NOTICE: This document contains references to Varian. Please note that Varian, Inc. is now part of Agilent Technologies. For more information, go to **www.agilent.com/chem.**

Agilent Technologies

TPS-compact

Models:

969-8217 **969-8218**
969-8219 **969-8220**
969-8221 **969-8222**
969-8223 **969-8224**
969-8225 **969-8226**
969-8227 **969-8228**
969-8229 **969-8230**
969-8231 **969-8232**

(I) *MANUALE DI ISTRUZIONI*

(D) *BEDIENUNGSHANDBUCH*

(F) *NOTICE DE MODE D'EMPLOI*

(E) *MANUAL DE INSTRUCCIONES*

(P) *MANUAL DE INSTRUÇÕES*

(NL) *BEDRIJFSHANDLEIDING*

(DK) *INSTRUKSTIONSBOG*

(S) *BRUKSANVISNING*

(N) *INSTRUKSJON MANUAL*

(FIN) *OHJEKÄSIKIRJA*

(GR) *ΟΔΗΓΙΕΣ ΧΡΗΣΕΩΣ*

(H) *FELHASZNÁLÓI KÉZIKÖNYV*

(PL) *PODRECZNIK INSTRUKCJI*

(CZ) *NÁVOD K POUŽITÍ*

(SK) *NÁVOD NA OBSLUHU*

(SLO) *PRIROČNIK ZA NAVODILA*

(GB) *INSTRUCTION MANUAL*

87-901-010-01
APRIL 2008

TPS-compact

VARIAN

vacuum technologies

Dear Customer,

Thank you for purchasing a VARIAN vacuum product. At VARIAN Vacuum Technologies we make every effort to ensure that you will be satisfied with the product and/or service you have purchased.

As part of our Continuous Improvement effort, we ask that you report to us any problem you may have had with the purchase or operation of our product. On the back side you find a Corrective Action Request form that you may fill out in the first part and return to us.

This form is intended to supplement normal lines of communications and to resolve problems that existing systems are not addressing in an adequate or timely manner.

Upon receipt of your Corrective Action Request we will determine the Root Cause of the problem and take the necessary actions to eliminate it. You will be contacted by one of our employees who will review the problem with you and update you, with the second part of the same form, on our actions.

Your business is very important to us. Please, take the time and let us know how we can improve.

Sincerely.

Sergio PIRAS

Vice President and General Manager
VARIAN Vacuum Technologies

Note: Fax or mail the Customer Request for Action (see backside page) to VARIAN Vacuum Technologies (Torino) - Quality Assurance or to your nearest VARIAN representative for onward transmission to the same address.

CUSTOMER REQUEST FOR CORRECTIVE / PREVENTIVE / IMPROVEMENT ACTION

TO : VARIAN VACUUM TECHNOLOGIES TORINO - QUALITY ASSURANCE

FAX N° : XXXX - 011 - 9979350

ADDRESS: VARIAN S.p.A. - Via F.lli Varian, 54 - 10040 Leinì (Torino) - Italy

E-MAIL : marco.marzio@varianinc.com

NAME	COMPANY	FUNCTION

ADDRESS :

TEL. N° : FAX N° :

E-MAIL :

PROBLEM / SUGGESTION :

REFERENCE INFORMATION (model n°, serial n°, ordering information, time to failure after installation, etc.) :

DATE

CORRECTIVE ACTION PLAN / ACTUATION (by VARIAN VTT) LOG N°

XXXX = Code for dialing Italy from your country (es. 01139 from USA; 00139 from Japan, etc.)

VARIAN

Safety Guideline

for

Turbomolecular Pumps

Turbomolecular pumps as described in the following operating manual contain a large amount of kinetic energy due to the high rotational speed in combination with the specific mass of their rotors.

In case of a malfunction of the system for example rotor/stator contact or even a rotor crash the rotational energy may be released.

⚠ **WARNING!**

To avoid damage to equipment and to prevent injuries to operating personnel the installation instructions as given in this manual should be strictly followed!

GENERAL INFORMATION

This equipment is destined for use by professionals. The user should read this instruction manual and any other additional information supplied by Varian before operating the equipment. Varian will not be held responsible for any events occurring due to non-compliance, even partial, with these instructions, improper use by untrained persons, non-authorized interference with the equipment or any action contrary to that provided for by specific national standards.
The TPS-compact is an integrated system with a turbo-molecular pump for high and ultra-high vacuum applications associated with its relevant controller and its primary pump. The system can pump any type of gas or gas compound. It is not suitable for pumping liquids or solid particles. The pumping action is obtained through a high speed turbine driven by a high-performance 3-phase electric motor. The TPS-compact is free of contaminating agents and, therefore, is suitable for applications requiring a "clean" vacuum.
The TPS-compact is equipped with auxiliary connectors to control the vent valve, to be controlled from a remote site by means of an host computer connected through a serial line.
The following paragraphs contain all the information necessary to guarantee the safety of the operator when using the equipment. Detailed information is supplied in the appendix "Technical Information".
This manual uses the following standard protocol:

⚠ WARNING!

