ATH 400M / ATH 1000M
Maglev hybrid turbomolecular pump

Welcome

Dear Customer,

You have just purchased an Alcatel maglev hybrid turbo pump.
We would like to thank you and are proud to count you as one of our customers.

This product has benefited from Alcatel's many years of experience in the field of turbomolecular pump design.

In order to ensure the best possible performance of the equipment and your complete satisfaction in using it, we advise you to read this manual carefully before any intervention on your pump and to pay particular attention to the equipment installation and start-up section.

MANUAL REFERENCE : **101 688**
EDITION : **07 - JANUARY 2002**

APPLICATIONS:

SEMICONDUCTOR APPLICATIONS
Plasma etching, Ion implantation, Sputtering, Plasma deposition.

OTHERS APPLICATIONS
Electron microscopes, Surface analysis, Research and development, High energy physics, Space simulation, Accelerators.

ADVANTAGES:

High throughput - Quiet and clean vacuum - Corrosion proof - High MTBF - Minimum size, volume and weight - Smart and compact electronic controller - Reliability - Maintenance free - Battery free - Easy integration.

Edition 07 - January 02

Contents

User's Manual
ATH 400M / ATH 1000M

Edition 07 - January 02

MANUAL REFERENCE : **101 688**

EDITION : **07 - January 02**

Contents

User's Manual
ATH 400M / ATH 1000M

MANUAL REFERENCE : **101 688**

EDITION : **07 - January 02**

Edition 07 - January 02

Contents

User's Manual
ATH 400M / ATH 1000M

Edition 07 - January 02

MANUAL REFERENCE : **101 688**

EDITION : **07 - January 02**

* These chapters are reserved for the Customer Service.

Introduction to the ATH 400M/ATH 1000M and their associated ACT controllers

2 magnetically levitated hybrid turbo pumps

ATH 400M and ATH 1000M

Five active axes
ACTIDYNE® Maglev bearings type (S2M Patent)
Rotor position control in 5 directions.

Automatic balancing system
Lowest possible levels of noise and vibration.
Compensation for any imbalance of the rotor.

Inverted dynamic seal
High compression ratio.
Exclusive protection.

Inert gas purge
Eliminate corrosion of the motor and magnetic bearing coils.

Maintenance free

Battery free
In case of a power failure, the pump motor acts like a generator to transform the rotor energy into

ATH 400MT ATH 1000MT

Integral heater band
Maintaining the pumps internal surface up to 75°C to prevent the condensation effect.
Temperature regulated by the ACT controllers.

Edition 05 - October 96

Introduction to the ATH 400M/ATH 1000M and their associated ACT controllers

ACT 600M and ACT 1000M controllers

The new generation of ACT controller family

Especially designed for maglev turbopumps
Light and small controllers.
Battery free.

Convenient interface
Handy keyboard;
Alphanumeric display.

Modern pump monitoring
Monitoring of testing and troubleshooting parameters;
RS 232/485 serial links;
Automatic power supply detection from 85 to 265 V, 48/63 Hz single phase.

Large range of interface
Dry contacts interface for status signals and optocoupled control inputs;
Selectable Analog 0-10 V output.

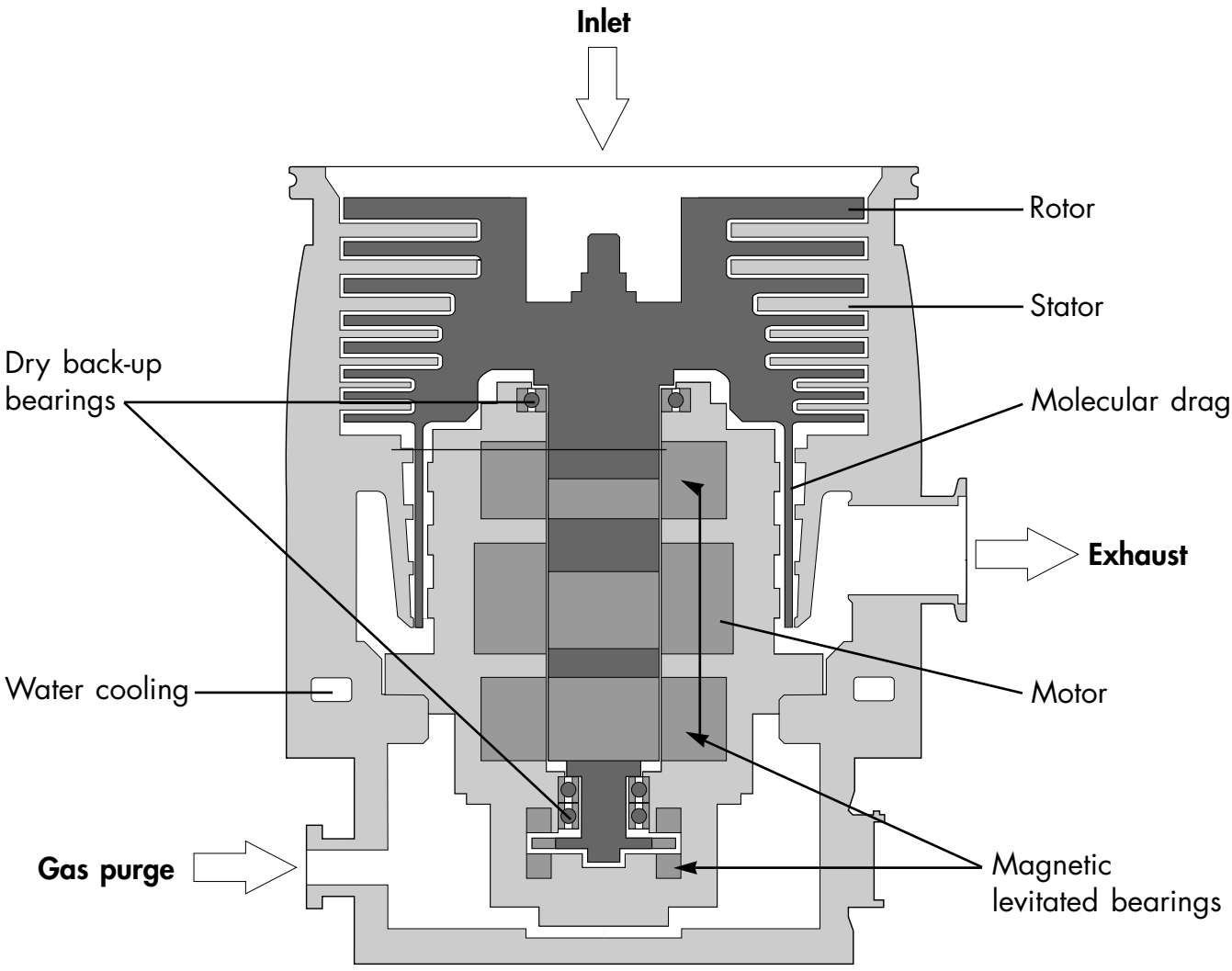
Edition 05 - October 96

The pump operating principle

A hybrid technology

The ATH 400M and ATH 1000M integrate the advantages of a multi-staged turbomolecular pump with a spiral helix molecular drag section to enhance ultra high-vacuum (UHV) and ultra clean technology (UCT).

The turbomolecular section provides high pumping speeds and UHV ultimate vacuum.
The molecular drag section provides a high compression ratio and extends forevacuum tolerance up to 5 mbar.

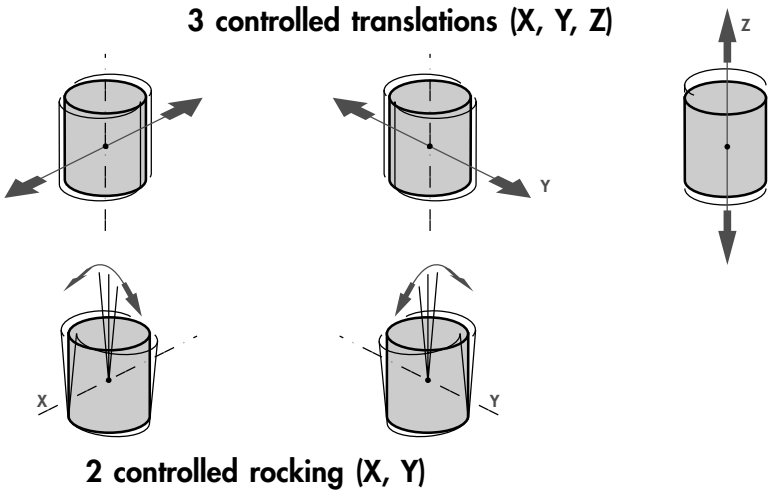


Edition 05 - October 96

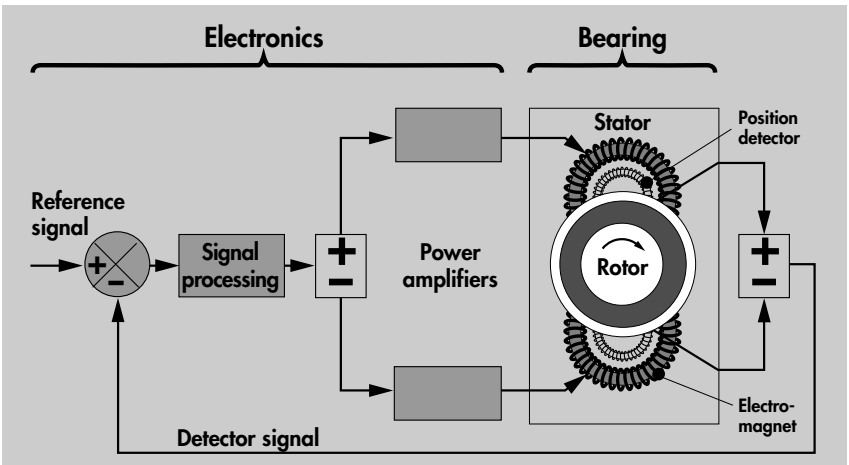
The pump operating principle

5 actives axis

The mobile assembly formed by the turbo rotor and the shaft is known as the rotor. This rotor is driven by the motor and held in suspension by magnetic fields generated by electromagnets housed in active bearing, type ACTIDYNE® maglev bearing (S2M Patent).
The mobile rotor has five axes of freedom monitored by 5 active bearings.



Movements in relation to these axes are monitored by position sensors. According to the position data recorded, the ACT controller corrects differences to bring the rotor back to its optimum position, by varying the current in electro-magnets.

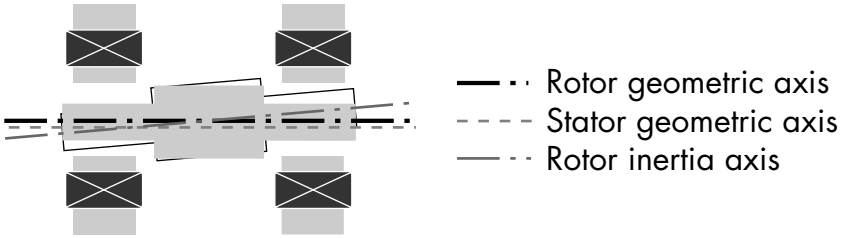


Edition 05 - October 96

The pump operating principle

Automatic Balancing System

The **Automatic Balancing System** is an electronic device. That monitors the rotor position, allowing it to rotate on its own axis of inertia.
Changes in the rotor balance, due to deposit built-up during the life time of the pump, are automatically compensated by the **Automatic Balancing System**.
Therefore, there is a total absence of vibration.



The back-up bearings

They are dry-lubricated ceramic ball bearings.
They are never used in normal operation, since the rotor is not in contact with the bearings.
The back-up bearings are only used to protect the pump in accidental air in-rushes, accidental shocks or power failure.

No maintenance

By design, the pump doesn't include parts liable to wear and doesn't need preventive maintenance. However, the back-up bearings used in case of accidental shut-downs have to be changed when the controller indicates it: the percentage of landing time to be deducted depends on its frequency of use (**see D 10**).

Battery free

In case of a power failure, the motor acts like a generator, supplying enough power for the magnetic bearings.
When the rotation speed is lower than the minimum setpoint, the pump lands and shuts down on the back-up bearings: the emergency breaking valve opens.

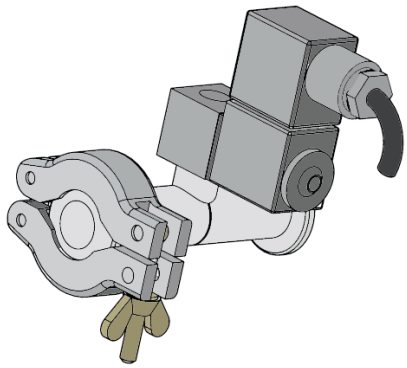
Edition 05 - October 96

The pump operating principle

Emergency braking valve

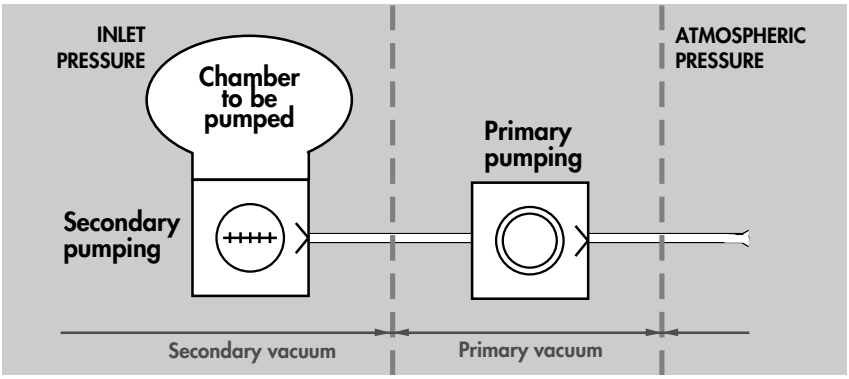
The valve is fitted in parallel with purge port and opens in case of events such as:
- uncontrolled violent shocks applied to the pump;
- large accidental air in-rushes.

It will also put the pump to atmospheric pressure when the controller is stopped.
This valve will slow down the pump in complete safety.



The hybrid-turbo pump in an installation

At the pump exhaust, the gases are evacuated to atmosphere by a primary pump.
Since the ATHM compression ratio is set by the design, the ATHM limit the pressure is given by that of the primary pump used.



Edition 05 - October 96

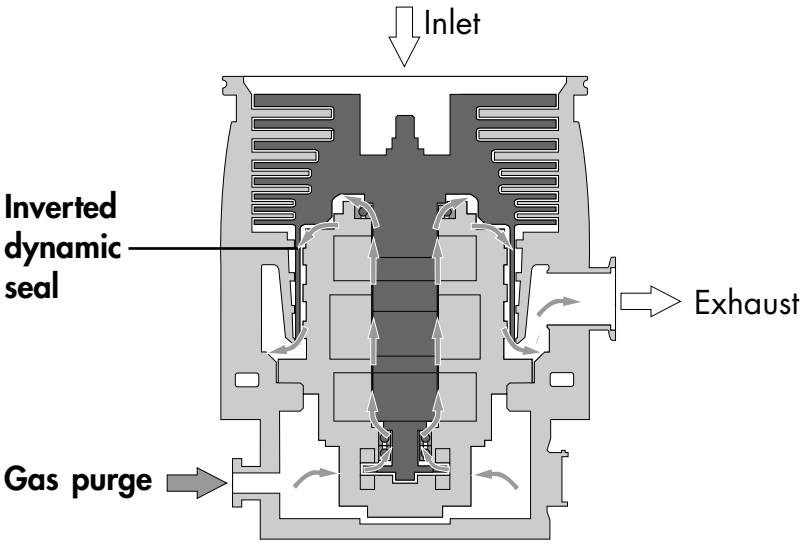
The different versions

Standard version ATH 400M - ATH 1000M

An inverted dynamic seal

It creates a high compression ratio between the bearings and the pump exhaust and thus minimizes the quantity of corrosive gases in contact with the bearings.

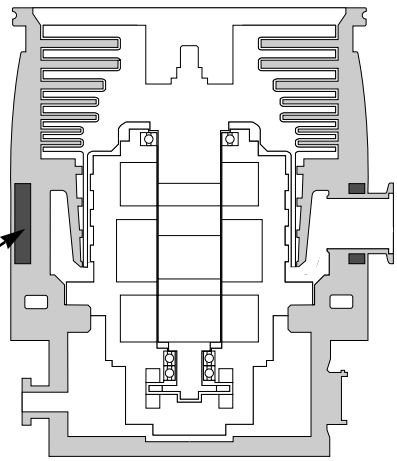
When used with **a gas purge** for high flow rate applications, the dynamic seal can, on its own, provide excellent protection for corrosive applications.



ATH 400MT ATH 1000MT

The built-in heater band

In high pressure and high throughtput processes such as metal etch, deposit can build up in the lower compression stages of the rotor, leading the pump to early failure.
The built-in heater band allows pump heating up to 75°C, which is sufficient to prevent the condensation effect.
This device is thermally controlled by the ACT controllers.



Edition 05 - October 96

The different versions

Variation of the pump rotational speed

The ATHM pump rotation speed can be selected and set between a standby speed and the maximum speed.
This makes it possible to optimize pumping characteristics according to each customer application (for example, high pressure pumping).

A distinction is made between the following speeds:
- **reduced speed (STANDBY speed)** which can be set between the low speed value and the maximum speed.
- **maximum speed** preselected at factory which corresponds to the pump model.

depending on operating conditions:	Pump model	Min. speed	Max. speed
Inlet pressure $\geq 10^{-2}$ mbar or Housing temperature $\geq$ 50°C	ATH 1000MT (with temperature control)	15000 rpm	30000 rpm
Inlet pressure $\leq 10^{-2}$ mbar or Housing temperature < 50°C	ATH 1000M	15000 rpm	33000 rpm
Inlet pressure $\leq$ 10-1 mbar	ATH 400M ATH 400MT	18000 rpm	39000 rpm

Edition 05 - October 96

ACT 600M and ACT 1000M controllers

The ACT 600M and the ACT 1000M controllers belong to the new generation of ACT controller family.

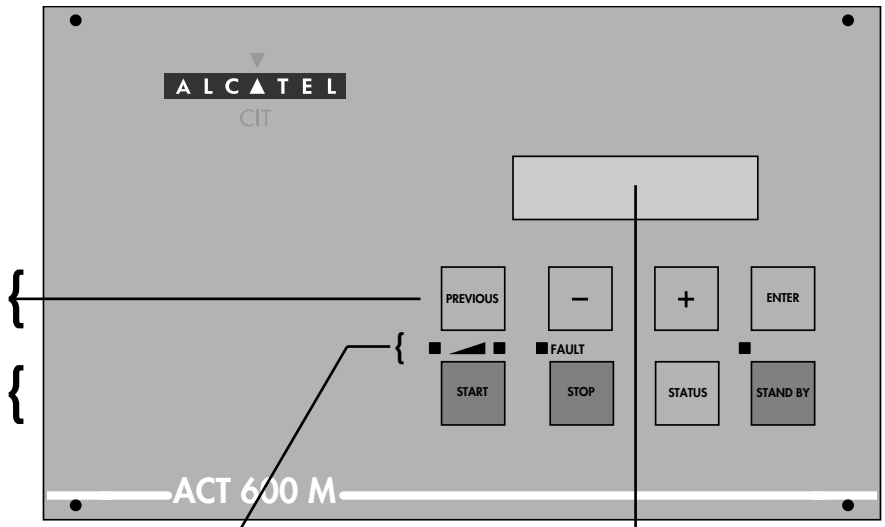
Compact and functional

Dimension: **1/2 Rack**.
Weigth: **8.5 kg** (18 lb).

All functions to monitor the ATHM are integrated into the controller.

Convenient interface

The front panel of the unit consists of:



Parameter selection and configuration keys

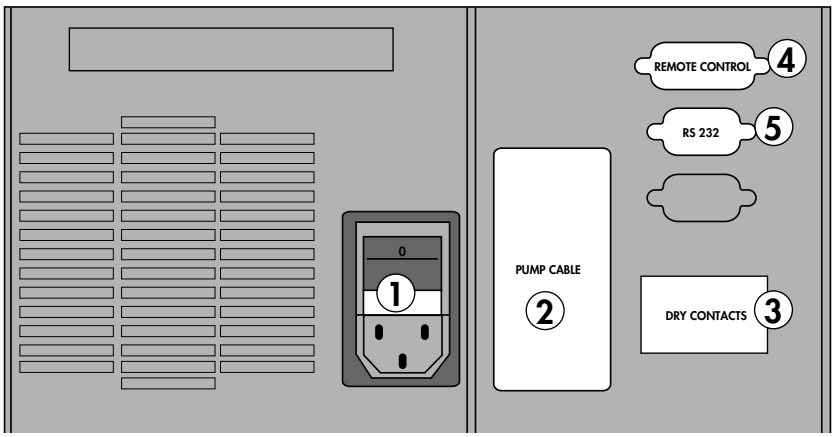
Manual control keys

Pump status indicator lights

Parameter and message LCD display (4 lines).

