit your installation, (other lengths are available on request).

ORDERING INFORMATION

PRODUCT DESCRIPTION	ORDERING NUMBER
1 m cable	D39618010
3 m cable	D39618030
5 m cable	D39618050

ACX AIR-COOLER

An ACX air-cooler is used to cool an EXT pump when a suitable cooling-water supply is not available or for an EXT pump in a mobile pumping system. The ACX air-cooler is an enclosed electrical fan and fixing bracket assembly which is easily fitted to bolt holes in the base of the pump.

The ACX air-cooler has a 24 V d.c. motor which can be powered and controlled from a rear panel socket on the EXC/TIC Controller or DX pump. It is supplied with 3 m of electrical cable.

ORDERING INFORMATION

PRODUCT DESCRIPTION	TO FIT PUMPS	ORDERING NUMBER
ACX75	EXT70, EXT70H, EXT75DX	B58053075
ACX250	EXT250M	B58053150
ACX250H	EXT255H, EXT255DX	B58053160
ACX555H	EXT555H	B58053561

BX BAKEOUT BAND

Use a BX bakeout band to increase the rate of degassing of the pump body to achieve faster pump down and lower ultimate pressure. Bakeout bands are only fitted to CF flanged pumps and/or intended for use in ultra high vacuum systems.

Bakeout bands are available for use with 110-120 or 220-240 V a.c. electrical supplies and can be powered from a rear panel socket on the EXC/TIC Controller or DX pump. It is supplied with 3 m cable and mating CE22 connector.

ORDERING INFORMATION

PRODUCT DESCRIPTION	TO FIT PUMPS	ORDERING NUMBER
BX70, 110 V, 30 W	EXT70, EXT70H, EXT75DX	B58052040
BX70, 240 V, 30 W	EXT70, EXT70H, EXT75DX	B58052060
BX250, 110 V, 60 W	EXT255H, EXT255DX, EXT250M	B58052041
BX250, 240 V, 60 W	EXT255H, EXT255DX, EXT250M	B58052061
BX501, 110 V, 100 W	EXT555H	B58052044
BX501, 240 V, 100 W	EXT555H	B58052064

PRX10 PURGE-RESTRICTOR

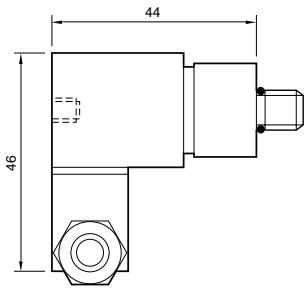
The PRX10 purge-restrictor is used to set the flow-rate of purge gas into the EXT pump. All of the EXT pumps (except the EXT70 and EXT70H) have a purge-port to allow you to purge the motor and bearing cavity with dry nitrogen or another inert gas. Fit a vent-port adaptor to the purge-port of the EXT255H or EXT250M pumps to convert it from ⅛ inch BSP to DN10NW, before you use the PRX10.

ORDERING INFORMATION

PRODUCT DESCRIPTION	ORDERING NUMBER
PRX10 purge-restrictor	B58065001

TAV VENT-VALVE

The TAV vent-valves are 24 V d.c. solenoid operated valves which you can use to vent your vacuum system with atmospheric air or dry nitrogen when you switch off the EXT pump. The valves are supplied with a sintered bronze inlet-filter, a riffled hose connector, 3m of electrical cable and a DN10NW adaptor. The vent-valves can be powered and controlled from a rear panel socket on the EXC Controller. You can either use your TAV vent-valve to replace the manual vent-valve supplied with the EXT pump, or adapt it to fit any other suitable port on the vacuum system upstream of the turbomolecular pump. For further advice about the choice of TAV vent-valve, see page 5-3.



ORDERING INFORMATION

PRODUCT DESCRIPTION	ORDERING NUMBER
TAV5 vent-valve	B58066010
TAV6 vent-valve	B58066020

VENT-PORT ADAPTOR

This ⅛ inch BSP male to DN10NW adaptor can be used to replace the TAV5 vent-valve or the manual vent-valve fitted to the EXT pumps. It allows the threaded vent-port on the pump (and the threaded purge-port on the EXT255H, EXT555H and EXT250M) to be converted to a DN10NW flange.

The vent-port adaptor is supplied with a removable flow-restrictor and an 'O' ring to seal the adaptor to the pump.

ORDERING INFORMATION

PRODUCT DESCRIPTION	ORDERING NUMBER
Vent-port adaptor	B58066011

VIBRATION ISOLATOR

A vibration isolator can be fitted to the inlet-flange of the EXT pump to reduce the transmission of the small amount of vibration generated by the pump to your vacuum system. The vibration isolator has two flanges separated by a flexible stainless steel bellows and an outer rubber anti-vibration collar.

The vibration isolator is designed for use with vertically mounted pumps only.