The warning messages are for attracting the attention of the operator to a particular procedure or practice which, if not followed correctly, could lead to serious injury.

☞CAUTION

The caution messages are displayed before procedures which, if not followed, could cause damage to the equipment.

NOTE

The notes contain important information taken from the text.

STORAGE

In order to guarantee the maximum level of performance and reliability of Varian pumping systems, the following guidelines must be followed:

- when shipping, moving and storing pumps, the following environmental specifications should not be exceeded:
  - temperature range: -20 °C to +70 °C
  - relative humidity range: 0 to 95% (non condensing)
- the turbomolecular pumps must be always soft-started when received and operated for the first time by the customer
- the shelf life of a turbomolecular pump is 10 months from the shipping date.

☞CAUTION

If for any reason the shelf life time is exceeded, the pumping system has to be returned to the factory. Please contact the local Varian Vacuum Sales and Service representative for informations.

PREPARATION FOR INSTALLATION

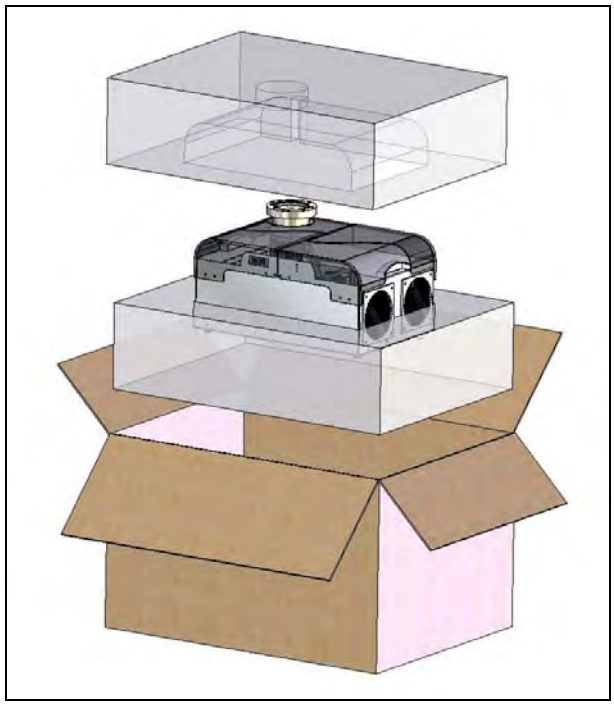
The TPS-compact is supplied in a special protective packing. If this shows signs of damage which may have occurred during transport, contact your local sales office.
When unpacking the system, be sure not to drop it and avoid any kind of sudden impact or shock vibration to it.
Do not dispose of the packing materials in an unauthorized manner. The material is 100% recyclable and complies with EEC Directive 85/399.

☞CAUTION

In order to prevent outgassing problems, do not use bare hands to handle components which will be exposed to vacuum. Always use gloves or other appropriate protection.

NOTE

Normal exposure to the environment cannot damage the TPS-compact. Nevertheless, it is advisable to keep it closed until it is installed in the system, thus preventing any form of pollution by dust.



INSTALLATION

☞CAUTION

Do not remove the adhesive and protective cap before connecting the turbopump to the system.

Do not install or use the pumping system in an environment exposed to atmospheric agents (rain, snow, ice), dust, aggressive gases, or in explosive environments or those with a high fire risk. During operation, the following environmental conditions must be respected:

- maximum pressure: 2 bar above atmospheric pressure
- temperature: from +5 °C to +35 °C
- relative humidity: 0 - 95% (non-condensing)

In the presence of magnetic fields the pumping system must be protected using a ferromagnetic shield.
The TPS-compact can be installed in any position. Fix the TPS-compact in a stable position connecting the inlet flange of the turbopump to a fixed counter-flange capable of withstanding a torque of 50 Nm around its axis.
The turbopump with ISO inlet flange must be fixed to the vacuum chamber by means of clamps or claws. The following table shows, for each fixing device, the necessary number of clamps or claws and the relevant fixing torque.

FLANGE	FIXING DEVICE	N.	FIXING TORQUE
ISO 63	M10 clamps	4	22 Nm
ISO 100 K	M10 clamps	4	22 Nm
ISO 160 K	M10 clamps	4	22 Nm

The turbopump with ConFlat inlet flange must be fixed to the vacuum chamber by means of the appropriate Varian hardware. See the appendix "Technical Information" for a detailed description.

NOTE

The TPS-compact cannot be fixed by means of its base.

For installation of optional accessories, see "Technical Information".

USE

This paragraph details the fundamental operating procedures.
Make all electrical an pneumatic connections before the use of the system.
While heating the vacuum chamber, the temperature of the inlet flange must not exceed 120 °C.

⚠ WARNING!

Never use the pumping system when the turboinlet flange is not connected to the vacuum chamber or is not blanked.

⚠ WARNING!

Do not touch the turbopump or any of its accessories during the heating process. The high temperatures may cause burns.