Edition 05 - October 96

ACT 600M and ACT 1000M controllers



The rear panel of the unit consists of:

① Power supply connector

② Pump connector

③ Relay terminal strip
(Wiring characteristics ***on B 80***.)

- to replicate the monitoring parameters available in the form of dry contacts.

④ Remote control connector/RS 485
(Wiring characteristics ***on B 90***.)

- for the remote control of the START, STOP, STANDBY functions;
- selectable 0 - 10 Volts output for speed, pump current or temperature;
- heater band control temperature;
- external safety taken in account.

RS485 serial link allowing many pump installations in a network.

⑤ RS 232 connector
(Wiring characteristics ***on B 100***.)

The RS 232 serial link is used to control and monitor the pump **using a computer**.

Edition 05 - October 96

The accessories

Pump accessories

Screen filter

This filter protects the pump against solid particles. Mesh size 2.5 mm.

Inlet flange	P.N.
100 ISO-KF (FPM)*	**056844**
100 ISO-KF (NBR)*	**103070**
100 CF-F	**056845**
160 ISO-KF	**056942**
160 ISO-KF (NBR)*	**103071**
160 CF-F	**056928**
200 ISO-KF (FPM)*	**063158**
200 ISO-KF (NBR)*	**103072**
200 CF-F	**063159**
ASA 6"	**102933**

Compact filter

This filter stops particles ≥ 20 microns and is used in the event of high densities of dust or risks of implosion when pumping tubes or lamps.

Inlet flange	P.N.
100 ISO-KF	**063215**
160 ISO-KF	**063216**
200 ISO-KF	**063911**

Purge reduction device

This device is used to reduce the purge gas flow rate to 25 SCCM in some processes.

Flow rate	P.N.
25 SCCM	**066950**

Isolation valve at inlet pump

The secondary isolation valve is used to maintain the vacuum in the chamber while the pump is reset to atmospheric pressure.

See the Alcatel catalog.

An entire range of connection accessories are available in the Alcatel catalog (clamping ring, centering ring, etc.).

Edition 06 - September 97

The accessories

Controller accessories

Connection cable

Interconnecting cable between pump and controller.

Length	P.N.
1 m	**104624**
3.5 m	**103719**
5 m	**103720**
10 m	**103721**
15 m	**104587**

Thermo. cable

Interconnecting cable between heater band and controller.

Length	P.N.
1.0 m 115 V	**104627**
1.0 m 230 V	**105206**
3.5 m 115 V	**103728**
3.5 m 230 V	**103729**
5.0 m 115 V	**103730**
5.0 m 230 V	**103731**
10 m 115 V	**103732**
10 m 230 V	**103733**
15 m 115 V	**105202**
15 m 230 V	**105204**

Edition 06 - September 97

The technical characteristics

The performances of the pumps

Model characteristics			ATH 400M ATH 400MT		ATH 1000M		ATH 1000MT	
Inlet flange		DN	100 ISO-K	160 ISO-K	160 ISO-K	200 ISO-K	160 ISO-K	200 ISO-K
Rotation speed		rpm	**39000**		**33000**		**30000**	
Pumping speed*	N_2	l/s	320	410	710	850	610	800
	He	l/s	290	360	650	750	600	650
	H_2	l/s	180	230	430	450	330	350
Compression rate*	N_2		$1x10^{+8}$		$2x10^{+8}$			
	He		$2x10^{+3}$		$1x10^{+4}$			
	H_2		$1x10^{+2}$		$4x10^{+2}$			
Ultimate pressure without purge, meas. according to Pneurop standard		mbar	$8x10^{-9}$		$8x10^{-9}$			
Maximum pressure at inlet in continuous operation**		mbar	1		$1x10^{-1}$			
Maximum permissible pressure at exhaust**		mbar	5		5			
Noise level		dBA	≤ 39		≤ 39			
Start-up time		min	< 3		< 5			
Maximum start-up power		W	650		650			
Maximum operating power		W	300		300			
N_2 purge flow rate		SCCM	50		50			
Cooling water flow rate		l/h	< 60		< 60			
Water temperature		°C	15 < T < 25°C		15 < T < 25°C			
Maximum ambient temperature		°C	40		40			
Weight		kg	19		28			
Recommended forepump			ADP 31		ADP 81			

Edition 07 - January 02

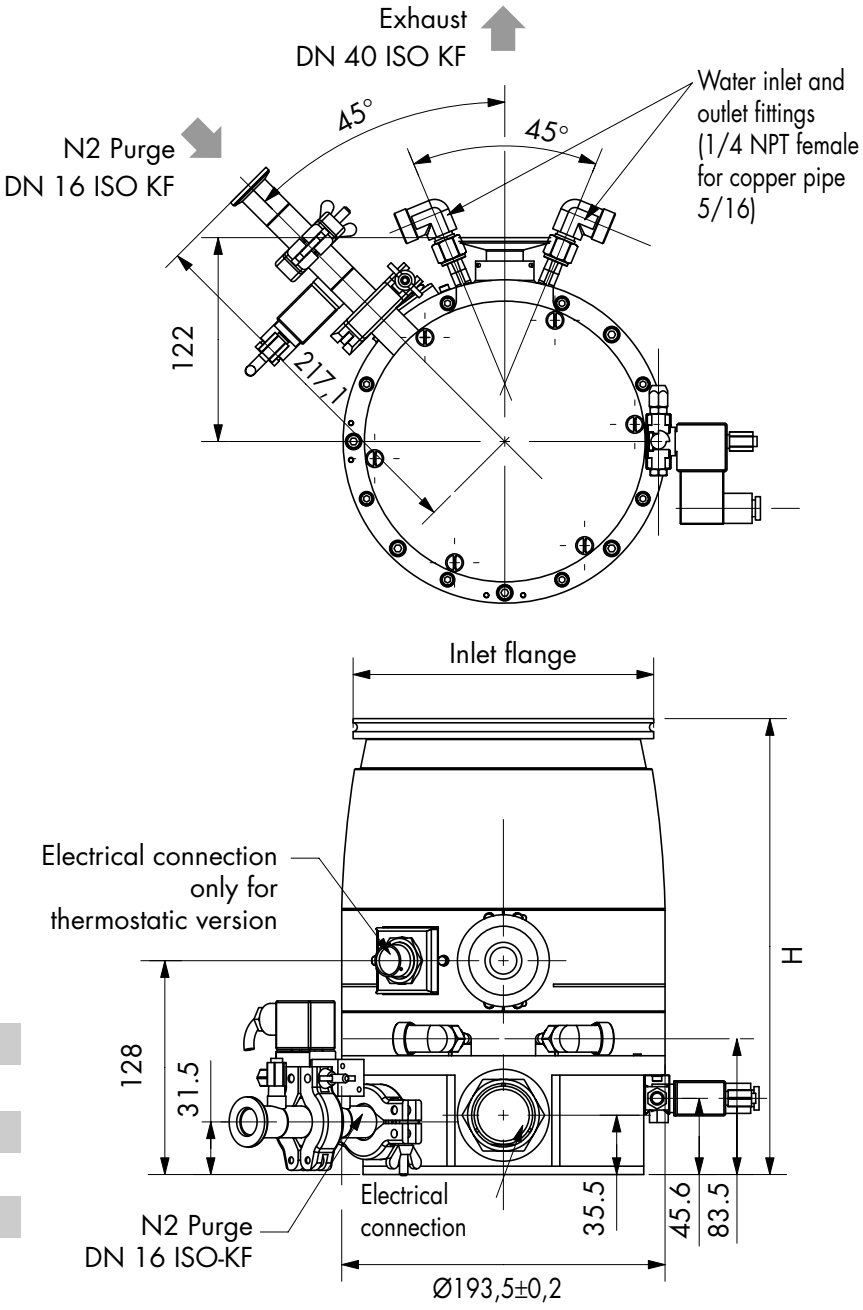
* ***See curves in G 10 and G 20.***

** The two maximum pressure cannot occur at the same time.

The technical characteristics

Dimensions

ATH 400M or ATH 400MT



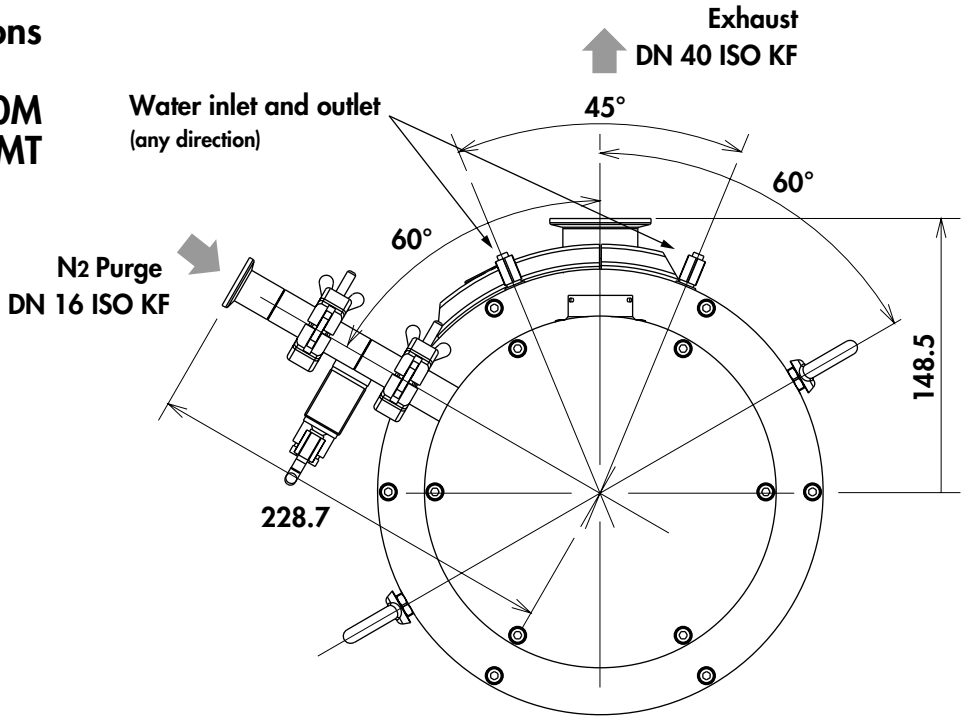
Inlet flange	H (mm)
DN 100 ISO-K	**292.5**
DN 160 ISO-K	**272.8**
DN 100 CF-F	**298.9**
DN 160 CF-F	**294.5**
ASA 6"	**279.8**

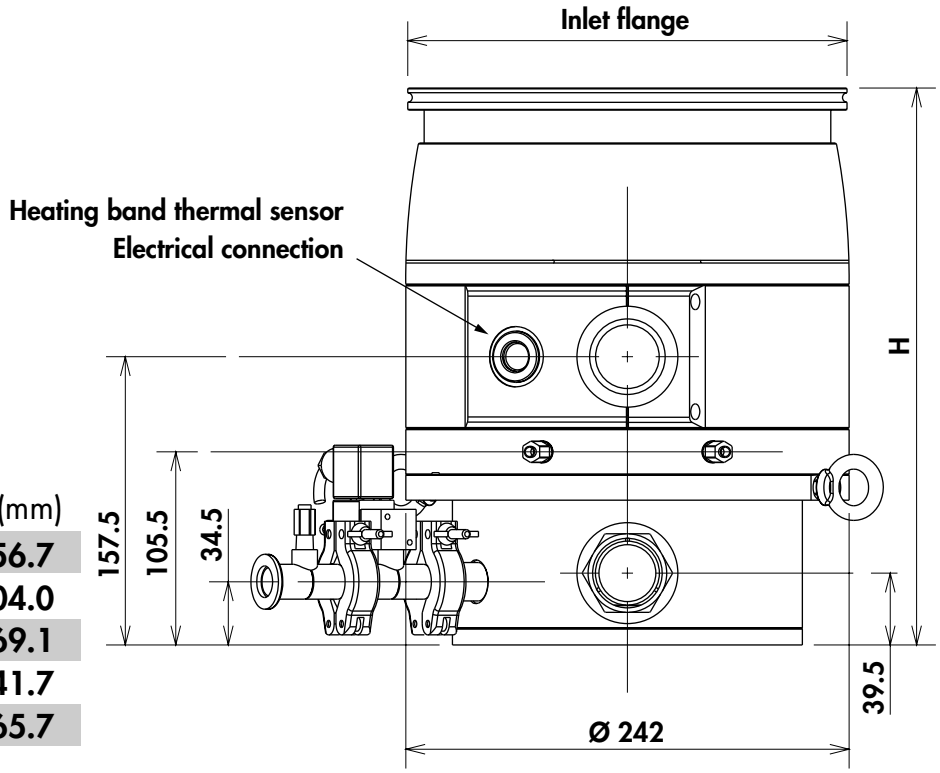
Edition 07 - January 02

The technical characteristics

Dimensions

ATH 1000M or ATH 1000MT





Inlet flange	H (mm)
DN 160 ISO-K	**356.7**
DN 200 ISO-K	**304.0**
DN 160 CF-F	**369.1**
DN 200 CF-F	**341.7**
ASA 6"	**365.7**

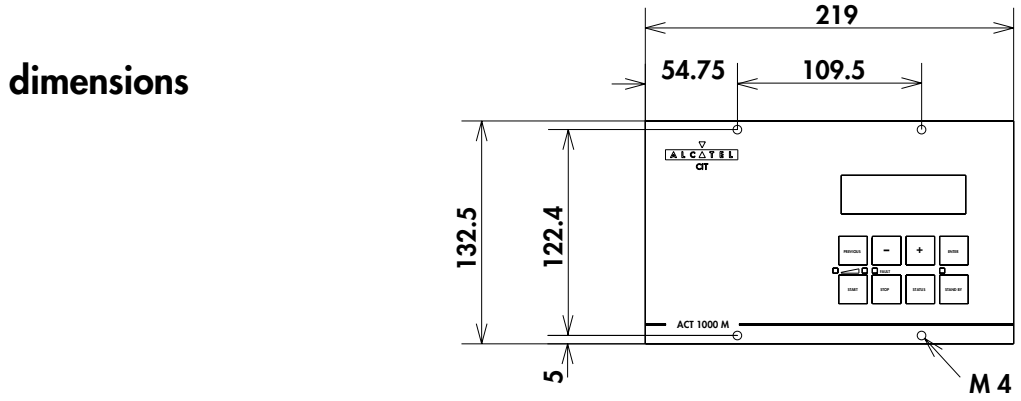
Edition 07 - January 02

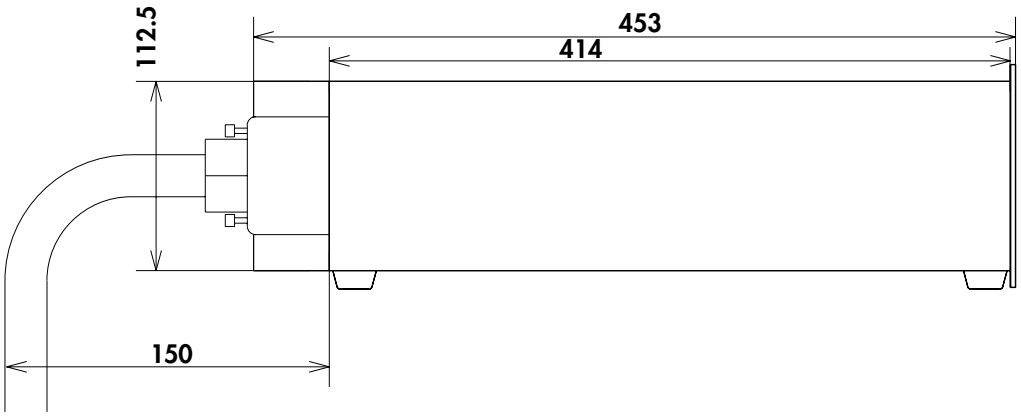
The technical characteristics

Controller characteristics

Model characteristics		ACT 600M	ACT 1000M
Weight	kg	8.5	
Dimensions HxWxD	mm	132.5 x 219 x 453 1/2 Rack 19"	
Power supply			
Nominal voltage	V	85 to 132 - 170 to 264	
Frequency	Hz	48/63	
Maximum power consumption	VA	750	
Customer main circuit breaker rating		10 A	
Ambient operating temperature	°C	T ≤ 50	

Controller dimensions





Edition 07 - January 02

B 10

Safety instructions related to installation

Before switching on the pump, the user should study the manual and follow the safety instructions listed in the compliance certificate booklet supplied with the pump.

Installation Start-up

• The controllers must be connected to an electrical installation including an ground connection in compliance with decree 88.1056 of 14th November 1988.

• Our products are designed to comply with current EEC regulations. **Any modification of the product made by the user** is liable to lead to non-compliance with the regulations, or even to put into doubt the EMC (electromagnetic compatibility) performance and the safety of the product. ALCATEL declines any responsibility for such operations.

• Before any maintenance operations on a product performed by a maintenance technician who has not received safety training (EMC, electrical safety, chemical pollution, etc.), isolate the product from the various energy sources (electricity, compressed air, etc.).

• The EMC performance of the product is obtained on the condition that the installation complies with EMC rules. In particular, in disturbed environments, **it is essential** to:
- use shielded cables and connections for interfaces,
- stabilize the power supply line with shielding from the power supply source to a distance of 3 m from the product inlet.

• The units containing control circuits are designed to guarantee normal safety conditions taking their normal operating environment into account (use in rack).
In specific cases of use on tables, make sure that no objects enter the ventilation openings or block the openings when handling the units.

Edition 05 - October 96

Safety instructions related to installation

Installation
Start-up
(continued)

• When switching off an item of equipment containing loaded capacitors at over 60 VDC or 25 VAC, take precautions concerning the access to the connector pins (single-phase motors, equipment with line filter, frequency converter, monitoring unit, etc.).

• When handling the equipment, use the devices provided for this purpose (hoisting rings, handle, etc.).

• Risk of toppling over: although compliance with EEC safety regulations is guaranteed (normal range ± 10°), it is recommended to take precautions against the risk of toppling over during handling, installation and operation.

• The performance and the operational safety of this product are guaranteed provided that it is used in normal operating conditions.

• The vacuum pump is also a compressor: incorrect use may be dangerous.
Study the user manual before starting up the pump.

• The access to the rotor of a turbomolecular pump with an unconnected intake is dangerous. Similarly, if the pump is not switched on, it may be driven by another pump in operation (risk of injury).

• Make sure that the parts or chambers connected to the intake of our pumps withstand a negative pressure of 1 bar in relation to the atmospheric pressure.

• The leaktightness of the products is guaranteed when they leave the factory for normal operating conditions. It is the user's responsibility to maintain the level of leaktightness particularly when pumping dangerous gases.

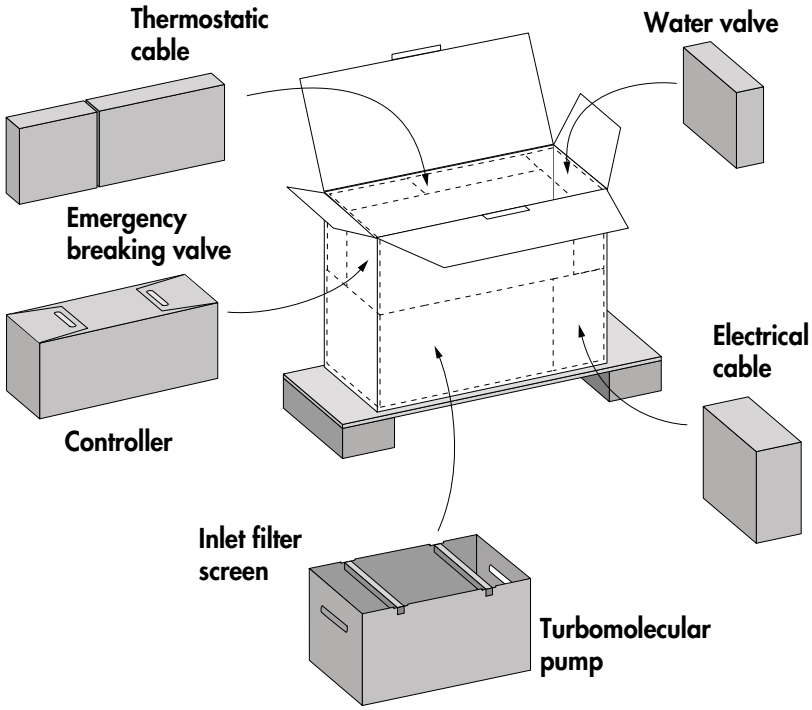
Edition 05 - October 96

Unpacking and storage

Unpacking

Unpack the equipment carefully and keep the packaging. Make sure that the equipment has not been damaged during the transport. If it has been damaged, take the necessary steps with the carrier and inform Alcatel if necessary.
In all cases, **we recommend that you keep the packaging (reprocessing material)** to transport the equipment if necessary or for prolonged storage.
To keep your product in the clean condition in which it left our factory, we recommend to unpack the pump only on its assemby site.

Weight of the complete shipping crate : 50 kg maxi.



Edition 05 - October 96

Unpacking and storage

The accessories This packaging also contains other cardborad boxes, for the accessories (screen filter, emergency braking valve, water valve and purge device) and for the electric cable.