ORDERING INFORMATION

TO FIT PUMP INLET-FLANGE	ORDERING NUMBER
DN63CF	B58101000
DN63ISO-K	B58115000
DN100ISO-K	B58120000
DN160ISO-K	B58125000
DN100CF	B58105000
DN160CF	B58110000

VRX VENT-RESTRICTOR

Fit a VRX vent-restrictor to your EXT pump if you will vent the pump when the pump speed is above 50% of full rotational speed. The vent-restrictor restricts the flow-rate of the vent gas into the EXT pump. You can also use the VRX to replace the standard restrictor supplied with the PRX10 purge restrictor to obtain a different purge rate.Note that the EXT250M pump is supplied with a VRX10 vent-restrictor fitted in the vent and purge ports.

You can fit the vent-restrictor to the TAV vent-valve, to the vent-port adaptor or directly to the vent or purge port of the EXT255H and EXT250M pumps.

ORDERING INFORMATION

VRX VENT-RESTRICTOR	ORIFICE DIAMETER (MM)	ORDERING NUMBER
VRX10	0.1	B58066021
VRX20	0.2	B58066022
VRX30	0.3	B58066023
VRX50	0.5	B58066024
VRX70	0.7	B58066025

EXT SPARES

Each EXT pump is supplied with an inlet seal, inlet screen and water cooler (with the exception of DX pumps). These items may also be ordered as spares.

ORDERING INFORMATION

PRODUCT DESCRIPTION	PUMP TYPE	TO FIT INLET FLANGE SIZE	ORDERING NUMBER
Inlet flange seals			
DN40NW Co-Seal, fluoroelastomer			B27158453
DN50NW Co-Seal, fluoroelastomer			B27158466
ISO63 Trapped 'O' ring, fluoroelastomer			B27158170
ISO100 Trapped 'O' ring, fluoroelastomer			B27158171
ISO160 Co-Seal, fluoroelastomer			B27158074
63CF copper compression gasket (pack of 10)			C10007490
100CF copper compression gasket (pack of 10)			C10009290
160CF copper compression gasket (pack of 5)			C10011290
ISX inlet-screen			
ISX63/4	EXT70, EXT70H	DN63ISO-K, DN63CF	B58051005
ISX100/6	EXT70, EXT70H, EXT255H, EXT255DX, EXT250M	DN100ISO-K, DN100CF	B58051001
ISDX63/4	EXT75DX	DN63ISO-K, DN63CF	B72240860
ISHX160/8C	EXT555H	DN160ISO-K, DN160CF	B58051007
ISHX160/8F	EXT555H	DN160ISO-K, DN160CF	B58051008
WCX water-cooler			
WCX250M	EXT250M		B73501164
WCX500	EXT70, EXT70H, EXT255H, EXT75DX, EXT255DX		B73600121
WCX555H	EXT555H		B58067003

EXPT 1 AND 2 PUMPING STATIONS

Our new range of EXPT pumping outfits brings added flexibility with our successful TIC Turbo and Instrument Controllers. A large selection of backing and turbo pumps are available in combination with TICs and accessories to suit a wide variety of applications such as:

- UHV systems
- Beam lines
- Load locks
- Surface science
- High energy physics

Features & benefits

- Fully assembled and ready to use
- System start/stop from control panel
- Control of both the turbo pump and gauges* from the integrated TIC
- Serial communication control available with RS232 and RS485
- Dry pumping options with XDD1, XDS5 and XDS10



EXPT1 - Base plate with EXT70H turbo pump and XDD1 diaphragm pump with TIC.

EXPT2 - Base plate with EXT255H turbo pump and XDS10 scroll pump with TIC.



For North America and Brazil, see photos below. Contact our National Sales Centre at 800-848-9800. Please note, these cart systems are available in North America & Brazil only. All other territories, see information above.





ORDERING INFORMATION

This information applies to our UK-made turbo casts. For US-made turbo casts, please contact our national sales centre at 1-800-848-9800.

Turbomolecular pump
M EXT70DX
N EXT255DX
Y EXT70H
Z EXT255H

Flange type
1 DN40NW
2 DN63ISO-K
3 DN63CF
4 DN100ISO-K
5 DN100CF

Backing pump
1 E2M0.7
2 E2M1.5
3 RV3
4 RV5
5 RV8
6 RV12
A XDD1
B XDS5
C XDS10

Mounting
1 EXPT1
2 EXPT2

T [ ][ ] – [ ][ ] – [ ][ ][ ][ ]

Instrumentation

Turbo control only 100 W	**1**
Turbo and instrument control 100 W	**2**
Turbo control only 200 W	**3**
Turbo and instrument control 200 W	**4**

Backing pump accessories

None	**0**
EMF mist filter	**1**
FL20K foreline trap	**2**
Castors	**3**
1+2	**4**
1+3	**5**
2+3	**6**
1+2+3	**7**
Castors + silencer	**8**

Turbomolecular pump accessories

None	**0**
TAV5 vent valve	**1**
LCPVEK backing isolation valve	**3**
1+3	**5**

Electrical supply

220-240 V 50/60 Hz (Europe)	**1**
110-120 V 50/60 Hz (USA)	**2**
100 V 50/60 Hz (Japan)	**3**
220-240 V 50/60 Hz (UK)	**4**

* Gauges and cables to be ordered separately.
Not all combinations are permissible. Please consult your regional BOC Edwards centre.
Units are supplied with integral air cooler.
Please refer to working instructions or your regional BOC Edwards center for compatible gases.

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