⚠ WARNING!

Avoid impacts or harsh movements of the pump when in operation. The bearings may become damaged and damages to the persons or the things could be taken place.

☞CAUTION

Use inert gas free from dust, particles or humidity (like Nitrogen) for venting the pump. The pressure at the vent port must be less than 2 bar (above atmospheric pressure).

⚠ WARNING!

When employing the pump for pumping toxic, flammable, or radioactive gases, please follow the required procedures for each gas disposal.
Do not use the pumping system in presence of explosive gases.

Switching on and Use of TPS-compact

To switch on the TPS-compact it is sufficient to supply the mains and then move the external switch to ON position. The integrated controller automatically recognizes the mains presence and start up the pump.
At the first start up it is recommended to use the "Soft Start" mode by enabling it on the controller. For the following start ups it is recommended to disable the "Soft Start" mode. For the "Soft Start" mode activation procedure, see the paragraph "Signal Description" in the chapter "Technical Information".
The blue LED “STATUS” located on the TPS-compact base rear panel indicates with its flashing frequency the system operating conditions:

- with no flashing: the pump is normally rotating;
- slowly flashing (period of about 400 ms): the system is in ramp, or in braking, or in Stop, or in “Waiting for interlock” status;
- fast flashing (period of about 200 ms): error condition.

See the appendix "Technical Information" for a detailed description of the TPS-compact control panel.

TPS-compact Switching off

To switch off the TPS-compact it is sufficient to move the external switch to OFF position. The integrated controller immediately stops the pumping system.

Emergency Stop

To immediately stop the TPS-compact in an emergency condition it is necessary to remove the supply cable from the mains plug or moving the external switch to OFF position.

MAINTENANCE

The TPS-compact does not require any maintenance (except Tip-seal replacement). Any work performed on the system must be carried out by authorized personnel.

⚠ WARNING!

Before carrying out any work on the system, disconnect it from the mains, vent the pump by opening the appropriate valve, wait until the rotor has stopped turning and wait until the surface temperature of the pump falls below 50 °C.

In the case of breakdown, contact your local Varian service center.

NOTE

Before returning the system to the constructor for repairs, the "Health and Safety" sheet attached to this instruction manual must be filled-in and sent to the local sales office. A copy of the sheet must be inserted in the system package before shipping.

If a system is to be scrapped, it must be disposed of in accordance with the specific national standards.

DISPOSAL

Meaning of the "WEEE" logo found in labels
The following symbol is applied in accordance with the EC WEEE (Waste Electrical and Electronic Equipment) Directive.
This symbol (**valid only in countries of the European Community**) indicates that the product it applies to must NOT be disposed of together with ordinary domestic or industrial waste but must be sent to a differentiated waste collection system.
The end user is therefore invited to contact the supplier of the device, whether the Parent Company or a retailer, to initiate the collection and disposal process after checking the contractual terms and conditions of sale.

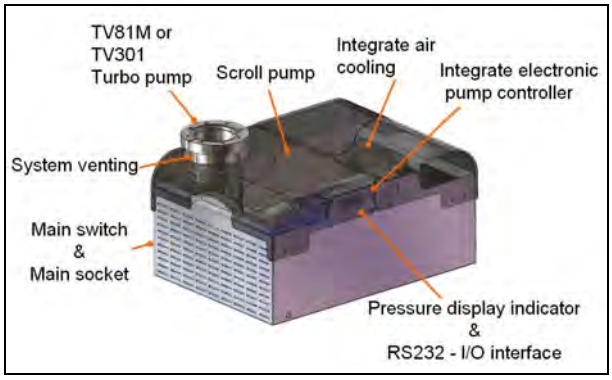
DESCRIPTION OF THE TPS-COMPACT

The TPS-compact pumping system consists of a pump with an integrated controller and a forepump and is available in sixteen models which differ in the TPM size, high vacuum flange and voltage.

The models are:

P/N	TMP	Flange	Foreline	Voltage
969-8217	TV81M	KF40	3.6 m^3/h Scroll	110V 60Hz
969-8218	TV81M	CFF 2.75	3.6 m^3/h Scroll	110V 60Hz
969-8219	TV81M	ISO63	3.6 m^3/h Scroll	110V 60Hz
969-8220	TV81M	CFF 4.5	3.6 m^3/h Scroll	110V 60Hz
969-8221	TV301	ISO100	3.6 m^3/h Scroll	110V 60Hz
969-8222	TV301	CFF6	3.6 m^3/h Scroll	110V 60Hz
969-8223	TV301	ISO160	3.6 m^3/h Scroll	110V 60Hz
969-8224	TV301	CFF8	3.6 m^3/h Scroll	110V 60Hz