The controller It is packaged in a separated cardboard box.
Lift the device out of its packaging (weight 8.5 kg) by hand.

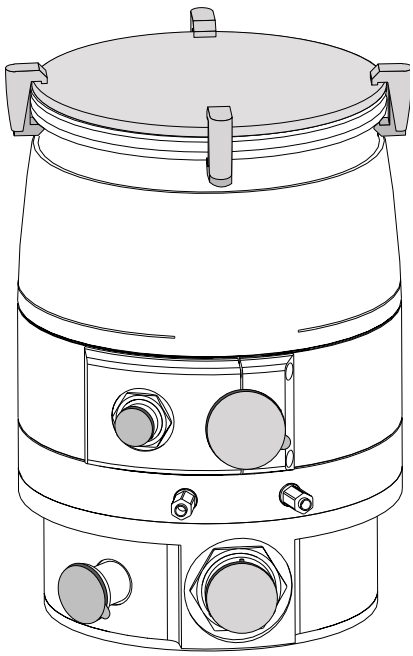
The pump It is packaged in a separated cardboard box.

⚠ **Lift the ATH 1000M out of its packaging by using the hoisting rings (weight 28 kg)**.

Pump storage

Our equipment can be stored without special precautions (ambient temperature between 5 and 40°C) .

Inlet ASA 6'', ISO or CF-F flange blanking and rotor holding system.



Exhaust Blanked with a DN 40 ISO-KF protector.

Connection for emergency braking valve and nitrogen device Blanked with a DN 16 ISO-KF protector.

Edition 05 - October 96

Unpacking and storage

Controller storage

The controller can be stored in its cardboard box at storage temperature between - 20°C and + 70°C.

Storage mode

The controller is set in STORAGE mode at factory, to protect internal RAM memory during transport and storage.

When the controller is powered, the storage mode disappears automatically.

Set the storage mode for prolonged storage when the pump is stopped.

Edition 05 - October 96

B 30

Pump connections to an installation

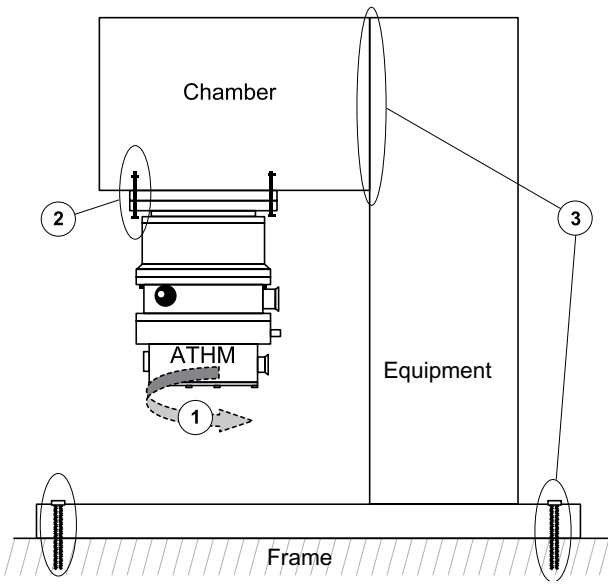
Maglev pump connection instructions

Why securing MAGLEVpump installation ?

Maglev hybrid Turbopumps are designed so as to prevent any safety hazard to the user in standard operating conditions.
However, some operating conditions may generate hazards for the user and the environment: **the kinetic energy stored in a maglev turbopump is very important. In case of a mechanical failure an improperly installed pump could be ejected from the equipment if the kinetic energy was tansferred to the pump body.**

It is absolutely necessary to install the pump according to the following installation specifications to secure the user and the equipment.
Alcatel declines any responsibility if the pump installation is not design in accordance with these installation specifications.

Installation spécifications



Edition 06 - January 02

Pump connections to an installation

Installation with bolted flange

The kinetic energy of the rotor has to be absorbed by the installation **if the pump seizes suddenly.**
The resulting maximum deceleration torque is based on the assumption, that the rotor stops in half a turn and that the whole energy has to be taken by the pump assembling bolts.
Design and secure the pump frame so that it can withstand the maximum deceleration torque.

Maximum deceleration torque to stop the rotor in half a turn (item 1)

- 9159 Nm for ATH 400 M at nominal speed 39000 rpm
- 20000 Nm for ATH 1000 M at nominal speed 33000 rpm

Inlet flange installation conditions (item 2)

According to the housing type:

Mounting holes at inlet flanges			
Inlet flange DN - ISO-F	**160**	**200**	**250**
Type of bolts dictated	M 10	M 10	M 10
Number of bolts dictated	8	12	12
Bolt metric grade	$12^{.9}$	$12^{.9}$	$12^{.9}$
Installation torque per bolt N.m	35^{+5}	35^{+5}	35^{+5}

For safety reasons, it is important to tighten the bolts with a torque wrench according to the specified values :
- lower torque: risk of loosened bolts
- higher torque: risk of damaging the bolts.

Edition 06 - January 02

Pump connections to an installation

Inlet flange installation conditions (item 2)) (Continued)

We strongly recommend the use of ISO-F or CF-F flanges.
ISO-K type flanges are not recommended to fasten turbomolecular pumps with inlet flange equal or larger than DN 200 because:

- there is no visual reminder (like threaded holes on ISO-F) to signal how many clamps are needed to secure the pump,
- it is not as easy to fasten claw clamps on ISO-K flanges as to secure bolts on ISO-F flanges,
- the ISO-K flanges do not prevent accidental rotation of the pump on the equipment flange in case of pump rotor crash. This rotation could damage the foreline and the purge gas line which would generate hazards for the user.

Equipment installation conditions (item 3)

The equipment frame on which the pump is installed must be sufficiently rigid to absorb the kinetic energy of the rotor in case of pump rotor crash. For this, take into account:

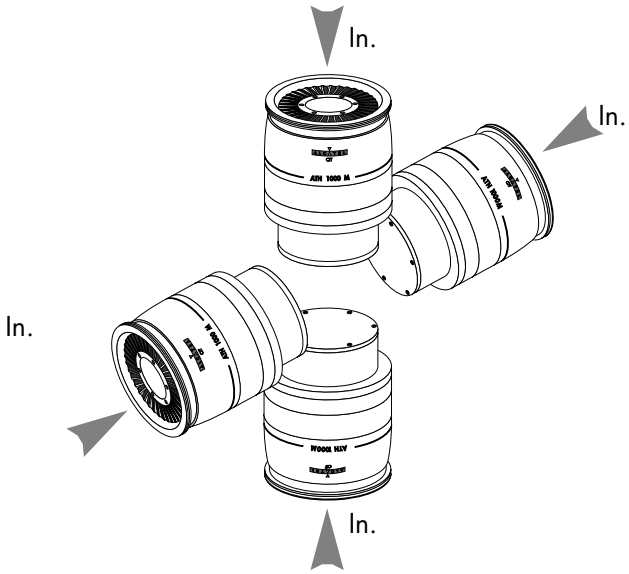
- the maximum deceleration torque to calculate the equipment attachment devices,
- the flange dimensions,
- the quality and the number of screws,

no reducing adaptater or bellows should be installed between pump inlet flange and the chamber.

Edition 06 - January 02

Pump connections to an installation

The pump can operate in any position



Rotor flanging device disassembly

Welcome

To prevent the pump maglev bearings from being damaged due to shocks during transport, **the rotor is flanged to the pump housing.**

The pump must never be swiched in this condition. This flanging must only be removed when the pump is to be installed.

We recommend that you keep the flanging to transport the equipment.

Edition 06 - January 02

Pump connections to an installation

Vacuum connections

Remove the protective parts blocking the inlet, exhaust and purge openings: these components prevent foreign bodies from entering the pump during transport and storage. It is dangerous to leave them on a pump in operation.

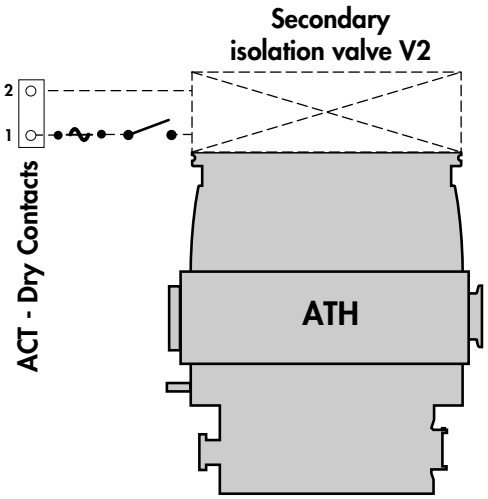
At inlet:

Screen filter

Install the screen filter or compact filter accessory on the pump; connect the pump to the installation or connect a secondary isolation valve.

Secondary isolation valve

It is recommended to install an isolation valve between the chamber to be pumped and the pump inlet to maintain the pressure in the chamber while the pump is reset to atmospheric pressure. This valve can be driven by the controller («ISOL.VALVE» contact ***see B 90***).



If the controller stops the pump by opening the emergency braking valve, the contact opens and closes the secondary isolation valve.

Edition 06 - January 02

Pump connections to an installation

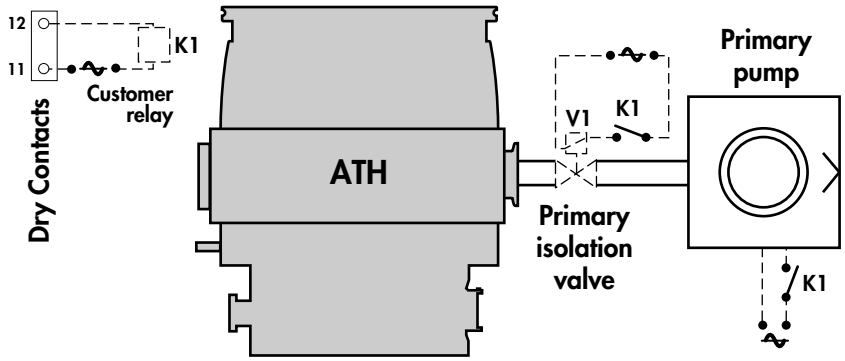
At exhaust:

Primary isolation valve

It is highly recommended to install an isolation valve, (closed with power off) between the ATH pump and the roughing circuit.
The valve is closed using the « START » contact on the controller. If the valve is missing, the time taken to slow down in the event of an accident is increased, thereby reducing the service life of the back-up bearings.

Connect this valve such as an Alcatel bracket valve **as near the pump exhaust as possible** depending on the space available and the accessories installed.

Connect the valve to the primary pumping circuit*.



* Different connection accessoiries can be found in the Alcatel Catalog.

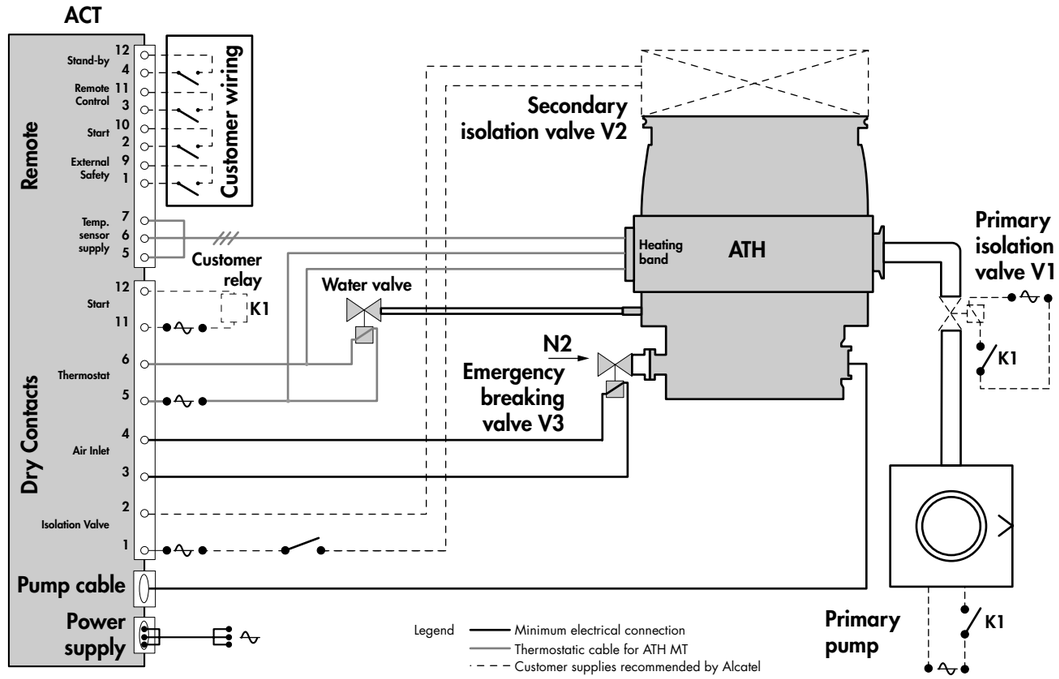
Edition 06 - January 02

Pump connections to an installation

Typical connection

In this installation, we use:

- A primary isolation valve **V1** between the ATH and the roughing pump;
- a secondary isolation valve **V2** between the ATH and the chamber to be pumped;
- a relay **K1**, their contacts drive the valve **V1** and the primary pump power supply;
- the thermostatic option.



Edition 06 - January 02

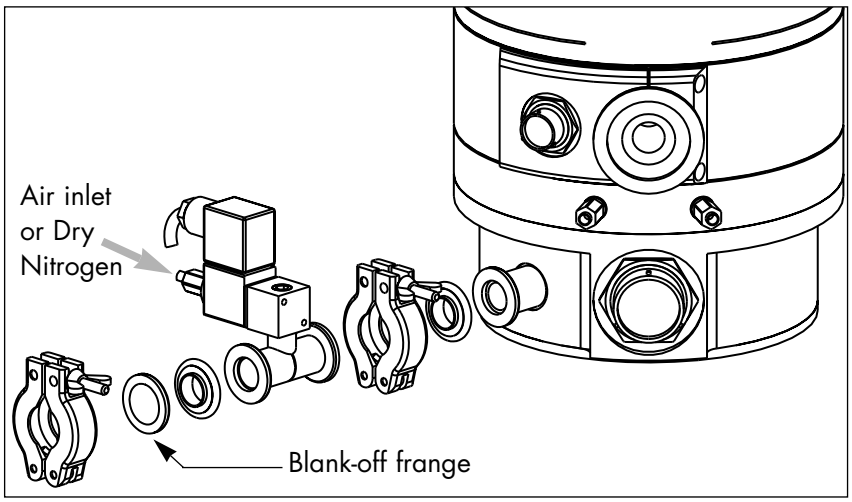
Emergency braking valve connection

The braking valve must be connected to ensure the pump's safety and durability.

Function

In the event of a major problem (magnetic bearings fail, external shock...), the pump must be stopped as soon as possible to prevent damage to the back-up bearings.
The emergency braking valve is calibrated to reset the volume of the pump to atmospheric pressure.
When the pump is isolated (at inlet and exhaust) the rotor slow down efficiency is increased.
The reset to atmospheric pressure takes place when faults are registered on the controller which stops the pump and controls the air inlet ***(see D 20)***.

Vacuum connection



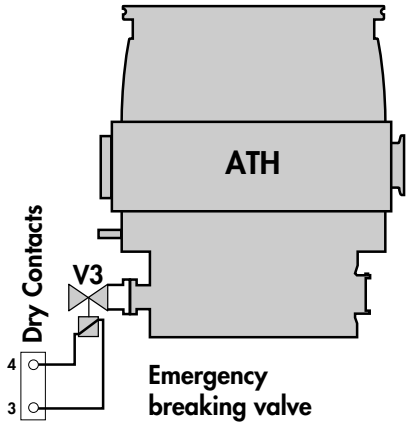
Install the calibrated emergency braking valve on the DN 16 fitting of the pump.
The valve must be connected to an air inlet line which can be for example dry nitrogen (Pressure between 1 and 1.5 bars absolute) ***(see B 50 for nitrogen characteristics)***.

Edition 05 - October 96

Emergency braking valve connection

Electrical connection

Connect the valve powered and driven by the controller via the **«AIR INLET»** contact on the Dry Contacts connector ***(see B 90)***.



Edition 05 - October 96

Nitrogen purge device connection

Characteristics of of filtered dry nitrogen supply

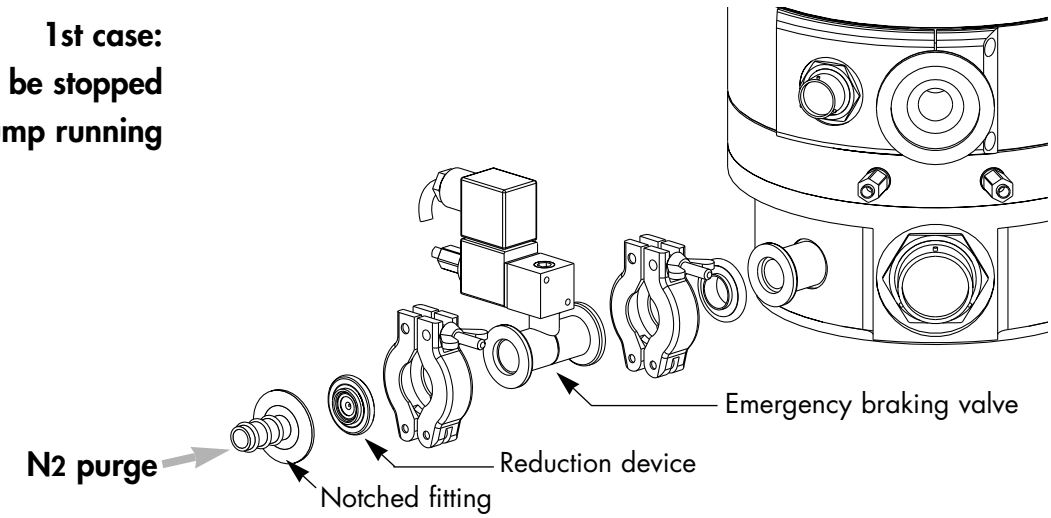
A filtered dry nitrogen supply with the following characteristics is required:
- Dew point < 22°C
- Dust < 1 µm
- Oil < 0.1 ppm
- Absolute pressure of 1 to 1.5 bar.

Purge connection

The nitrogen purge must be connected to the braking valve so as not to disturb its operation and not between the valve and the pump.

Connect the nitrogen supply to the DN 16 purge fitting*. The nitrogen flow reduction device controls the pressure and guarantees a flow rate of 50 SCCM at pressure 1.1 bars.

1st case: Purge can be stopped during pump running

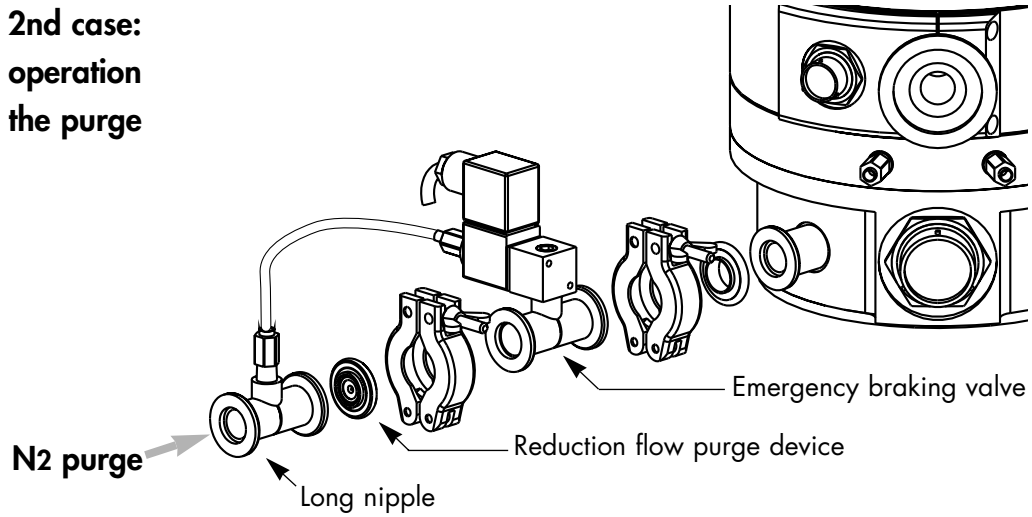


* Différent connection accessories can be found in the ALCATEL catalog.

Edition 05 - October 96

Nitrogen purge device connection

2nd case: Continous operation of the purge

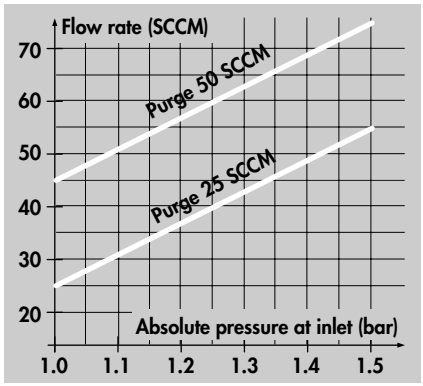


Connect the little flexible pipe between the long nipple and the valve.

Adjust the flow rate

Feed the nitrogen purge throughout pumping according to the flow rate and pressure values in the scale given.

For limited the flow rate at 25 SCCM, connect the nitrogen flow reduction device accessory ***(see A 50)***.



Edition 05 - October 96

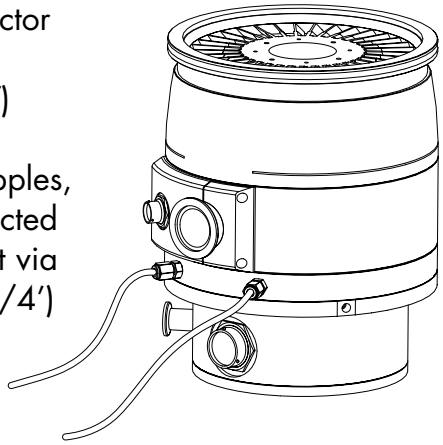
Water cooling connection

Characteristics of water cooling

In order to limit the corrosion and clogging of the cooling pipes, it is recommended to use cooling water with the following characteristics:
- treated soft water or non-corrosive industrial water
- pH between 7.5 and 11
- hardness < 7 milli-equivalent/dm^3
- Resistivity > 1500 Ω.cm
- Solid pollution < 100 mg/dm^3
- Max. pressure: 7 bars
- Temperature: 15 < T < 25°C
- Flow rate: 60 l/h

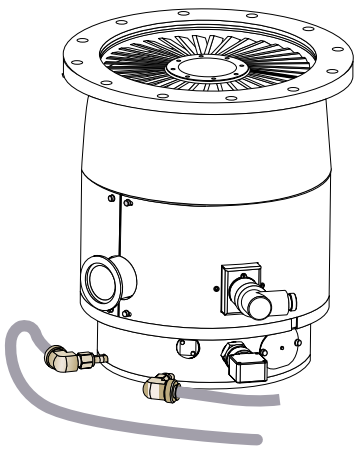
For ATH 1000M models

- Provide a water inlet pipe and a tap to adjust the flow rate.
- Install the two male connector delivered on the cooling device (connector 1/8 NPT)
- Connect the water inlet line to one of the cooler nipples, with the other nipple connected to the water draining circuit via a flexible tube (ext. diam 1/4') (supplied by customer).



For ATH 400M models

- Connect the water inlet line to one of the cooler water fittings 1/4 NPT female on the pump, with the other fitting connected to the water draining circuit via a tube (supplied by customer).

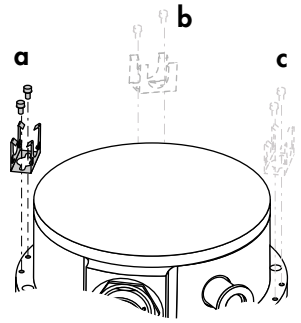


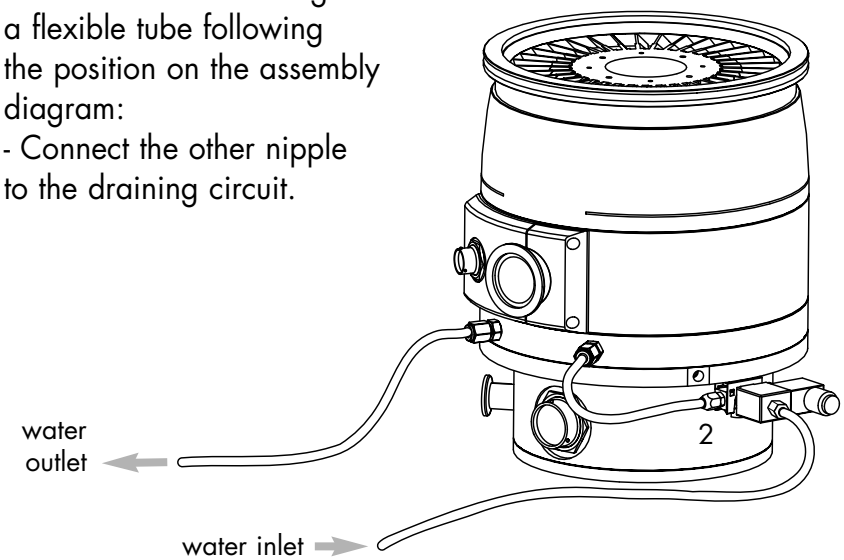
Edition 07 - January 02

Water cooling connection

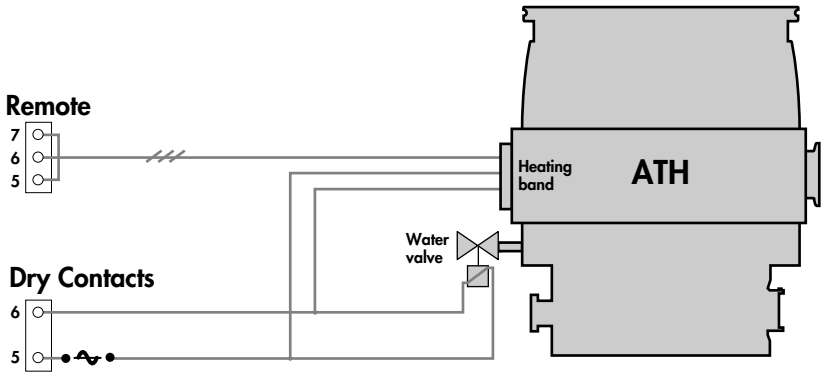
For ATH 400MT or ATH 1000MT models

- Provide a water inlet pipe and a tap to adjust the flow rate.
- Assemble the valve holding stirrup on the pump frame (3 positions **a,b,c**).
- Install the water electrovalve on its holding.
- Install the water valve to the water inlet line using a flexible tube following the position on the assembly diagram:
- Connect the other nipple to the draining circuit.





Electrical connection



Connect the water valve via the «THERMOSTAT» contact on the DRY CONTACTS connector and supply it via the thermostatic cable.

Edition 07 - January 02

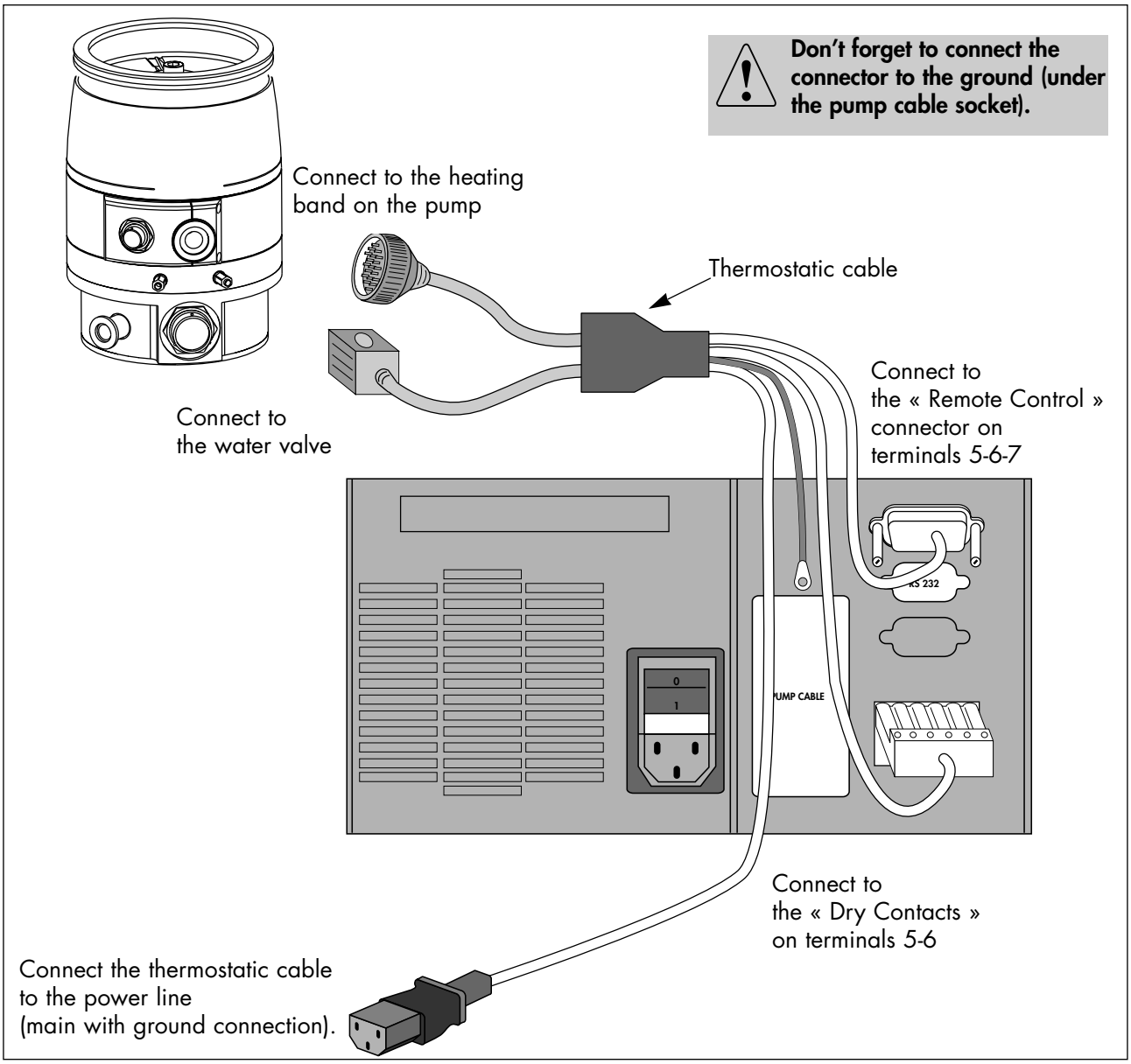
Heating band connection

For ATH 400MT and ATH 1000MT

These pumps are equipped with an heating band, a thermal sensor and a valve to regulate the water flowrate. The body of the pump can be heated to 75°C to avoid gas condensation in the pump on the semiconductor processes.

Connection

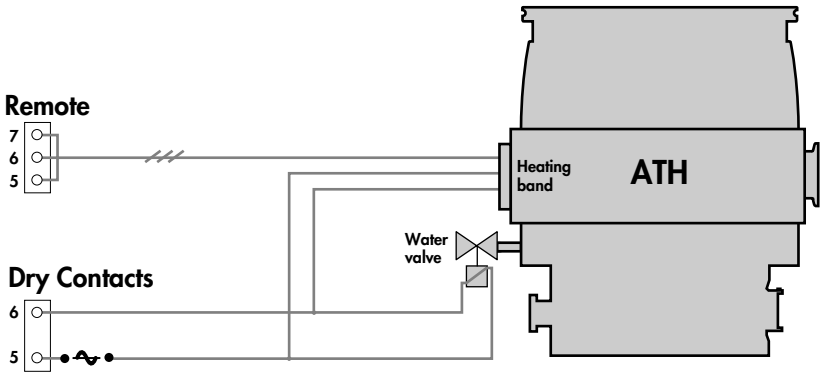
Connect the thermostatic cable as follows:



Edition 05 - October 96

Heating band connection

Heating band temperature



The temperature can be choosen on the controller (between 31 and 75°C or NO°C).
By choosing «NO°C» temperature, the heating band is switched off and the pump is cooled permanently.

If there is a failure on the temperature sensor on the heating band, the controller display indicates:

PUMP-TEMP2	00°C
DEF 38	TEMP.SENSOR 2

The heating band is switched off and the pump is cooled permanently.
The temperature of the heating band can be read on the display of the controller ***(see C 30)***.

Hot surfaces are signalled by  **symbol.**

The pump housing temperature can reach 75°C.

Edition 05 - October 96

Electrical connection

Controller installation

The unit must be installed in an environment ventilated either by natural convection or by the movement of forced air. Cooling is normally performed by an internal fan which ventilates air from the inside to the outside of the unit.

Make sure that:

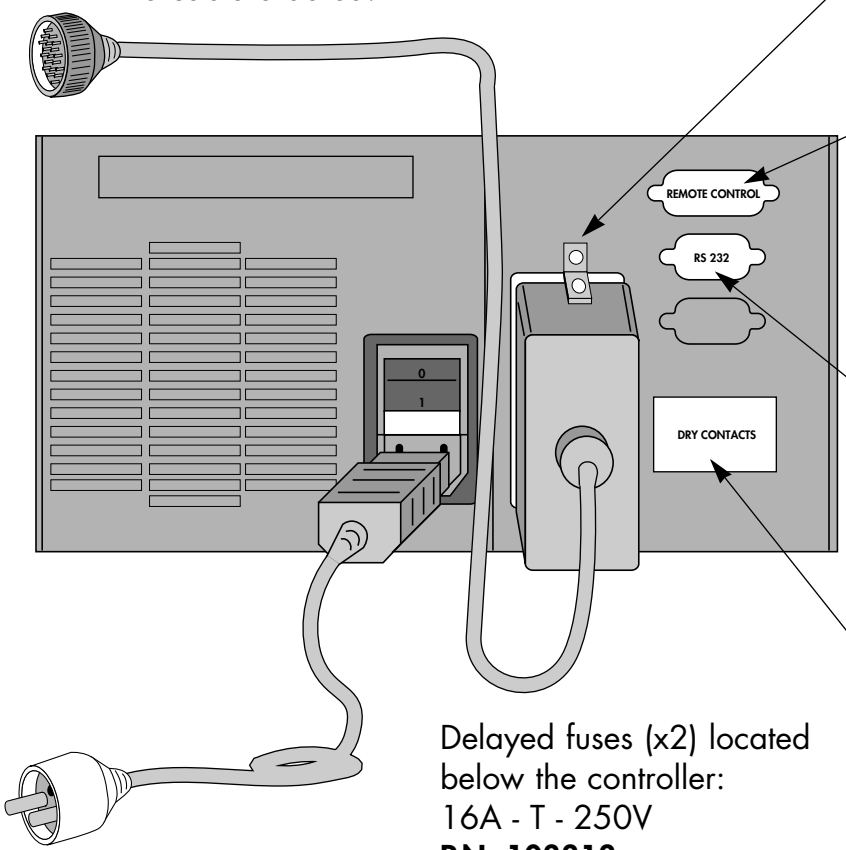
- the openings on the bottom, top and rear of the unit are not blocked;

- the ambient temperature does not exceed 50°C;

- a free space of at least 15 mm is left behind and below the unit.

Connections

Connect the **controller to the pump** using the cable ordered.



Connect the connector with square and screw M3 to respect the EMC.

If the unit is remote controlled, make the various connections on the **REMOTE CONTROL** ***(see B 100)***.

Connect the **RS232** serial link cable to the connector (cable supplied by customer). ***(see B 110 and B 120).***

Some output contacts are available on terminal **DRY CONTACTS** ***(see B 90)***.

Delayed fuses (x2) located below the controller:
16A - T - 250V
P.N. 103313

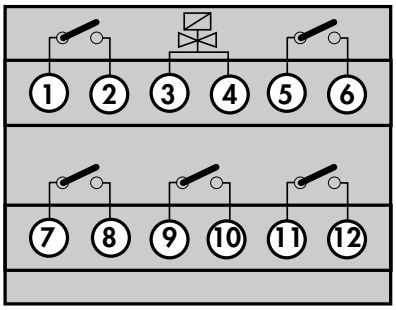
Connect the **controller to the power supply** using the cable supplied.
(Main with ground connection).

Edition 05 - October 96

«Dry contacts» relay wiring

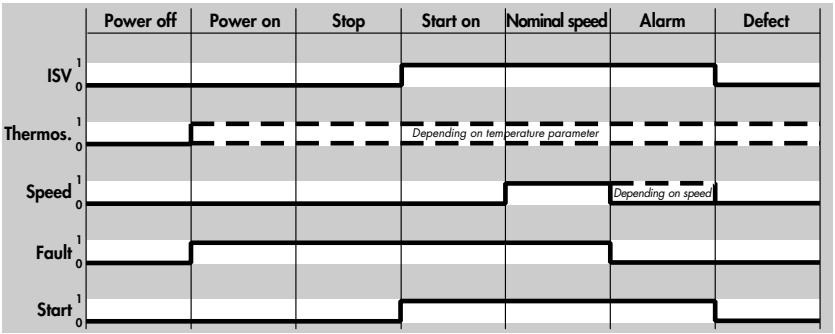
Signaling using output contacts:

These are dry contacts **(220VAC - 3A)**:
their functions are to copy the data concerning the pump operating status.



Isol. valve	**1 - 2**	When the controller detects a bearing operating fault or after a stop, it opens the contact. **This contact must be used to control a secondary isolation valve** which is used to maintain the pressure in the chamber while the pump is reset to atmospheric pressure.
Air inlet	**3 - 4**	When the controller detects a bearing operating fault, it stops the power supply to the emergency braking valve (12V-5W): the valve opens and air enters.
Speed	**7 - 8**	The contacts is closed when the pump reaches the selected speed.
Fault	**9 - 10**	The contact is opened if a faults appears.
Thermostat	**5 - 6**	The contact is opened or closed, depending on the pump temperature and the selected temperature.
Start	**11 - 12**	The contact is closed when the «START» control is activated on the controller. The contact can be used to control a primary isolation valve, and via a power relaying device, to control a primary pump.

Contact functionnal status

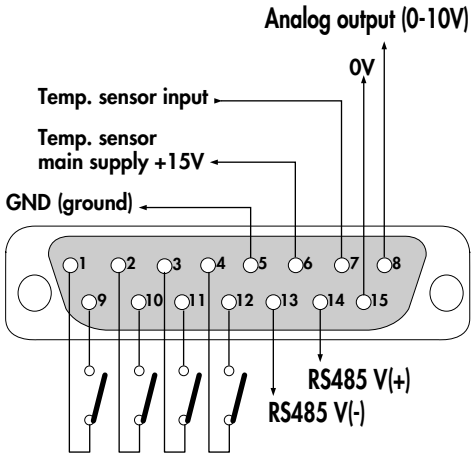


Edition 05 - October 96

"Remote Control" connector wiring

When the units containing the control circuits are equipped with dry contact outputs, it is the customer's responsibility to use the outputs in compliance with safety regulations.

The control contact



Ext. safety **1 - 9**	When the contact is closed, an external safety device is signalled: the motor is stopped and the controller generates a fault. This contact must be opened for the pump to operate. The emergency valve is opened.
Start/Stop (in remote mode) **2 - 10**	When the contact is closed, the pump is started up and accelerates to reach its nominal speed or reduced speed (depending on parameter settings). If the contact is open, the pump is no longer powered.
REMOTE Mode **3 - 11**	When the contact is closed, the remote control mode is selected. The actions on the keyboard are without effect. If the contact is open, the local mode is selected (control using the front panel keypad).
STANDBY Mode **4 - 12**	When the contact is closed, the reduced speed rotation mode is selected.
Temp. Sensor **5 - 6 - 7**	These contacts allows to read the heating band temperature.
Analog. Output **8 - 15**	Used to monitor the selected parameter (see ANALOG OUT menus C 30).

Edition 06 - September 97

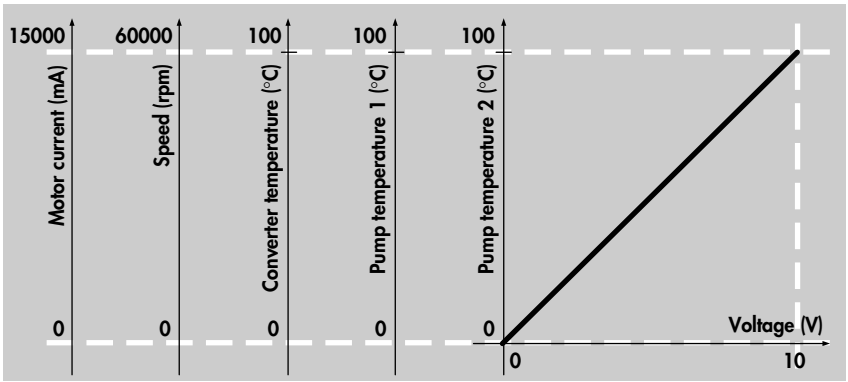
"Remote Control" connector wiring

Analog output signal

The signal is transmitted between terminal 8 and 15 of the remote connector.

Five values can be used to plot curves:

θ1 Pump temperature: (θ1 PUMP)	**0°C**	**(OV) to**	**100°C**	**(10V)**
θ2 Pump temperature: (θ2 PUMP)	**0°C**	**(OV) to**	**100°C**	**(10V)**
Pump rotation speed: (SPEED)	**360 rpm**	**(OV) to**	**30000 rpm**	**(5V)**
	360 rpm	**(OV) to**	**33000 rpm**	**(5.5V)**
	360 rpm	**(OV) to**	**39000 rpm**	**(6.5V)**
Controller temperature: (θ CONV)	**0°C**	**(OV) to**	**100°C**	**(10V)**
Motor current: (I MOTOR)	**0 mA**	**(OV) to**	**8700 mA**	**(5.8V)**



Factory configuration is setted on **(SPEED).**

Edition 06 - September 97

RS 232 or RS 485 serial link wiring

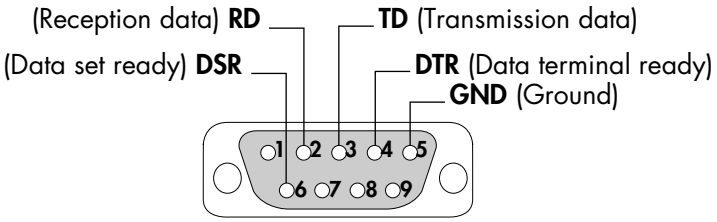
At the first power-up, the user finds the default configuration. The serial link parameters can be modified by accessing the corresponding unit menu **(see C 30)**.