P/N	TMP	Flange	Foreline	Voltage
969-8225	TV81M	KF40	3.0m^3/h Scroll	220V 50-60Hz
969-8226	TV81M	CFF 2.75	3.0m^3/h Scroll	220V 50-60Hz
969-8227	TV81M	ISO63	3.0m^3/h Scroll	220V 50-60Hz
969-8228	TV81M	CFF 4.5	3.0m^3/h Scroll	220V 50-60Hz
969-8229	TV301	ISO100	3.0m^3/h Scroll	220V 50-60Hz
969-8230	TV301	CFF6	3.0m^3/h Scroll	220V 50-60Hz
969-8231	TV301	ISO160	3.0m^3/h Scroll	220V 50-60Hz
969-8232	TV301	CFF8	3.0m^3/h Scroll	220V 50-60Hz



Turbopump Description

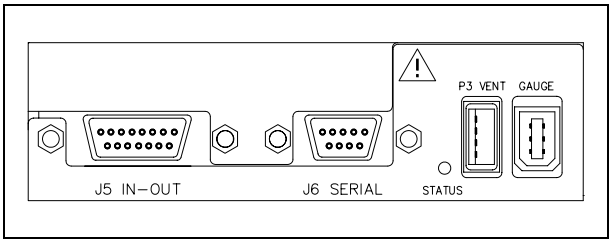
The turbopump consists of a high frequency motor driving a turbine fitted with many bladed stages and Macrotorr stages. The turbine rotates in an anticlockwise direction when viewed from the high vacuum flange end.
The turbine is made of high-strength, light aluminium alloy, and is machined from a single block of aluminium. The turbine blades have five different angles, from 44° to 12°, while the Macrotorr stages are in the form of discs.
The turbine rotor is supported by permanently lubricated high precision ceramic ball bearings installed on the forevacuum side of the pump.
The static blades of the stator are fabricated in stainless steel. These are supported and accurately positioned by spacer rings.
The Macrotorr stators are in the form of self-positioning machined discs with pumping channels and an opening restricted by the corresponding rotor discs. These are fabricated in aluminium alloy.
During normal operation, the motor functions with a power feed at 54 Vac three-phase at 1330 Hz (TV81M) or 963 Hz (TV301). To reduce losses during start-up to a minimum, the frequency increases according to a ramp with a higher initial voltage/frequency ratio.
A thermistor sensor is mounted near the upper bearing to prevent the pump from overheating.
The pump is balanced after assembly with a residual vibration amplitude less than 0.01 μm.

Controller Description

The integrated controller is a solid-state frequency converter which is driven by a single chip microcomputer and is composed of a PCB which includes a power supply with a 3-phase AC output, analog and input/output section, microprocessor and digital section. The controller recognizes the mains presence and converts the single phase AC mains supply into a 3-phase, medium frequency output which is required to power the pump.
The controller can be operated by a remote host computer via the serial connection.

Control Panel Description

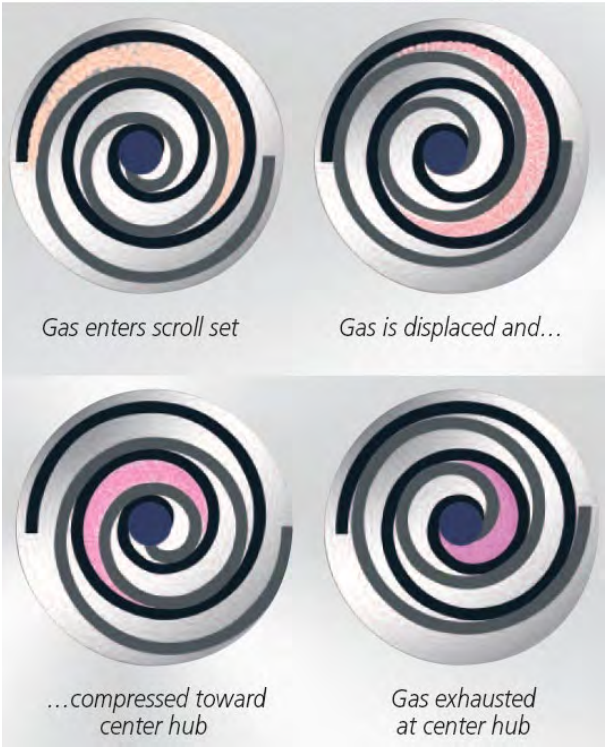
The following picture shows the TPS-compact control panel; the associated table lists the available commands. For a detailed description see the following paragraphs.



CONTROL NAME	DESCRIPTION
J5 IN-OUT	Input-output connector to remote control the TPS-compact
J6 SERIAL	Serial input-output connector to control the TPS-compact via an RS 232 or RS 485 connection
STATUS	Blue LED to show the system operating condition
P3 VENT	Connector to control the optional vent valve
GAUGE	Connector to control external EyeSys Gauge
ON-OFF switch (not shown in the picture)	It is located on the rear side of the system. It is the power supply switch.

Scroll Pump Description

The TPS-compact internal scroll creates vacuum using a simple dual scroll mechanism in which one of the nested scrolls orbits about the other, creating moving zones of captured gas.
Gas enters the scroll set at the perimeter and is displaced and compressed toward the center hub where it is exhausted.