The default configuration of the serial link is as follows:

- Type: **RS 232**
- Transmission speed: **9600 bauds**
- Data length: **8 bits**
- Parity: **NONE**
- Stop bit: **1**

Refer to C 30 to customize the parameters.

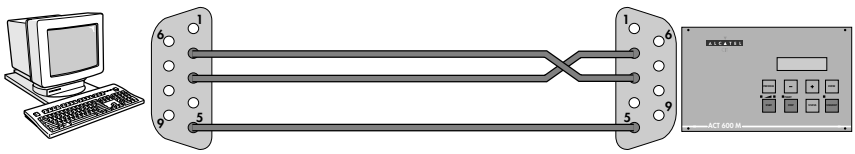
RS232 connector wiring:



DB 9 contacts, male connector.

Connection examples:

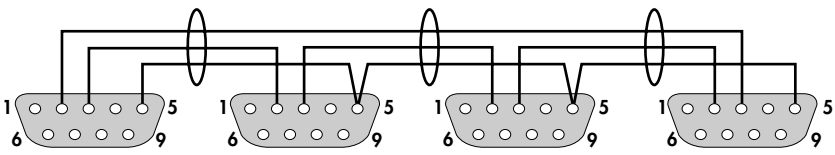
RS232 type serial link with a single controller



Edition 05 - October 96

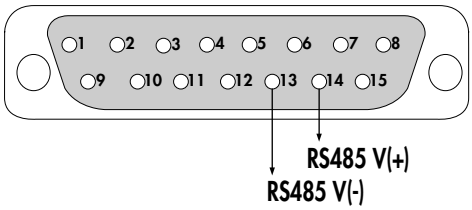
Multiple RS232 serial link: several units (up to 999) can be controlled on a single link.

The multiple link is obtained by creating a loop:



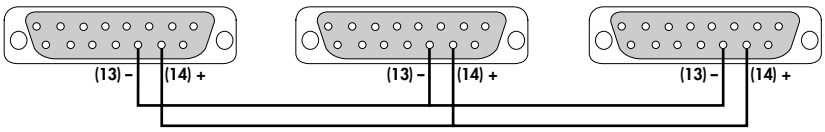
RS 232 or RS 485 serial link wiring

RS485 connector wiring:



«Remote Control» connector 13 and 14 pins
DB 15 contacts, male connector.

Multiple RS485 serial link:
several units (up to 999) can be controlled on a single link.



Edition 05 - October 96

Detailed description of RS232 and RS485 commands

(valid from V.2.03 version controller)

Conventions applicable to the syntax of all commands:

adr = address, from 000 to 255
<CR> Carriage Return (ascii 13)
<LF> Line Feed (ascii 10); between square brackets: this character is not compulsory.

Status values

OK : command executed correctly

Error messages

Err0 : adjustment error (out of bounds)
Err1 : command error (syntax)
Err2 : parameter error (e.g. non-hexadecimal character)
Err3 : context error
Err4 : checksum error

ADR

Specifies the address of the device for networking.

Syntax

#adr**ADR**,aaa<CR>[<LF>]
adr = address of the device before the command
aaa = new address of the device
condition : 000 ≤ aaa ≤ 255

Result

#aaa,OK or Err2

This command is used to allocate a specific number to each of the products making up a network (loop for RS 232 or parallel for RS 485).

Note : it is important to note down the number allocated to each device.

DEF

List the faults

Syntax

#adr**DEF**<CR>
List the faults separated by the separator character.

Result

#adr,OK if there is no fault

Edition 06 - September 97

Detailed description of RS232 and RS485 commands

DLI — Defines the DataLogger transmission interval

Syntax #adr**DLI**,xxx<CR>[<LF>]
xxx: DataLogger send interval in seconds
condition: 001 ≤ xxx ≤ 255

Result #adr,OK or Err2

See also: **DLR** Note: if OK, the interval sent is stored in user memory.

DLR — Enables DataLogger operation (only with RS232)

Syntax #adr**DLR**<CR>[<LF>]

Result #adr,OK

The main characteristics of the pump and its controller are sent over the RS link, at the rate defined by the **DLI** command.

Note: any new characters arriving on the serial port (RS 232) will cancel the automatic DataLogger transmission.

GET — List the data (data only)

Syntax #adr**GET**AI<CR>[<LF>] : List analog inputs
#adr**GET**LI<CR>[<LF>] : List logical inputs
#adr**GET**LO<CR>[<LF>] : List logical outputs

Edition 06 - September 97

Detailed description of RS232 and RS485 commands

IDN — Identifies the device which is communicating, and its software version

Syntax #adr**IDN**<CR>[<LF>]

Result #adr, ACT1000M Vx.zz

Returns the type of Variable drive Supervisor, the software version (x), the software edition (zz).

LEV10 — Returns the state of the parameters defined by SET

Syntax #adr**LEV**10<CR>[<LF>]

Result #adr,nnnnn,sssss,00000,0,ccccc,eeeee,ddddd,pppp,qqqq, jj,kk,000,mmm

Returns current values:

- **nnnnn** : nominal speed set point (in rpm)
- **sssss** : stand-by speed set point (in rpm)
- **00000**: not used
- **0** : not used
- **ccccc** : pump working time (in hours)
- **eeeee** : electronic working time (in hours)
- **ddddd**: start delay (max 14459 s, that is 240 mn 59 s)
- **pppp** : time to venting (max 3599 s, that is 59 mn 59 s)
- **qqqq** : venting time (max 3599 s, that is 59 mn 59 s)
- **jj** : speed threshold for relay (3 to 50 %)
- **kk** : control temperature (30 to 75°C)
- **00** : not used
- **mmm** : bearing current value (0 to 100 %)

Edition 06 - September 97

Detailed description of RS232 and RS485 commands

NOW — Display date and time

Syntax #adr**NOW**<CR>[<LF>]

Result MM/DD/YY HH:MM:SS

NSP — Switches the speed set point to the nominal speed value

Syntax #adr**NSP**<CR>[<LF>]

Result #adr,OK

The speed set point for the pump is set to its nominal value.

OPT — Used to select possible user choices

Syntax #adr**OPT**01,n<CR>[<LF>]

choice of parameters on the analog output:

n = 0 : real pump speed
n = 1 : pump current
n = 2 : temperature of pump body
n = 3 : temperature of internal electronics

Result #adr,OK

Comment: The choice of the temperature unit affects the results of the DLR and STA strings and the display (if cabinet fitted).

Edition 06 - September 97

Detailed description of RS232 and RS485 commands

RPM — Defines the speed set point in stand-by mode

Syntax #adr**RPM**,nnnnn<CR>[<LF>]

Result #adr,OK *or* #adr,ErrX
1, out of range; 2, parameters ; 3, context
(not in Stand-by mode)

Comment: if OK, the new speed is automatically stored in user memory.

SBY — Switches the speed set point to the stand-by value

Syntax #adr**SBY**<CR>[<LF>]

Result #adr,OK

Resets the stand-by speed to its last stand-by stored value, and allows it to be modified if an «RPM» command is sent. This configuration is automatically stored in user memory.

SEL10 — Returns the state of the parameters defined by OPT

Syntax #adr**SEL**10<CR>[<LF>]

Result #adr,a,0,0,0
a : Returns choice of parameters on the analog output:
- a = 0 : real pump speed
- a = 1 : pump current
- a = 2 : temperature of pump body
- a = 3 : temperature of internal electronics

0,0,0 : not used

Edition 06 - September 97

Detailed description of RS232 and RS485 commands

SCR — List all the data (titles and data)

Syntax

#adr**SCR**<CR>[<LF>] : List all the data
#adr**SCR**AI<CR>[<LF>] : List all the analog inputs
#adr**SCR**AO<CR>[<LF>] : List all the analog outputs
#adr**SCR**LI<CR>[<LF>] : List all the logical inputs
#adr**SCR**LO<CR>[<LF>] : List all the logical outputs

SET — Defines the internal operating parameters

Syntax

#adr**SET**10,ccccc<CR>[<LF>] :	pumping working time (in hours)
#adr**SET**11,eeeee<CR>[<LF>] :	electronic working time (in hours)
#adr**SET**13,ddddd<CR>[<LF>] :	start delay (max 14459s, that is 240mn 59s)
#adr**SET**14,pppp<CR>[<LF>] :	time to venting (max 3599s, that is 59mn 59s)
#adr**SET**15,qqqq<CR>[<LF>] :	venting time (max 3599s, that is 59mn 59s)
#adr**SET**30,jj<CR>[<LF>] :	speed threshold for relay (3 to 50 %)
#adr**SET**31,kk<CR>[<LF>] :	control temperature (30 to 75°C)
#adr**SET**33,mmm<CR>[<LF>] :	bearing current value (0 to 100 %)

Result #adr,OK *or* ErrX

Edition 06 - September 97

Detailed description of RS232 and RS485 commands

SEP — Defines the character which separates the parameters in a reply

Syntax #adr**SEP**,nnn<CR>[<LF>]

nnn: 3-digit decimal value of the ascii code of the desired character (with leading zeros).
condition : 000 ≤ nnn ≤ 255

Result #adr,OK *or* #adr,ErrX if error

Allows the user to select the character which separates the parameters returned by the **DLR**, **STA** and **LEV** commands.
Default value: comma «,» ascii code = 044
If ok, the selected value is automatically stored in user memory.

SPD — Returns the current speed

Syntax #adr**SPD**<CR>[<LF>]

Result #adr,nnnnn

Edition 06 - September 97

Detailed description of RS232 and RS485 commands

STA — Returns the status of the internal dynamic parameters

Syntax #adr**STA**<CR> or STA<CR>

Result #adr,s,rrrrr,vvv,www,xxx,yyy,zzz,aaa,bbbbb,cccc,ddd,eee,fff,ggggggggggggggggggg<CR>

adr: address

s: order status

Bit	7	6	5 LOCAL	4 STOP	3 RS	2 REM	1 STDBY	0 START
0	-	OFF	OFF	OK	OFF	OFF	OFF	OFF
1	1	-	ON	fault	ON	ON	ON	ON

rrrrr: speed in rpm
vvv: Radial v13
www: Radial w13
xxx: Radial v24
yyy: Radial w24
zzz: Axial z12

aaa: Motor voltage V
bbbbb: Motor current mA
cccc: Motor load W
ddd: Pump temp 1 (°C)
eee: Pump temp 2 (°C)
fff: Controller temp (°C)

g	0 = OK	1 = ALERT	2 = FAULT
0	0=OK	D02: motor overheat	
1	0=OK	D03: converter overheat	
2	0=OK		D04: hall sensor
3	0=OK		D05: permanent fault sensor
4	0=OK		D06: external safety
5	0=OK		D31: jump DT0/DT1/DT2
6	0=not used		
7	0=not used		
8	0=not used		
9	0=OK		D14: v13
10	0=OK		D15: w13
11	0=OK		D16: v24
12	0=OK		D17: w24
13	0=OK		D18: z12
14	0=OK	D23: hot pump	D21: overheat-1
15	0=OK	D22: controller temp.	
16	0=OK		D26: wires disconnected
17	0=OK	D27: converter memory	
18	0=OK	D28: pump memory fault	
19	0=OK		D29: input power failure
20	0=not used		

Edition 06 - September 97

Detailed description of RS232 and RS485 commands

TIT — List the data titles

Syntax

#adr**TIT**AI<CR>[<LF>] : List analog inputs
#adr**TIT**LI<CR>[<LF>] : List logical inputs
#adr**TIT**LO<CR>[<LF>] : List logical outputs

TMP — Defines the operating state of the turbomolecular pump

Syntax

#adr**TMP**ON<CR>[<LF>]	start pump rotation
#adr**TMP**OFF<CR>[<LF>]	stop pump

Result

#adr,OK *or* #adr,Err3 if the pump is already in the state requested (context error)

Edition 06 - September 97

C 10

Safety instructions related to operation

Before using the controller, make sure that the mechanical and electrical connections have been made *(see chapter B)*.
If an error message is displayed during operation, *see D 20*.

The machines are designed so as not to present a thermal risk for the user's safety. However, specific operating conditions can generate temperatures which require particular care to be taken by the user (external surfaces > 70°C).

Avoid moving or causing a shock on a pump in operation.
There is a risk of seizing if the pump rotates in an axis perpendicular to its axis of rotation.

The emergency braking valve must be connected *(see B 40)* to ensure the pump's safety and durability.
As long as the pump is running, the emergency braking valve has to be supplied with neutral gas.

The controller should never be switched off as long as the rotor is moving.

It is highly recommended to install:
- **a screen filter at the pump inlet;**
- **an isolation valve between the chamber to be pumped and the ATH pump;**
- **an isolation valve between the ATH pump and the backing pump.**

Edition 06 - September 97

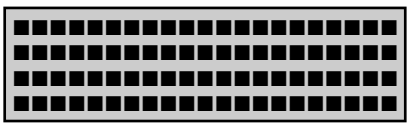
Controller start-up

Once the various electrical connections have been made, set the main switch on the rear panel to "**I**".

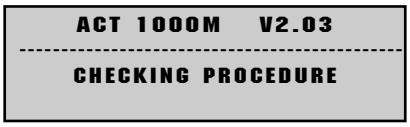
The controller performs a self-test and identifies the pumps to which it is connected.

The initialization time is approximately 4 seconds.

Display initialization:



The equipment is identified, the program version is displayed.



Indicator light test: they are lit in succession.

The working screen is displayed.

The parameter setting keys

Parameter setting access — PREVIOUS
- used to access the parameter setting mode.
- used to exit the various menus without validating the functions.

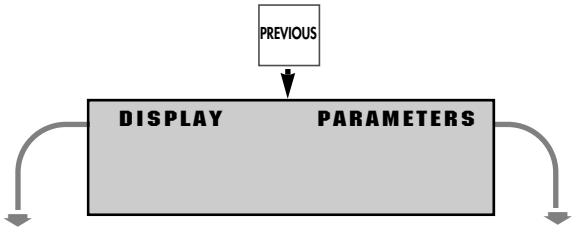
Selection — + / –
- used to move in the menus, or from one parameter to another.
- used to select or adjust the value of the selected parameter.

Validation — ENTER
- used to validate the selection of a menu, parameter or value.

STATUS
- used to exit the menus and return to the pump parameter display.

Configure the parameters for the application using the various menus.

Enter the sub-menus by pressing



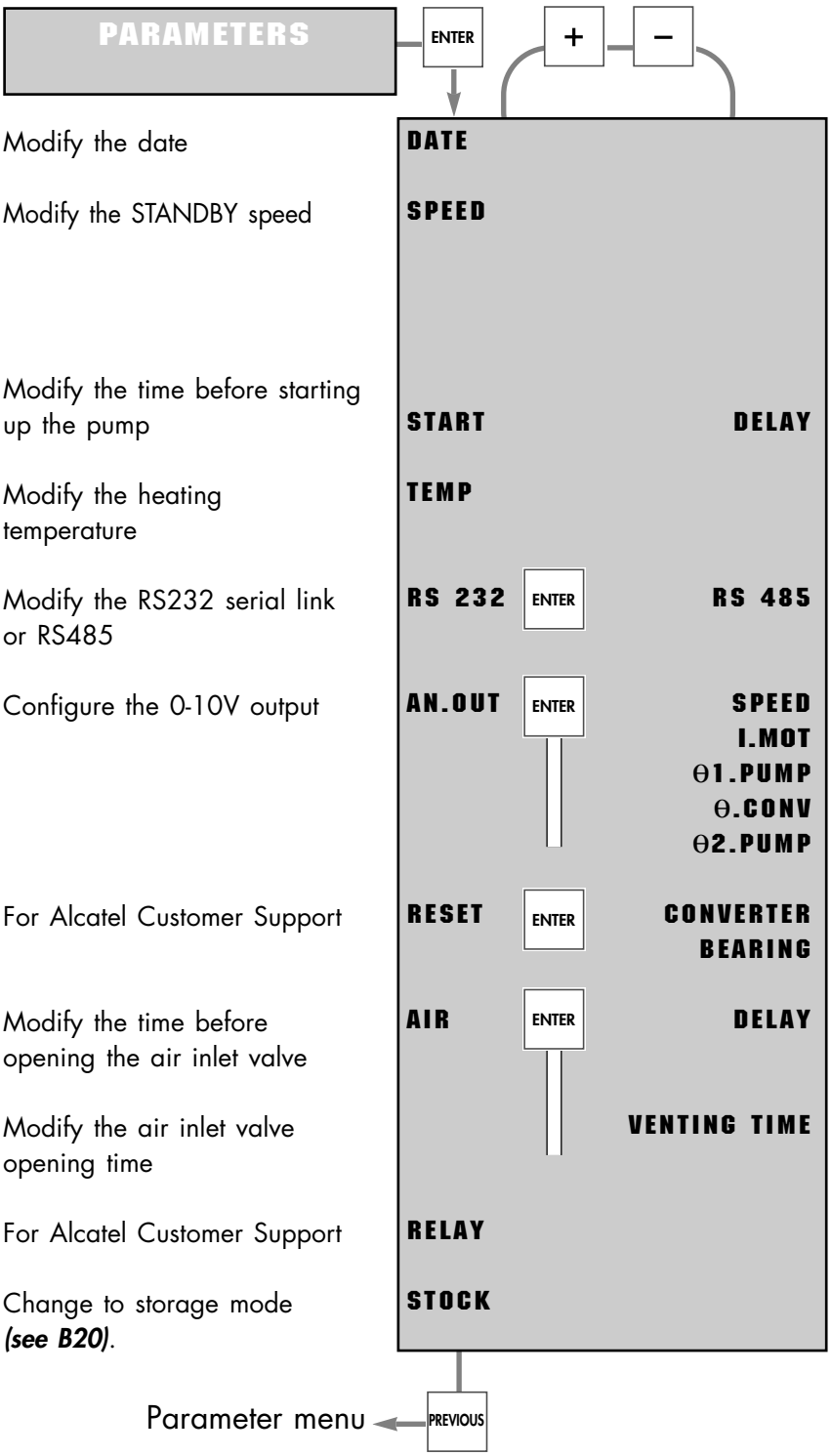
Display and/or select the parameters to be monitored ***(see C 30)***.

Access the parameter programming ***(see C 30)***.

Edition 06 - September 97

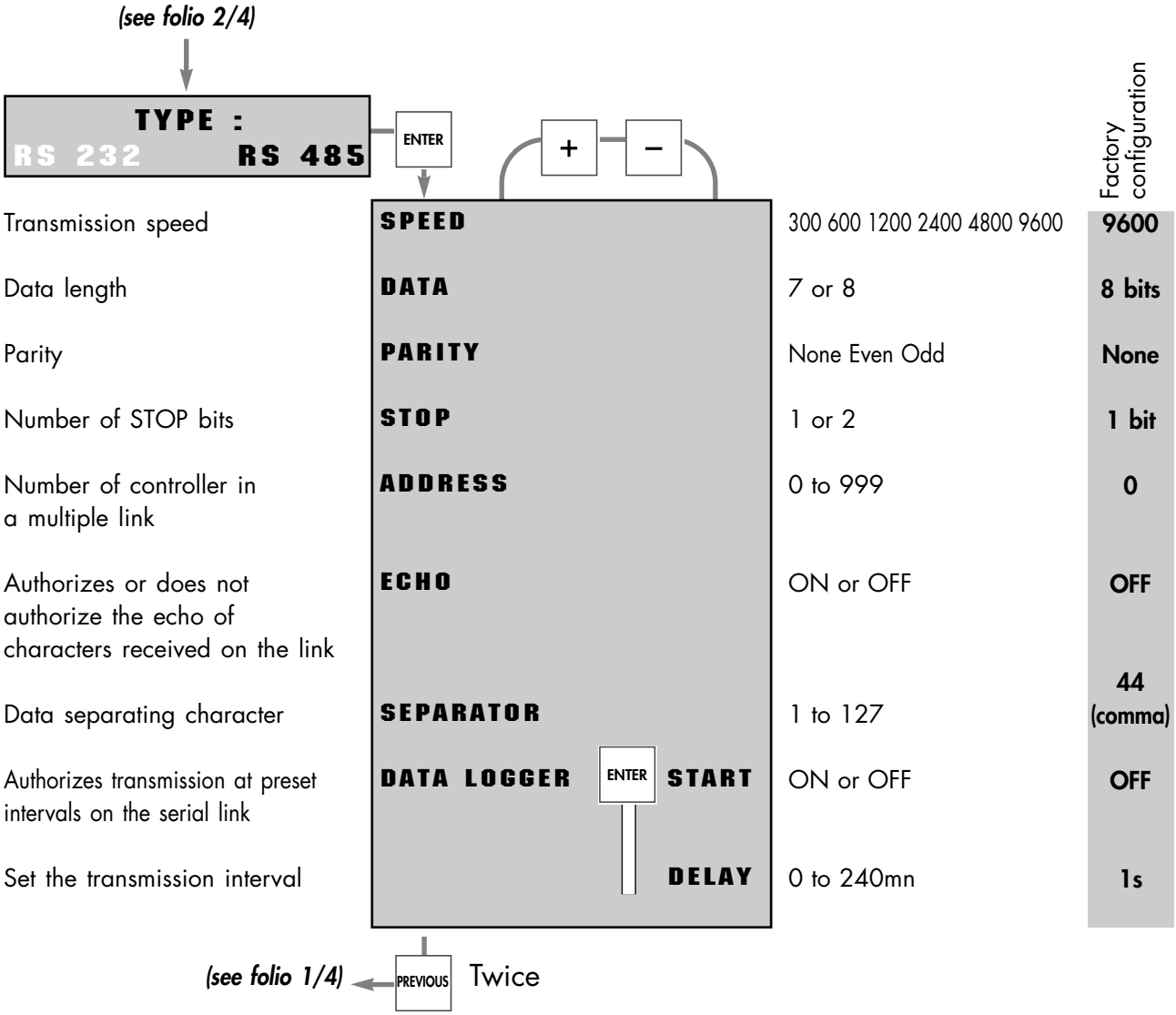
Configuring the controller for the application

Programming the parameters



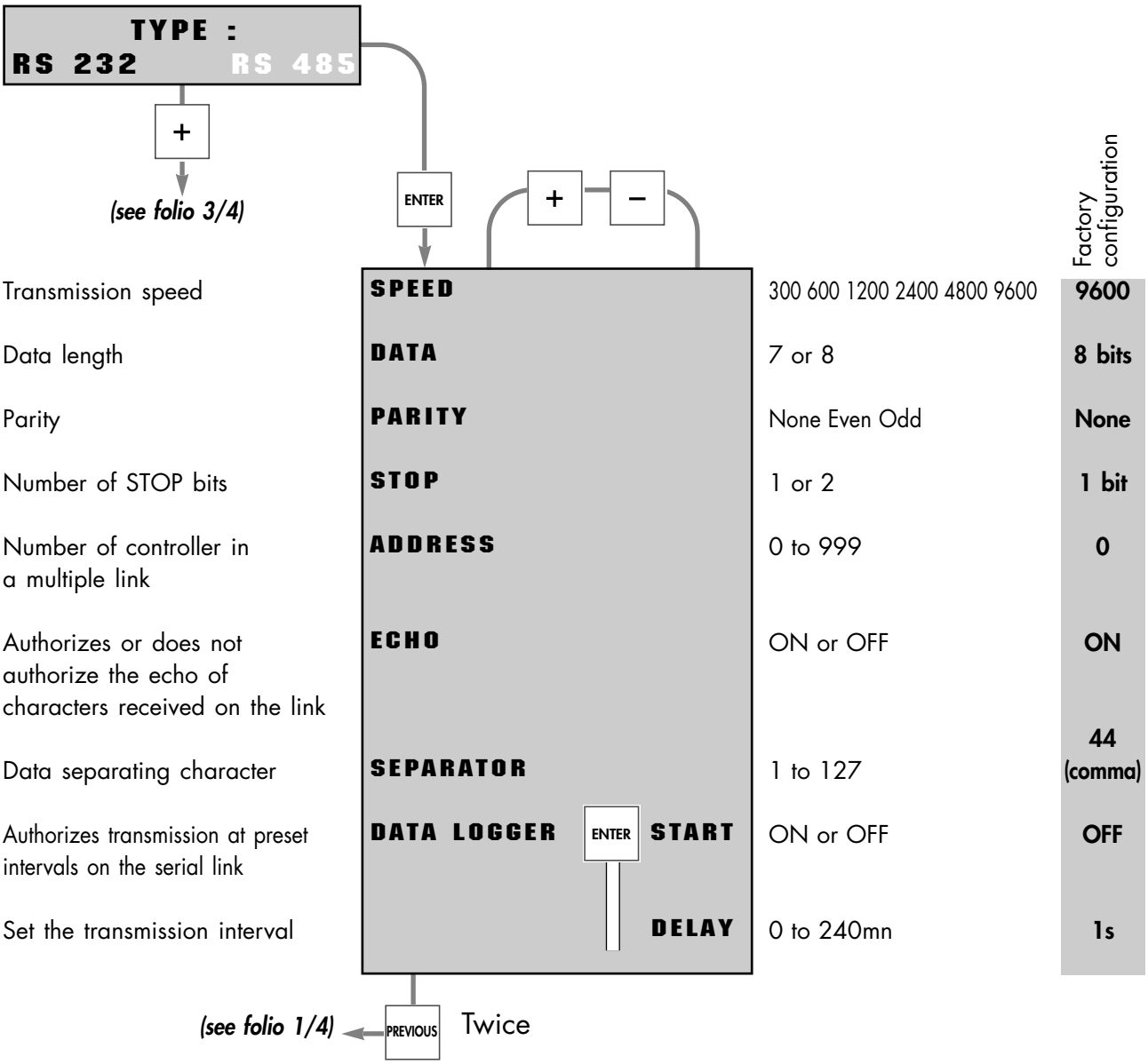
Edition 06 - September 97

Configuring the controller for the application



Edition 06 - September 97

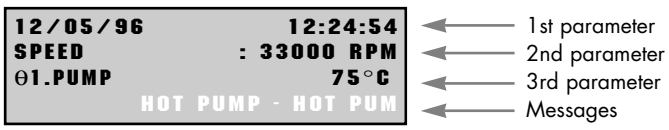
Configuring the controller for the application



Edition 06 - September 97

Configuring the controller for the application

The various indicators on the display:

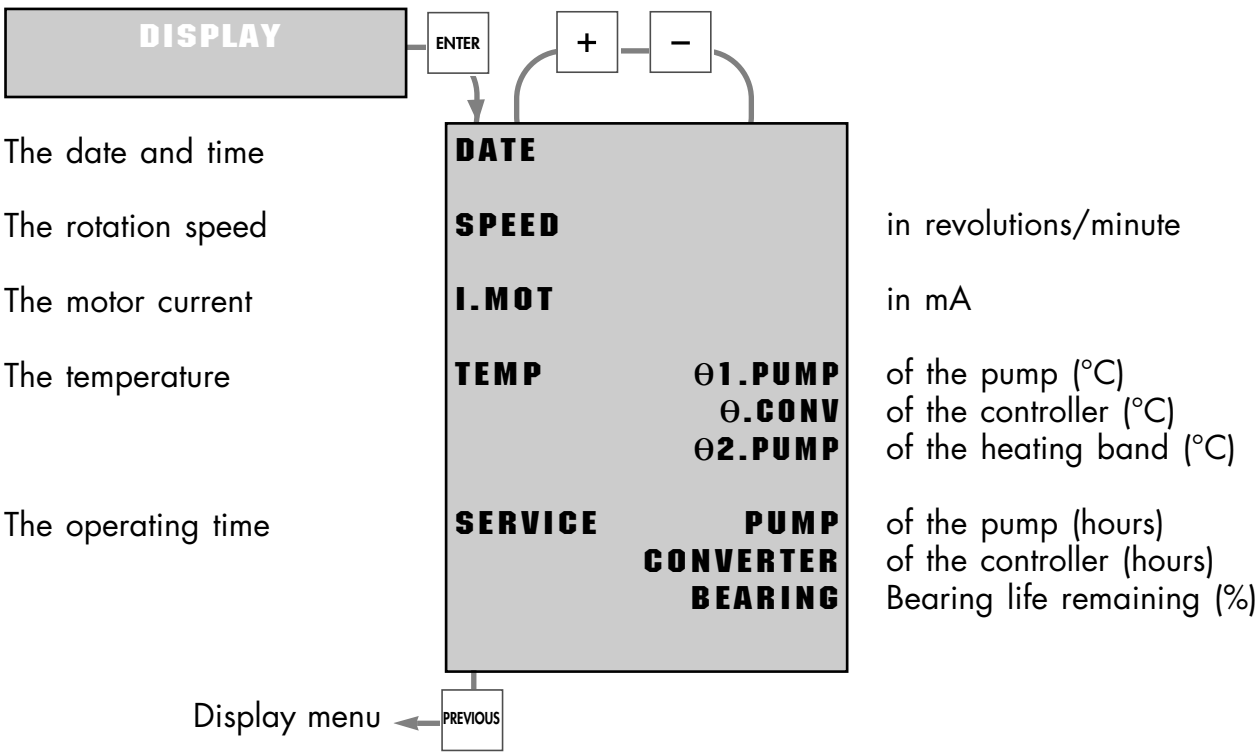


3 parameters can be selected in the pull-down menu from the list below:

- the current date and time;
- the rotation speed of the pump in «rpm»;
- the current pump motor (mA);
- the pump internal temperature and the housing temperature of the pump (°C);
- the temperature of the controller (°C);
- the number of hours that the pump is in operation (h);
- the number of hours that the controller is in operation (h);
- the % life remaining on the back-up bearings (%) before changing the bearings.

When switched on, the controller displays: the date and time, the rotation speed and the pump temperature.

Configuring the display screen



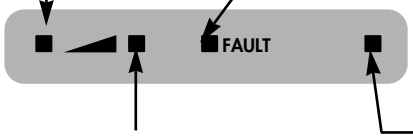
Edition 06 - September 97

Controlling the pump using the controller front panel

Rotation indicator lights:

Yellow lit
The pump rotation speed is **lower** than the selected speed.

Red lit
The pump is faulty.
This fault is accompanied by an audible signal.



Yellow lit
Standby mode selected.

Green flashing
The pump rotation speed is **higher** than the selected speed (decrease of the selected speed during operation).

Green lit
The pump has reached the selected speed.

Start up the pump by pressing START

The pump is started up to reach the selected speed.

The yellow rising speed indicator light comes on. When the pump reaches its selected speed, the yellow indicator light goes off and the green indicator light comes on.

Select the reduced speed rotation mode by pressing STAND BY

The speed selection indicator light comes on. The pump regulates its speed to reach the value of the programmed reduced rotation speed ***(see C 30)***.

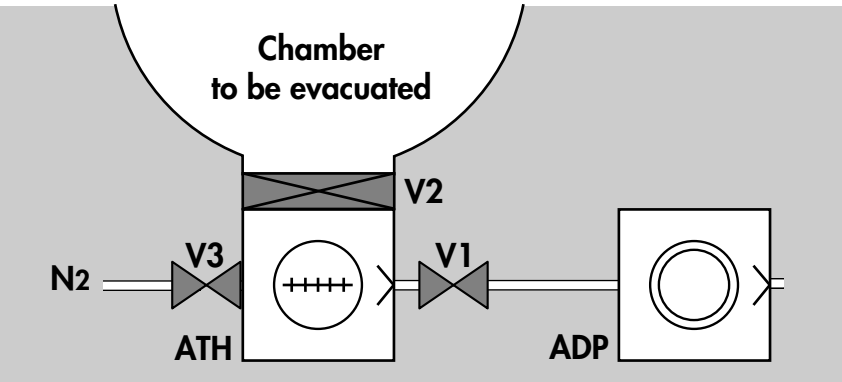
Stop the pump by pressing STOP

The rotation speed monitoring indicator light goes off. The pump motor is no longer powered, the pump decelerates.

Edition 05 - October 96

Pump operation in a pumping application

Pumping cycle from chamber at atmospheric pressure



Local mode operation

Pumping start

Switch on the controller

The valve **V3** closes and the «FAULT» contact closes.
The rotor is levitated.
The heating band is powered (for ATH MT).

Start the pumping by START

The primary pumps starts and valve **V1** opens (if the primary pumping is controlled by the controller).
If the pump start-up time has been programmed ***(see C 20)***, the countdown of the time before the pump begins rotating is displayed on the screen.
If the pump start-up time has not been programmed, the primary pumping system and ATH start up at the same time.

Open the valve V2

Take care to wire the customer relay in series with «ISOL. VALVE» contact.
The chamber continues to be pumped until the customer operating pressure is reached.

Select the stand-by mode STAND BY

The pump reaches the standby speed programmed ***(see C 30)***.
The standby mode can be selected when pump is stopped or in rotation.

Edition 05 - October 96

Pump operation in a pumping application

Pumping stop

Stop the pumping by STOP

This closes the primary isolation valve **V1** and the primary pump stops. If the ISV contact is connected, **V2** closes.

Close the valve V2

The level of vacuum in the chamber is maintaining.

Allow the purge to flow through after pumping has stopped in order to eleminate the dead volume in the pump with neutral gas.
Eventually, make an air inlet on the pump to brake its rotation.
Without air inlet, the duration of the rotor slow-down until its complete stop could be more than 30 minutes.

Remote control mode operation

Remote control mode selection

Close the contact «REMOTE» on the Remote Control connector ***(see B 90)***.
The keyboard control keys on the front panel (Start, Stop, Standby) are deactivated.

In this mode, the functions are the same to the local mode.

Edition 05 - October 96

Pump operation in a pumping application

Immediate restarts

If the pump has been stopped by an air inlet, we advise to limit to 2 the number of immediate restarts.
If the pump has been stopped without air inlet, immediate restarts are not limited.

Event of a power cut

If a power cut occurs, the rotor remains suspended by the energy emitted by the motor's counter-electromotive force, until the rotor rotation speed is low enough (around 9000 rpm) so that it can rest on the back-up bearings without being damaged.

Short power cuts

The controller display indicates temporarily:

If the power is restored before this minimum speed (9000 rpm) is reached, the pump resumes its initial speed without any disturbance. The landing's time counter doesn't decrease.

Long power cuts

Otherwise, the minimum speed is reached before the power is restored:
- «ISOL.VALVE» contact is open (V2 closes);
- «START» contact is open (V1 closes);
- the emergency braking valve is open by power failure;
- the pump lands on its back-up bearings;
- the controller is stopped;
- the landing's time counter decreases ***(see D 10)***.

The normal start-up procedure is to be resumed after power has been restored ***(see page 1)***.

If the pump is remote controlled, open the START contact and close it again.

Edition 05 - October 96

C 60

«External safety» contact operation

If the «EXT. SAFETY» contact on the Remote Control connector ***(see B 90)*** is closed:
- the controller display indicates: D 06 : EXT.SAFETY
- the pump is stopped and the emergency braking valve opens.

To restart the pump, open the «EXT. SAFETY» contact and start the pump:
- in local mode: push the START key;
- in remote control mode: open «START/STOP» contact then, close it ***(see B 100)***.

Edition 05 - October 96

Safety instructions related to maintenance

It is important to isolate the machine from the electrical power supply source before any interventions inside the equipment (for maintenance reasons).

Before any maintenance operations, check the pumping conditions of the installation: toxicity, possible corrosion of the pumped gases. Depending on the case, we recommend:
- to purge the pumping installation with dry nitrogen before any intervention
- to wear gloves, protective goggles and breathing masks, if necessary
- to ventilate the room well and disassemble the equipment under a fume hood.

Before restart, follow all the safety instructions concerning start-up.

The controller should never be switched off as long as the rotor is moving (speed = 0 rpm).

Edition 06 - September 97

Safety instructions related to maintenance

Back-up bearings

When the pump is running, the rotor is levitated magnetically. There is therefore no friction between moving and fixed parts.

When the pump is stopped from the controller, the back-up bearings are not used. The rotor remains levitated by magnetic bearings.

Only the back-up bearings require maintenance: they are designed to withstand many accidental shut-downs, or many landings of the rotor on the bearings at full speed. These accidental shut-downs occur only in exeptional circumstances: broken power supply cable, strong shocks, faulty electronics. **It is advisable to check the bearing counter and provide ball bearings maintenance, when needed.**

The bearing counter

Life time of these bearings depends on the duration and number of landing. The initial percentage displayed by the controller is 100.00%.
When this percentage reaches 0%, the pump can't restart and the back-up bearings have to be changed.
The decrementation of the counter is done by:
- a landing after a magnetic bearing trouble, nearly 0.20% per landing;
- a landing at 9000 rpm after a prolonged power failure, nearly 0.04%.

However, the decrementation depends on the bearings rotation duration:
- if the braking valve is not connected or,
- if the gas supply is closed on it or,
- if there are no exhaust or inlet isolation valves or,
- if theses valves are not driven by the controller,
the counter can count down 30% since the first landing.

The internal memory of the controller informs the operator when the bearings require maintenance by displaying:

D 24: BEARINGS MUST BE CHANGED

Edition 06 - September 97

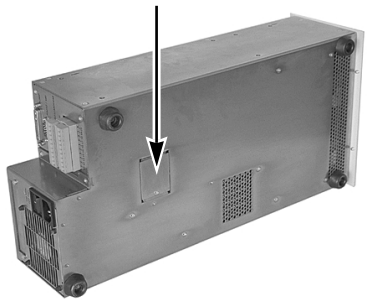
D 20

Diagnosis and troubleshooting

Edition 06 - September 97

Screen blocked on a display

INCIDENT	CAUSE	REMEDY
Display remains OFF after power ON	**Controller not powered**	■ Check that the controller is powered. ■ Check the power supply voltage: 85 V < U < 132 V or 170 V < U < 264 V
	NO	
	Defective fuses	■ Check the fuses: 2 fuses 16A located under the controller (Acces panel).

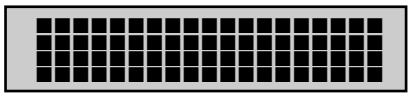
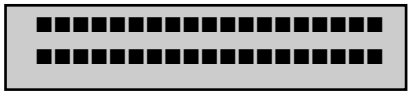
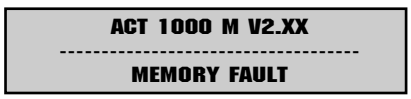


⚠ Isolate the product from its various energy sources before any maintenance operations.

NO — ■ If the message continues, call the Alcatel Customer Service.

Edition 06 - September 97

Screen blocked on a display

INCIDENT	CAUSE	REMEDY
	**No mains current**	■ Check the power supply voltage of the controller: 85 V < U < 132 V or 170 V < U < 264 V
	NO	■ If the message continues, call the Alcatel Customer Service.
	**Microprocessor board does not run**	■ Switch ON /OFF the controller.
	NO	■ If the message continues, call the Alcatel Customer Service.
	**The pump is not identified after controller initialisation**	■ ***See D 250.***
	**The microprocessor runs on itself**	■ Stop the pump, Switch the controller ON/OFF. Restart the pump.
	NO	■ If the message continues, call the Alcatel Customer Service.

Edition 06 - September 97

D01 : POWER OVERHEAT

INCIDENT	CAUSE	REMEDY
Controller temperature too high	**Bad mains voltage**	■ Check the voltage: 85 V < U < 132 V or 170 V < U < 264 V
	NO	
	Bad controller cooling	■ Check that the air admissions are not blocked . ■ Respect a free space of 15mm above and under the controller.
	NO	
	Fan is not running	■ Check the fan power supply. ■ If the message continues, call the Alcatel Customer Service.
	NO	
	Ambient temperature too high > 50°C	■ Ventilate the controller environment.
	NO	■ If the message continues, call the Alcatel Customer Service.

Edition 06 - September 97

D02 : MOTOR CONTROL OVERHEAT

INCIDENT	CAUSE	REMEDY
Motor temperature too high	**Number of start-ups too frequent**	■ Reduce the number of ON/OFF switchings with air inlet.
	NO	
	Working pressure too high ATH 400M : P > 1 mbar ATH 1000M : P > 1.10^{-1} mbar	■ Adapt the working pressure.
	NO	
	Exhaust pressure too high > 5 mbar	■ Adapt the exhaust pressure, ***see curves G 10 and G 20.***
	NO	
	Problem on water cooling circuit	■ Check the flow rate (60 l/h).
	NO	
	Water electrovalve does not open when thermostatic pump parameter is set to NO°C	■ Change the valve, ***see B 60 and F 90.***
	NO	
	Defective ACT/ATH link	⚠ **Wait for the complete pump stop before any interventions on the cable !** ■ Check the connector locking. ■ Change the cable.
	NO	■ If the message continues, call the Alcatel Customer Service.

Edition 06 - September 97

D03 : MOTOR CONTROL OVERHEAT

INCIDENT	CAUSE	REMEDY
Controller temperature too high	**Bad controller cooling**	■ Chek that the air admissions are not blocked. ■ Respect a free space of 15mm above and under the controller.
	NO	
	Number of start-ups too frequent	■ Reduce the number of ON/OFF switchings with air inlet.
	NO	
	Working pressure too high **ATH 400M : P > 1 mbar** **ATH 1000M : P > 1.10^{-1} mbar**	■ Adapt the working pressure.
	NO	
	Exhaust pressure too high > 5 mbar	■ Adapt the exhaust pressure, ***see G 10 and G 20.***
	NO	■ If the message continues, call the Alcatel Customer Service.