TECHNICAL SPECIFICATION

Characteristic	TV301	TV81M
Pumping speed (l/s)	N_2: 215 l/s	N_2: 60 l/s
Base pressure*	$1x10^{-9}$ mbar (*) [CFF flanges] $7.5x10^{-10}$ Torr (*) [CFF Flanges] $1x10^{-8}$ mbar [ISO Flanges] 7.5×10^{-9} Torr [ISO Flanges]	
Inlet flange	ISO 100, ISO 160, CFF 6, CFF 8	KF 40, ISO 63, CFF 2.75, CFF 4.5
Rotational speed	56000 RPM	80000 RPM
Start-up time	15 s	
Operating position	Any	
Operating ambient temperature	+ 5° C to + 35° C	
Bakeout temperature	120° C at inlet flange max. (CF flange) 80° C at inlet flange max. (ISO flange)	
Noise level	55 dB (A) at 1 meter	
Lubricant	permanent lubrication	
Power supply (Line type): Input voltage: Input frequency: Max input power:	 115 or 200–240 Vac 50 or 50 – 60 Hz 310 VA	 115 or 200–240 Vac 50 or 50 – 60 Hz 260 VA
Protection fuse	115 Vac: 4 A 220 Vac: 2.5 A	115 Vac: 5 A 220 Vac: 3 A
Compliance with:	UNI EN 292-1 UNI EN 292-2 EN 55011 (Class A Group 1) EN 61000/3/2 EN 61000/3/3 EN 61000/4/2 EN 61000/4/3 EN 61000/4/4 EN 61010-1 EN 1012-2	
Installation category	II	
Pollution degree	2	
Power cable	115 Vac: USA plug 5 meters long 220 Vac: EU or UK plug 5 meters long	
Serial communication (kit)	RS232 cable with a 9-pin D type male connector and a 9-pin D type female connector, and software (optional)	
Storage temperature	- 20° C to + 70° C	
Weight kg (lbs)	19.1 (42.1)	16.7 (36.8)

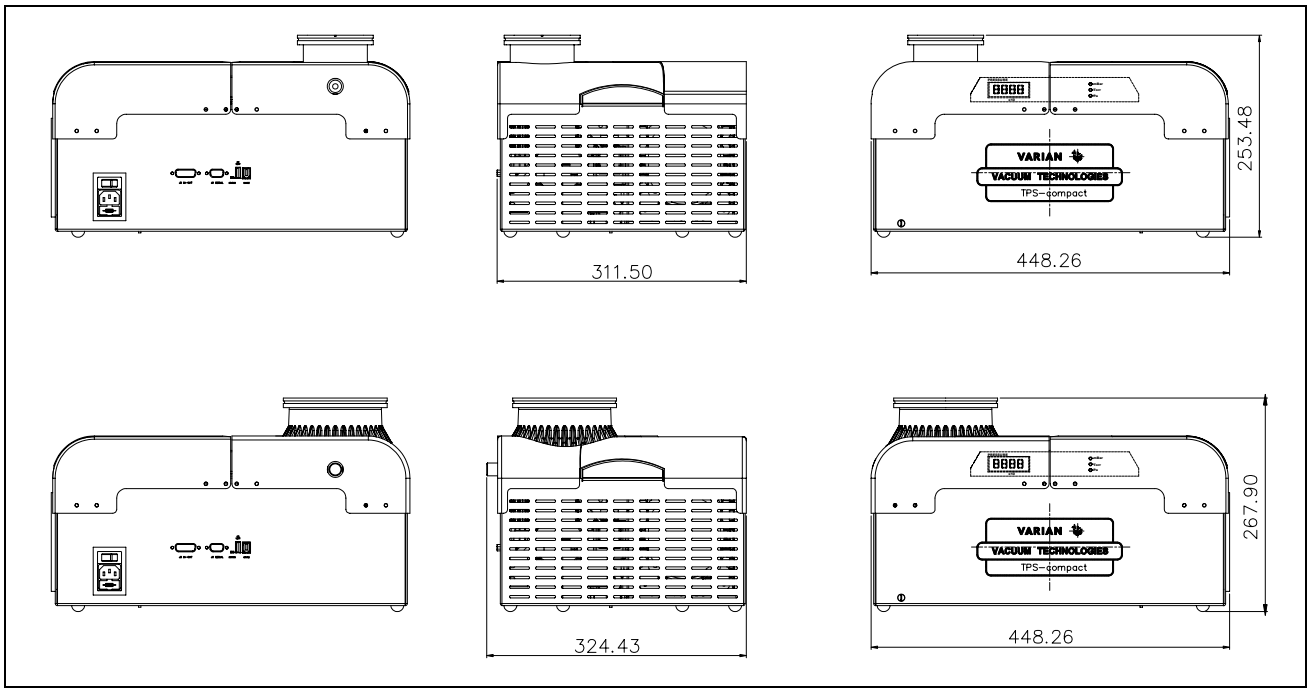
** According to standard DIN 28 428, the base pressure is that measured in a leak-free test dome, 48 hours after the completion of test dome bake-out, with a Turbopump fitted with a ConFlat flange.*