Edition 06 - September 97

D04 : HALL SENSOR

INCIDENT	CAUSE	REMEDY
Wrong information coming from motor stator	**Default on Hall effect sensors of motor**	■ Try to restart the pump: Local mode: pressing «start». Remote mode: open and close the «start» contact.
	NO	⚠ **Wait the pump isn't running.** ■ Switch OFF the controller and restart it.
	Defective ACT/ATH link	⚠ **Wait for the complete pump stop before any interventions on the cable !** ■ Check the connector locking ■ Change the cable.
	NO	■ If the message continues, call the Alcatel Customer Service.
Display: D04 - D05	**Motor information default**	■ ***See previous incident***
Display: D04 - D05 - D11 - D25 - D26 - D31	**ACT/ATH link cable disconnected**	■ ***See D 250***

Edition 06 - September 97

D05 : OVERCURRENT OR SENSOR

INCIDENT	CAUSE	REMEDY
Motor stator overcurrent	**Default on Hall effect sensors of motor**	■ Try to restart the pump: Local mode: pressing «start». Remote mode: open and close the «start» contact.
	NO	⚠ **Wait the pump isn't running.** ■ Switch OFF the controller and restart it.
	Defective ACT/ATH link	⚠ **Wait for the complete pump stop before any interventions on the cable !** ■ Check the connector locking. ■ Change the cable.
	NO	■ If the message continues, call the Alcatel Customer Service.

Edition 06 - September 97

D06 : EXTERNAL SAFETY

INCIDENT	CAUSE	REMEDY
The external safety contact is activated	**Problem on a safety device wired by the user**	■ Test the external safety devices and repair the fault (contact 1 - 9) on Remote Control connector. ■ Try to restart the pump: Local mode: pressing «start». Remote mode: open and close the «start» contact.
	NO	
	Problem on Remote Control plug	■ Remove the plug: the default should disappear.
	NO	
	Impedance problem on safety contact of Remote Control plug	■ Call the Alcatel Customer Service.

Edition 06 - September 97

D11 : MAG SUSPENSION

INCIDENT	CAUSE	REMEDY
Mechanical or electrical problem	**Rotor does not run**	■ Change the pump.
	NO	
	Defective ACT/ATH link	⚠ **Wait for the complete pump stop before any interventions on the cable !** ■ Check the connector locking. ■ Change the cable.
	NO	
	Connectors problems Pump, cable, controller	■ Check that no pin is twisted or broken. ■ Change the cable.
	NO	■ If the message continues, call the Alcatel Customer Service.

Edition 06 - September 97

D11 + *other defaults*

INCIDENT	CAUSE	REMEDY
Display: D11 - D31	Incompatibility between the pump and the controller	■ *See D 250*
Display: D11 - D32	Magnetic bearings boards not powered	■ Call the Alcatel Customer Service.
Display: D11 - D15 - D18	Positioning out of tolerance	■ Call the Alcatel Customer Service.
Display: D11 - D14 - D15 - D16 - D17 - D18	Impossible positioning	■ Call the Alcatel Customer Service.

Edition 06 - September 97

D12 : POWER

INCIDENT	CAUSE	REMEDY
Secondary voltage too high	**Mains voltage problem**	■ Check the voltage: 85 V < U < 132 V or 170 V < U < 264 V
	NO	■ If the message continues, call the Alcatel Customer Service.

Edition 06 - September 97

D13 : POWER OVERCURRENT

INCIDENT	CAUSE	REMEDY
Overcurrent	**Mains voltage problem**	■ Check the voltage: 85 V < U < 132 V or 170 V < U < 264 V
	NO	
	Defective ACT/ATH link	⚠ **Wait for the complete pump stop before any interventions on the cable !** ■ Check the connector locking. ■ Change the cable.
	NO	■ If the message continues, call the Alcatel Customer Service.

Edition 06 - September 97

D 130

D14 - D15 - D16 - D17 - D18

INCIDENT	CAUSE	REMEDY
Rotor position out of limits	**Bad pump fixation**	■ Check the pump fixation rigidity regarding to the chamber, **inlet bellow prohibited**. ■ Try to restart the pump: Local mode: pressing on «start». Remote mode: open and close the «start» contact.
	NO	
	Vibrations on the frame	■ Check if there are no vibrations generated by the frame, for exemple, equipement installed on a floating stone. ■ Try to restart the pump: Local mode: pressing on «start». Remote mode: open and close the «start» contact.
	NO	
	Defective ACT/ATH link	⚠ **Wait for the complete pump stop before any interventions on the cable !** ■ Check the connector locking. ■ Change the cable.
	NO	■ If the message continues, call the Alcatel Customer Service.

Edition 06 - September 97

D21* : PUMP OVERHEAT-1

INCIDENT	CAUSE	REMEDY
Without heating device: ATH 1000M **Pump temperature exceeds 50°C The pump speed switches to stand-by mode = 30000 rpm**	**Problem on water cooling circuit**	■ Check the flow rate (60 l/h). ■ **
	NO	
	Number of start-ups too frequent	■ Reduce the number of ON/OFF switchings with air inlet. ■ **
	NO	
	Working pressure too high P > 1.10^{-1} mbar	■ Adapt the working pressure. ■ **
	NO	
	Exhaust pressure too high > 5 mbar	■ Adapt the exhaust pressure, ***see G 10 and G 20.*** ■ **
	NO	
	Defective ACT/ATH link	⚠ **Wait for the complete pump stop before any interventions on the cable !** ■ Check the connector locking. ■ Change the cable.
	NO	■ If the message continues, call the Alcatel Customer Service.

** Then, delete the stand-by mode:
Local mode: pressing on «STANDBY».
Remote mode: open and close the «STANDBY» contact.

⚠ * 2 different messages for D21: Pump-overheat 1 or 2

Edition 06 - September 97

D21* : PUMP OVERHEAT-1

INCIDENT	CAUSE	REMEDY
Without heating device: ATH 400M **Pump temperature exceeds 80°C**	**Problem on water cooling circuit**	■ Check the flow rate (60 l/h).
	NO	
	Number of start-ups too frequent	■ Reduce the number of ON/OFF switchings with air inlet.
	NO	
	Working pressure too high P > 1 mbar	Adapt the working pressure.
	NO	
	Exhaust pressure too high > 5 mbar	■ Adapt the exhaust pressure, ***see G 10 and G 20.***
	NO	
	Defective ACT/ATH link	⚠ **Wait for the complete pump stop before any interventions on the cable !** ■ Check the connector locking. ■ Change the cable.
	NO	■ If the message continues, call the Alcatel Customer Service.

⚠ * 2 different messages for D21: Pump-overheat 1 or 2

Edition 06 - September 97

D21* : PUMP OVERHEAT-1

INCIDENT	CAUSE	REMEDY
WITH heating device: **Pump temperature exceeds 80°C**	**Problem on water cooling circuit**	■ Check the flow rate (60 l/h).
	NO	
	Number of start-ups too frequent	■ Reduce the number of ON/OFF switchings with air inlet.
	NO	
	Working pressure too high **ATH 400M : P > 1 mbar** **ATH 1000M : P > 1.10^{-1} mbar**	■ Adapt the working pressure.
	NO	
	Exhaust pressure too high > 5 mbar	■ Adapt the exhaust pressure, ***see G 10 and G 20.***
	NO	
	The water electrovalve does not open when the thermostatic pump parameter is set to NO°C	■ Check that the «THERMOS» contact (5-6) on the Dry Contacts connector (***voir B 90***) is really open. ■ Call the Alcatel Customer Service.
	NO	

⚠ * 2 different messages for D21: Pump-overheat 1 or 2

Edition 06 - September 97

D21* : PUMP OVERHEAT-1

INCIDENT	CAUSE	REMEDY
WITH heating device: **Pump temperature exceeds 80°C**	**Defective heating device link**	⚠ **Wait for the complete pump stop before any interventions on the cable !** ■ Check the connector locking. ■ Change the cable.
	NO	
	Defective ACT/ATH link	⚠ **Wait for the complete pump stop before any interventions on the cable !** ■ Check the connector locking. ■ Change the cable.
	NO	■ If the message continues, call the Alcatel Customer Service.

⚠ * 2 different messages for D21: Pump-overheat 1 or 2

Edition 06 - September 97

D21* : PUMP OVERHEAT-2

INCIDENT	CAUSE	REMEDY
Heating device temperature exceeds 80°C	**Problem on water cooling circuit**	■ Disconnect the mains plug of heating device cable and check that the water electrovalve opens. ■ Check the flow rate (60 l/h).
	NO	
	The water electrovalve does not open when the thermostatic pump parameter is set to NO°C	■ Check that the «THERMOS» contact (5-6) on the Dry Contacts connector (***voir B 90***) is really open. ■ Call the Alcatel Customer Service.
	NO	
	Defective heating device link	⚠ **Wait for the complete pump stop before any interventions on the cable !** ■ Check the connector locking. ■ Change the cable.
	NO	■ If the message continues, call the Alcatel Customer Service.

Edition 06 - September 97

⚠ * 2 different messages for D21: Pump-overheat 1 or 2

D22 : CONTROLLER OVERHEAT

INCIDENT	CAUSE	REMEDY
Controller temperature exceeds 60°C	**Mains voltage problem**	■ Check the voltage: 85 V < U < 132 V or 170 V < U < 264 V
	NO	
	Bad controller cooling	■ Check that the air admissions are not blocked. ■ Respect a free space of 15mm above and under the controller.
	NO	
	The fan does not run	■ Check the fan power supply. ■ Call the Alcatel Customer Service.
	NO	
	Ambient température too high > 50°C	■ Ventilate the controller environment.
	NO	■ If the message continues, call the Alcatel Customer Service.

Edition 06 - September 97

D23 : HOT PUMP

INCIDENT	CAUSE	REMEDY
Pump temperature ≥ 90°C	**The pump is not thermostatically controlled**	■ *See D 140*
	NO	
	The pump is thermostatically controlled	■ *See D 140 and D 150*

Edition 06 - September 97

D24 : BEARING MUST BE CHANGED

INCIDENT	CAUSE	REMEDY
The authorized number of landings has been reached	**Emergency bearings are damaged**	■ Call the Alcatel Customer Service.

Edition 06 - September 97

D25 : TEMP SENSOR-1

INCIDENT	CAUSE	REMEDY
The controller stops the pump, PUMP-TEMP1=0, the pump can't restart.	**Sensor reading default**	⚠ **Wait the pump isn't running.** ■ Switch OFF the controller and restart.
	NO	
	Defective ACT/ATH link	⚠ **Wait for the complete pump stop before any interventions on the cable !** ■ Check the connector locking. ■ Change the cable.
	NO	■ If the message continues, call the Alcatel Customer Service.

Edition 06 - September 97

D26 : NO CONNECT

INCIDENT	CAUSE	REMEDY
The pump does not start	**Defective ACT/ATH link**	⚠ **Wait for the complete pump stop before any interventions on the cable !** ■ Check the connector locking. ■ Change the cable.
	NO	■ If the message continues, call the Alcatel Customer Service.

Edition 06 - September 97

D27 : DATE AND TIME

INCIDENT	CAUSE	REMEDY
The pump is running but the display is not correct	**Incorrect parameters settings**	■ Reset the date on the «PARAMETER» controller menu.
The pump does not start	**Controller in storage mode**	⚠ **Wait the pump isn't running.** ■ Switch OFF the controller power supply and restart.
	NO	■ If the message continues, call the Alcatel Customer Service.

Edition 06 - September 97

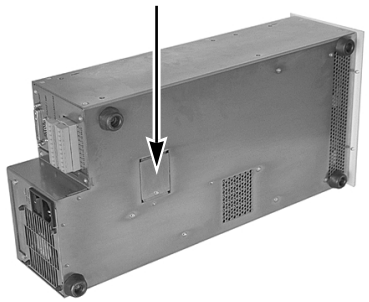
D28 : DISABLE WRITE

INCIDENT	CAUSE	REMEDY
Datas are not recorded by the controller	**Memory problem**	■ Reinitialize the controller: pump stopped, switch OFF the controller power supply and restart. ■ Call the Alcatel Customer Service.
	NO	■ If the message continues, call the Alcatel Customer Service.

Edition 06 - September 97

D29 : INPUT POWER

INCIDENT	CAUSE	REMEDY
Mains power supply failure **Imminent landing of the spindle**	**Controller not powered**	■ Check that the controller is powered. ■ Check the power supply voltage: 85 V < U < 132 V or 170 V < U < 264 V
	NO	
	Defective fuses	■ Check the fuses: 2 fuses 16A located under the controller (Acces panel).



⚠ Isolate the product from its various energy sources before any maintenance operations.

NO — ■ If the message continues, call the Alcatel Customer Service.

Edition 06 - September 97

D31 : CODING

INCIDENT	CAUSE	REMEDY
No handshake between pump and controller	**Incompatibility between pump and controller**	■ Check the couple ATH 400M and ACT 600M or, ATH 1000M and ACT 1000M. ■ Replace the non-conform model.
	NO	
	Defective ACT/ATH link	⚠ **Wait for the complete pump stop before any interventions on the cable !** ■ Check the connector locking. ■ Change the cable.
	NO	■ If the message continues, call the Alcatel Customer Service.

Edition 06 - September 97

D38 (37) : TEMP SENSOR-2

INCIDENT	CAUSE	REMEDY
PUMP-TEMP2=0, Wrong information from T2 sensor	Defective thermostatic control link	⚠ **Wait for the complete pump stop before any interventions on the cable !** ■ Check the connector locking. ■ Change the cable.
	NO	■ If the message continues, call the Alcatel Customer Service.

Edition 06 - September 97

D 280

Default not indicated by the controller

Edition 06 - September 97

D 280

Default not indicated by the controller

INCIDENT	CAUSE	REMEDY
The pump starts only in Standby mode	**Electronic problem**	⚠ **Wait the pump isn't running.**
		■ Pump stopped, switch OFF the controller and restart.
	NO	
	Remote connector wiring	■ Check that the contact 4 -12 of the Remote plug is open.
	NO	■ If the message continues, call the Alcatel Customer Service.
Power does not exceed 100W - Pump speed increases slowly	**Defective ACT/ATH link**	⚠ **Wait for the complete pump stop before any interventions on the cable !**
		■ Check the connector locking. ■ Change the cable.
	NO	■ If the message continues, call the Alcatel Customer Service.

Edition 06 - September 97

D 280

Default not indicated by the controller

INCIDENT	CAUSE	REMEDY
Over 9000 tr/mn, pump vibrations	**Incorrect pump fixation**	■ Check the pump fixation rigidity regarding to the chamber, **inlet bellow prohibited**.
	NO	
	Vibrations on the frame	■ Check if there are no vibrations generated by the frame, for exemple, equipement installed on a floating stone. ■ Try to restart the pump: Local mode: pressing on «start». Remote mode: open and close the «start» contact.
	NO	
	Defective ACT/ATH link	⚠ **Wait for the complete pump stop before any interventions on the cable !** ■ Check the connector locking. ■ Change the cable.
	NO	
	Connectors problems Pump, cable, controller	■ Check that no pin is twisted or broken.
	NO	■ If the message continues, call the Alcatel Customer Service.

Edition 06 - September 97

D 280

Default not indicated by the controller

INCIDENT	CAUSE	REMEDY
The pump doesn't reach the expected speed	**Leak on the installation**	■ Close the chamber isolation valve. ■ Start the pump. If it reaches its expected speed, then the leak is inside the chamber.
	NO	
	Exhaust isolation valve stays closed	■ If the valve is controlled by the «START» contact, check that the valve opens when the «START» command is selected. ■ If the valve doesn't open, check the coil and the connection. ■ Using an ohmeter (valve disconnected), check the closing of «START» contact (5-6) on the controller. ■ Change the valve.
	NO	
	Defective rough pumping	■ Disconnect primary pump inlet. Install a gauge at the primary pump inlet and check its vacuum limit ($P \leq 1.10^{-1}$ mbar).
	NO	
	Emergency braking valve	■ ACT powered and valve disconnected from the controller, check the «AIR INLET» output voltage (12VDC). ■ Change the coil.
	NO	
	Leak on emergency braking valve	■ Replace the valve by a blank-off flange. **Take care that the pump is not protected now !** ■ Start the pump. ■ If the pump reaches its speed, stop it quickly and replace the valve (it can take a long time before the pump isn't running).
	NO	

Edition 06 - September 97

D 280

Default not indicated by the controller

INCIDENT	CAUSE	REMEDY
The pump doesn't reach the expected speed (continued)	**Defective ACT/ATH link**	⚠ **Wait for the complete pump stop before any interventions on the cable !** ■ Check the connector locking. ■ Change the cable.
	NO	■ If the message continues, call the Alcatel Customer Service.
The thermostatic temperature is not reached	**Leak on the water valve**	■ Close the water line. If the temperature increases, there is a leak on the water line. ■ Change the valve.
	NO	
	Heating band not correctly powered	■ Using an ohmeter, check the closing of «THERMOSTAT» contact on the controller (5-6 : Dry Contact). ■ Check the mains presence on power supply cable. ■ On thermostatic control connector, check the power supply of the heating band: - between pins C - G: 115 V, Band resistance 100 Ω - between pins B - H: 230 V, Band resistance 400 Ω. ■ Change the thermostatic control cable.
	NO	■ If the message continues, call the Alcatel Customer Service.

Edition 06 - September 97

D 280

Default not indicated by the controller

INCIDENT	CAUSE	REMEDY
Control keys disactivated	**«REMOTE» contact closed**	■ Using an ohmeter, check that the «REMOTE» contact (3-11) of Remote Control connector is open ***(See B 100)***. ■ Check that the control keys on front panel are activated by unplugging the «REMOTE CONTROL» connector.
	NO	■ If the message continues, call the Alcatel Customer Service.
Continuous controller initialization	**Problem of magnetic levitation**	■ Remove the blocking plug. ■ Check manually the free rotation of the rotor and the axial clearance.
	NO	
	Defective ACT/ATH link	⚠ **Wait for the complete pump stop before any interventions on the cable !** ■ Check the connector locking. ■ Change the cable.
	NO	■ If the message continues, call the Alcatel Customer Service.
Partial and repetitive initialization (Presence of display back-lighting, magnetic levitation for just a while, complete stop and back-lighting again)	**Internal controller connection problem**	■ Call the Alcatel Customer Service.
	NO	■ If the message continues, call the Alcatel Customer Service.

Edition 06 - September 97

First level maintenance parts

Copper seals for pumps with CF-F flanges

Flange type	Sets of 10 parts	10 sets of 1 part (Unit packaged)
100 CF-F	**303284**	**303291**
160 CF-F	**303285**	**303292**
200 CF-F	**303286**	**303293**

Fuses for controllers

Description	Qty	ACT 600M	ACT 1000M
Fuse 6 x 32 T 250V	2	**16A**	

Emergency braking valve accessories

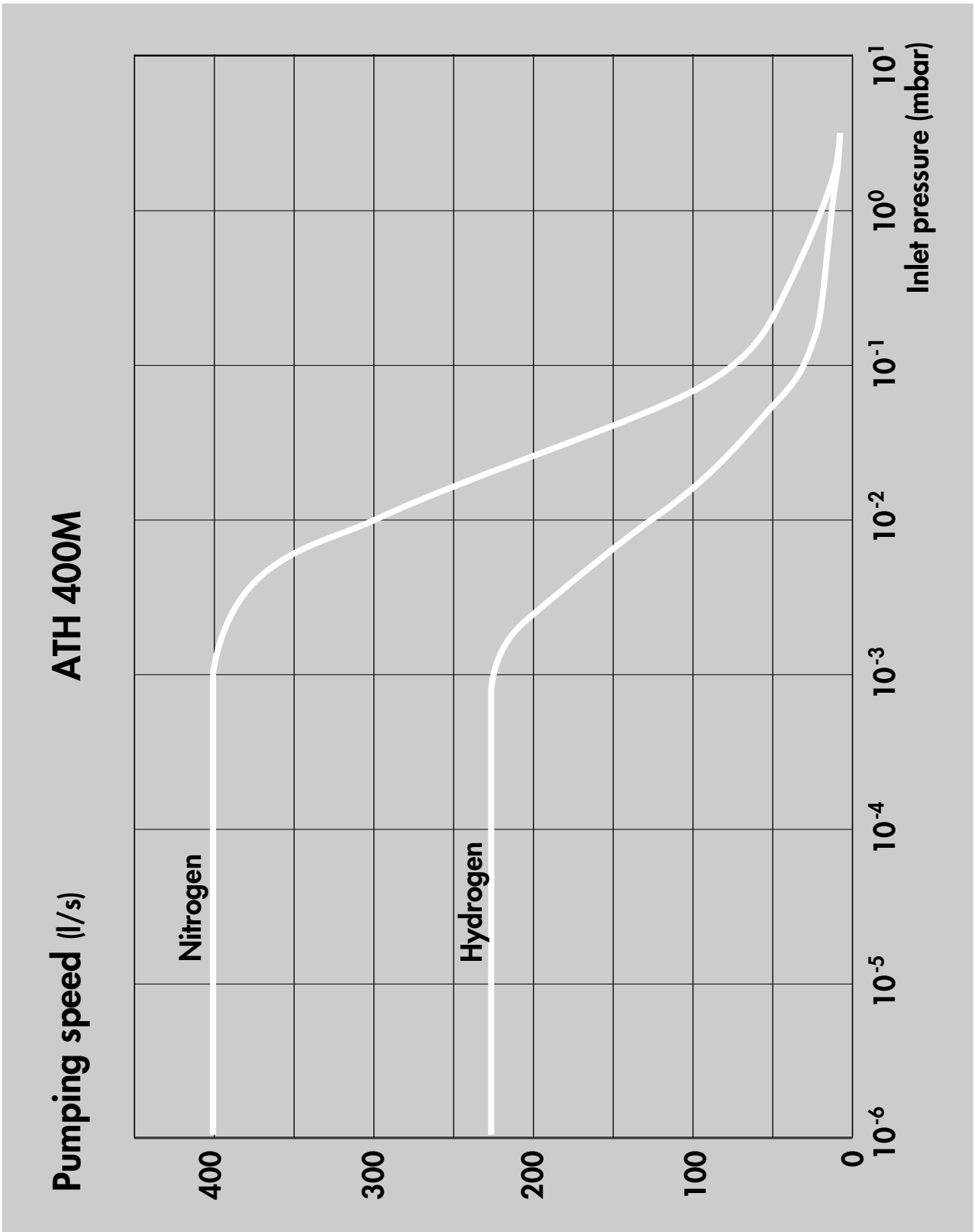
Description		Part Num.
Electrovalve coil	12V DC	**038127**
Equipped electrovalve DN 16		**066935**

Water electrovalve

Description		Part Num.
Coil	110V 50/60 Hz	**103839**
Coil	220V 50/60 Hz	**103840**
Electrovalve	110V	**103696**
Electrovalve	220V	**103697**

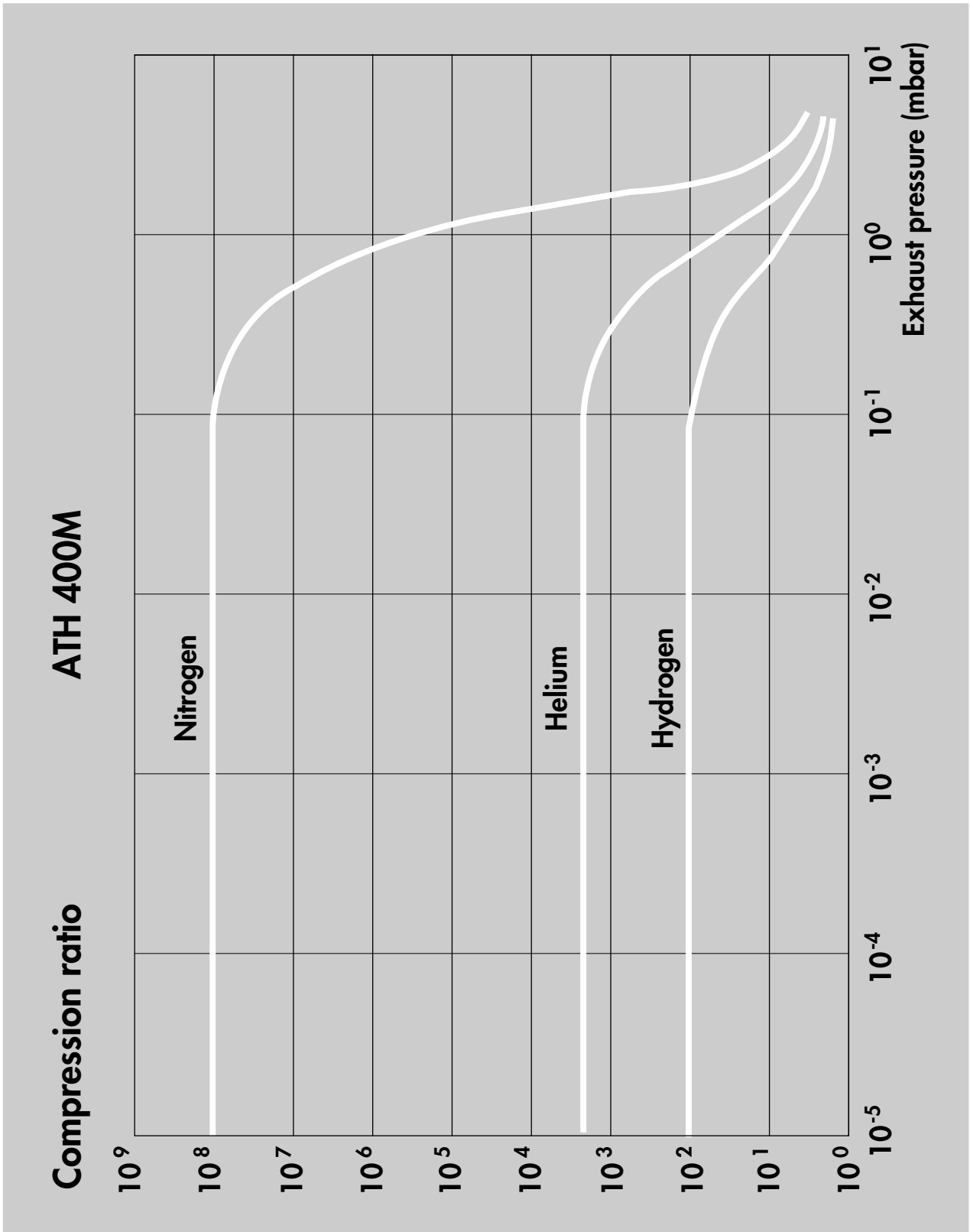
Edition 06 - September 97

Pumping curves ATH 400M



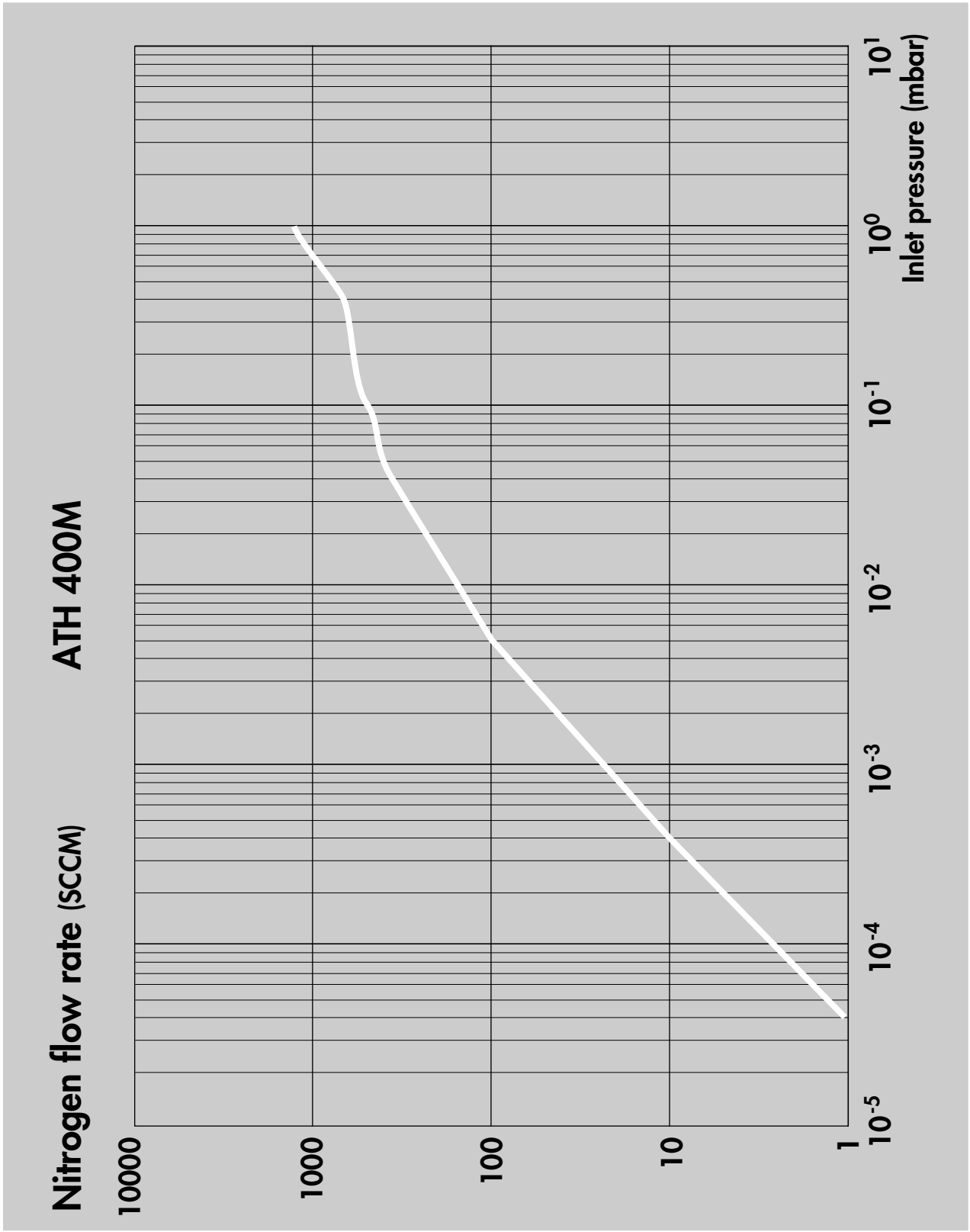
Edition 05 - October 96

Pumping curves ATH 400M



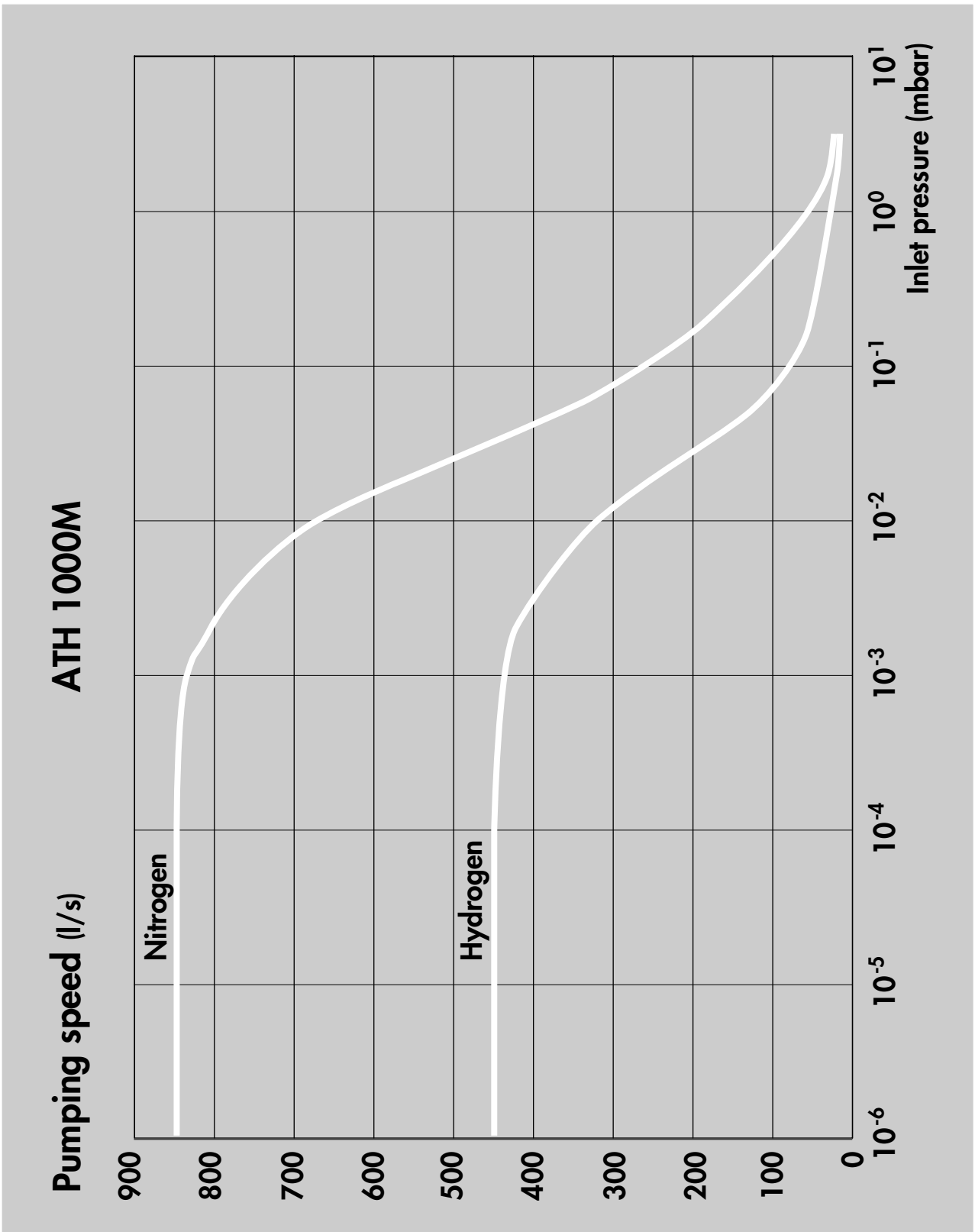
Edition 05 - October 96

Pumping curves ATH 400M



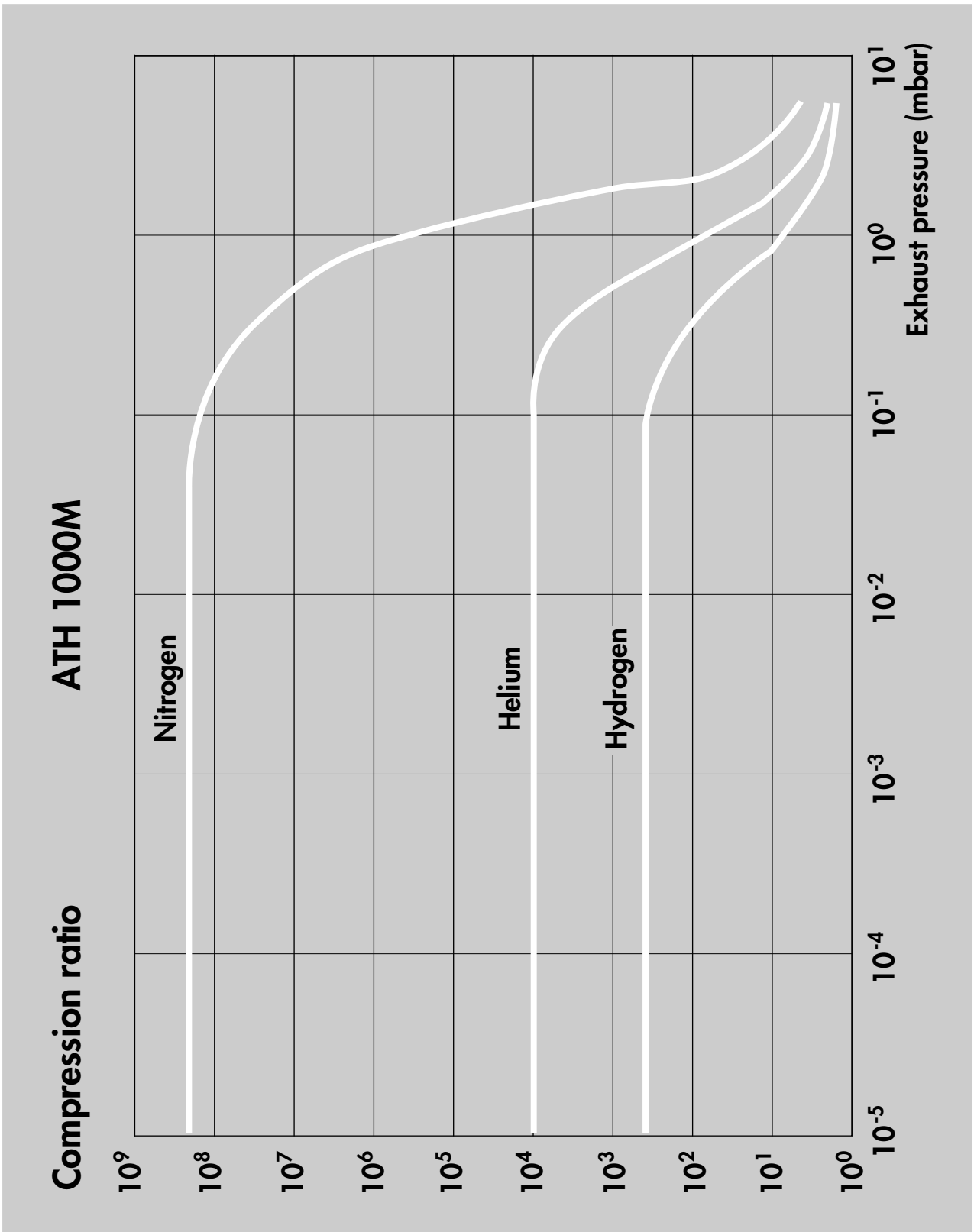
Edition 05 - October 96

Pumping curves ATH 1000M



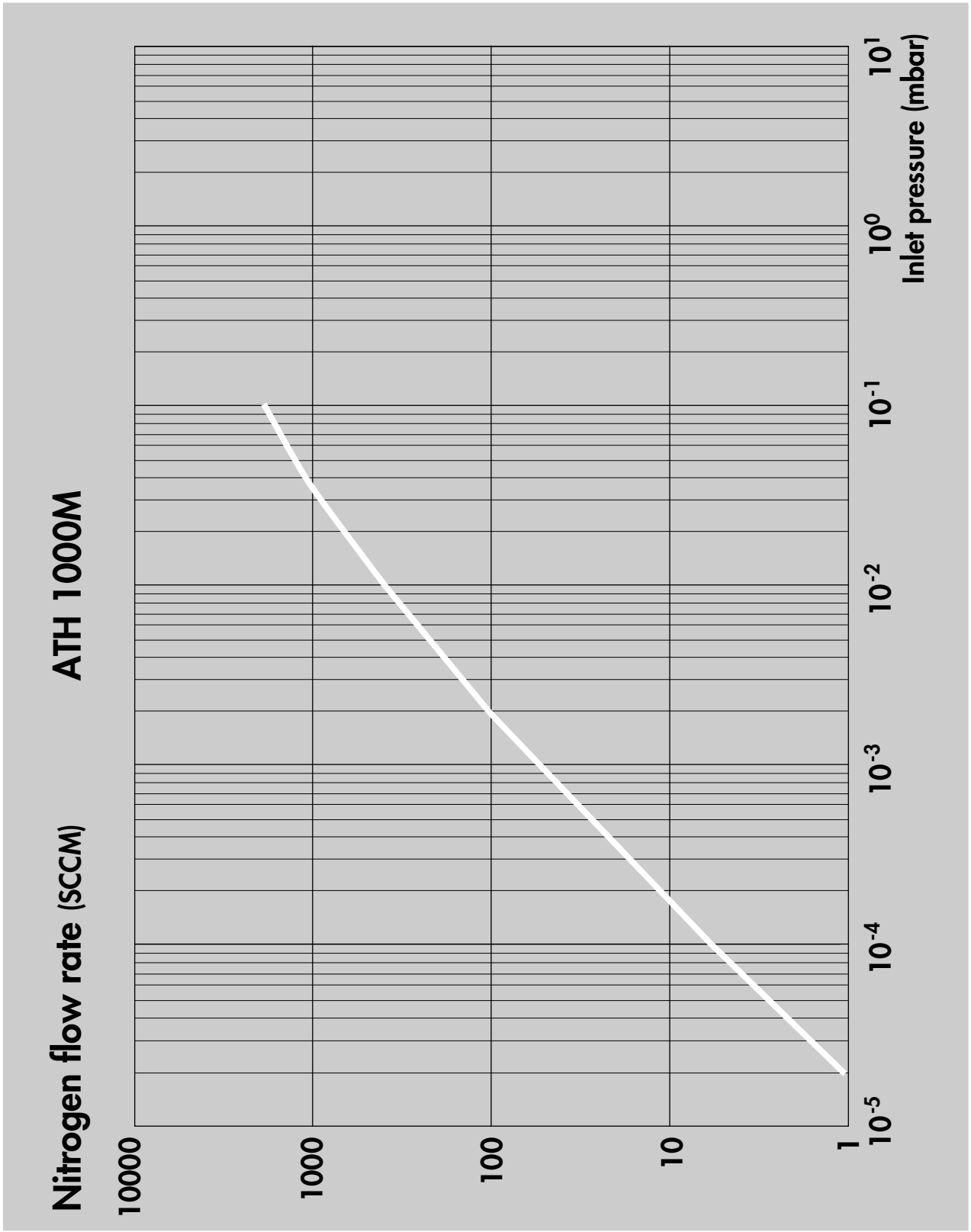
Edition 05 - October 96

Pumping curves ATH 1000M



Edition 05 - October 96

Pumping curves ATH 1000M



Edition 05 - October 96