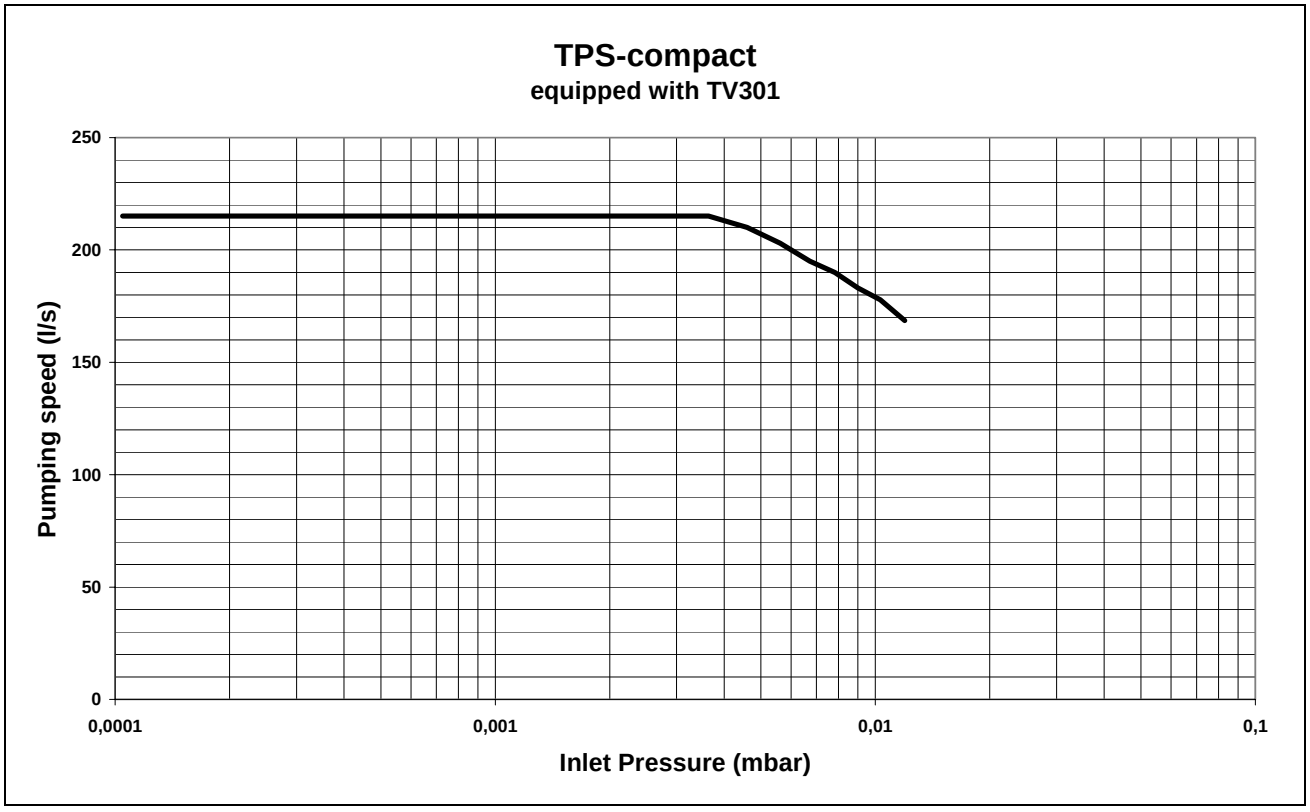
NOTE

When the TPS-compact has been stored at a temperature less than 5°C, wait until the TPS-compact has reached the above mentioned temperature.

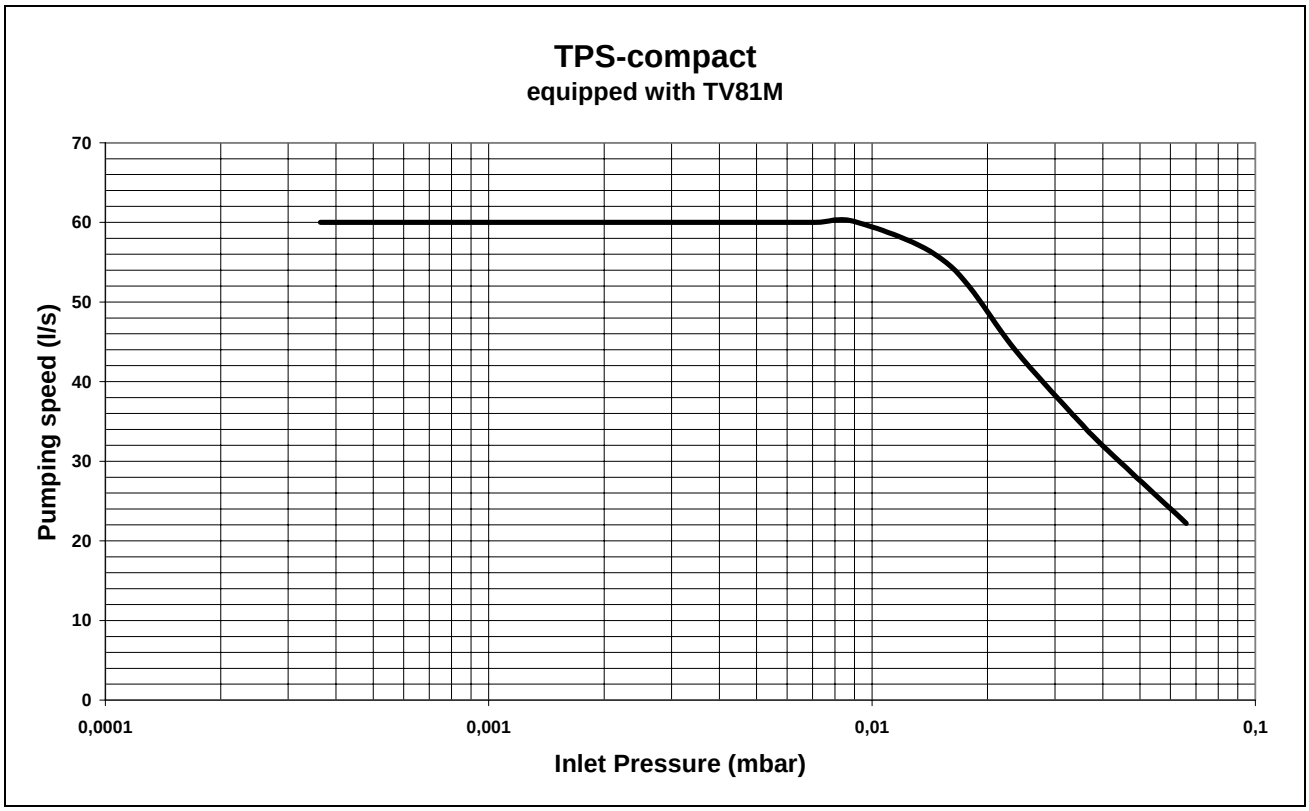
TPS-COMPACT OUTLINE

The following figure shows the TPS-compact outline. Dimensions are in mm.

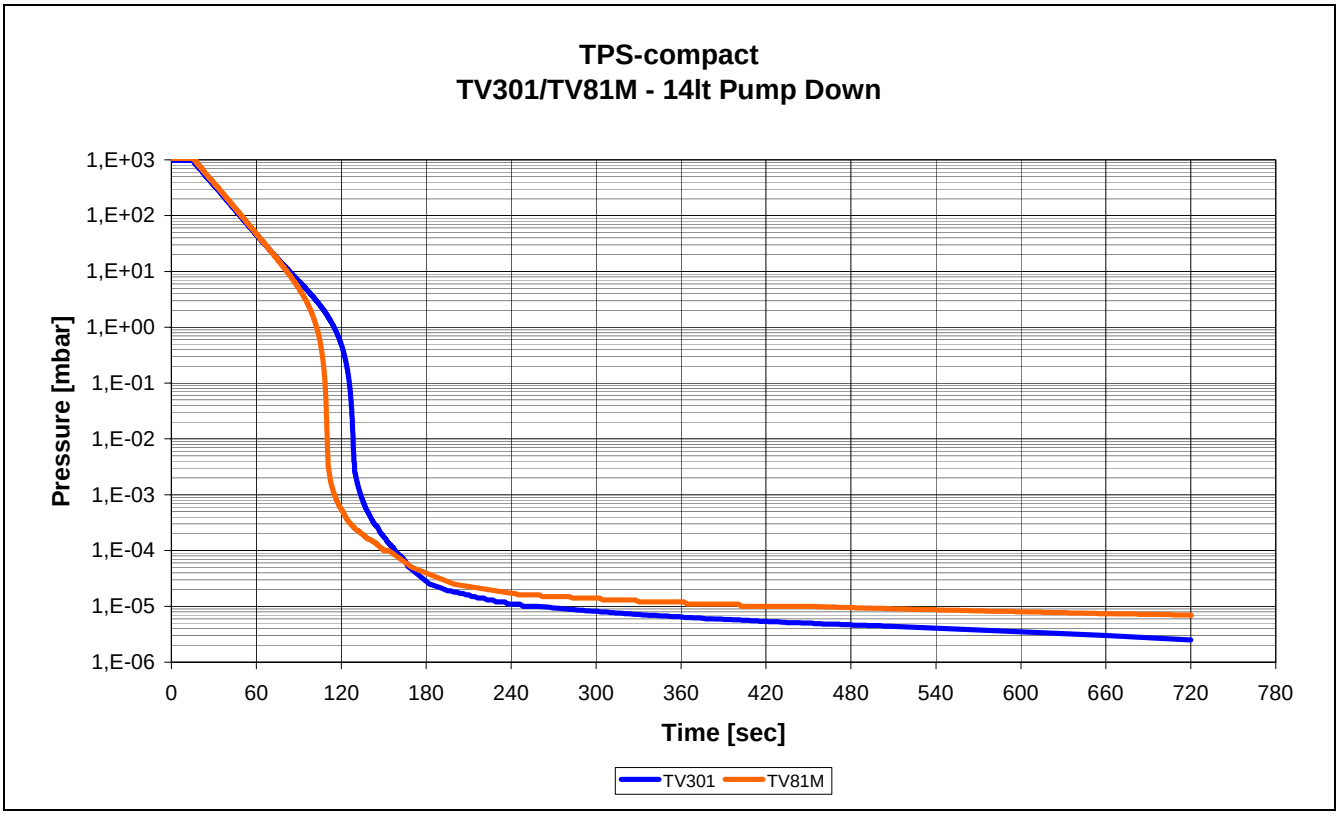




Graph of pumping speed vs inlet pressure

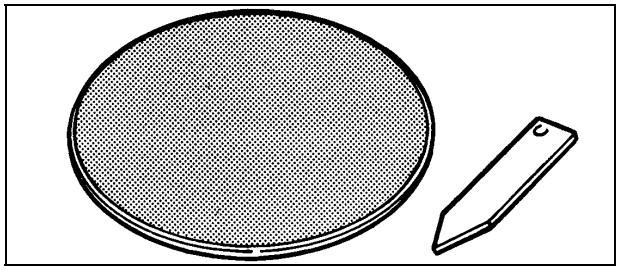


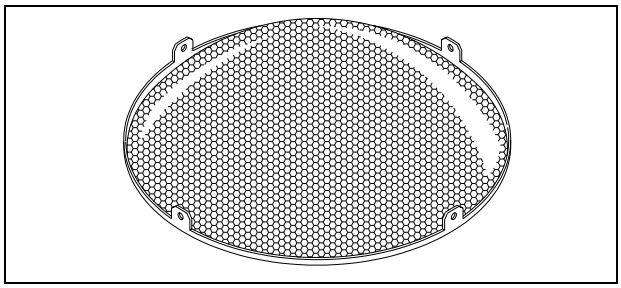
Graph of pumping speed vs inlet pressure



Graph of pressure vs time (with a pump down volume of 1 litre)

INLET SCREEN INSTALLATION

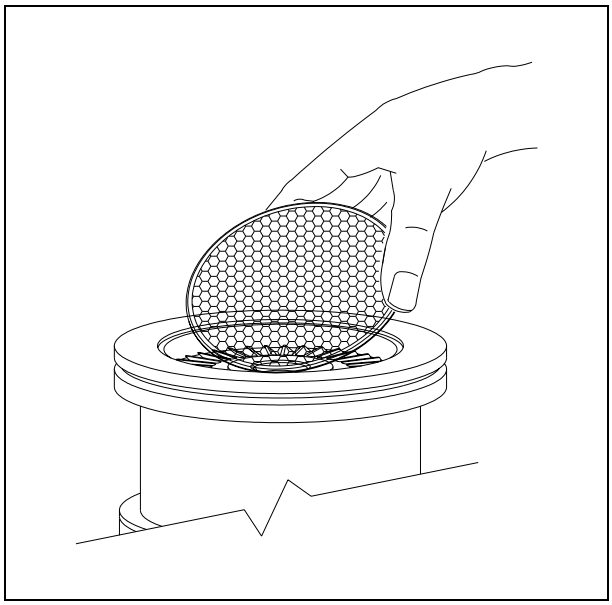




The inlet screens mod. 969-9300, 969-9309, 969-9302 and 969-9303 prevent the blades of the pump from being damaged by debris greater than 0.7 mm diameter.

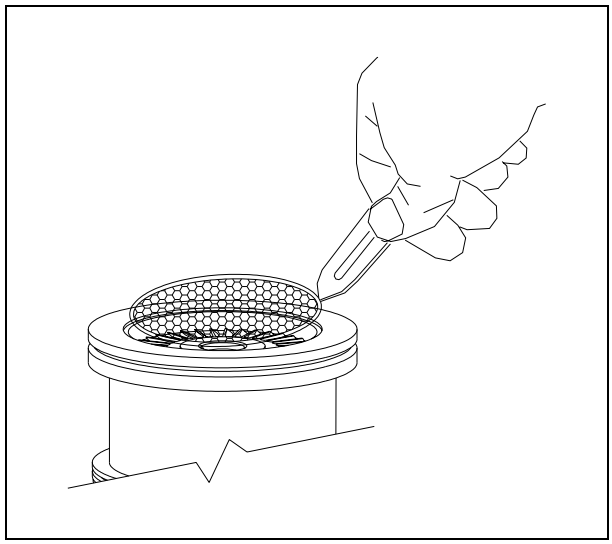
The inlet screen, however, does reduce the pumping speed by about 10%.

The inlet screen is fitted in the upper part of the pump, as shown in the figure.

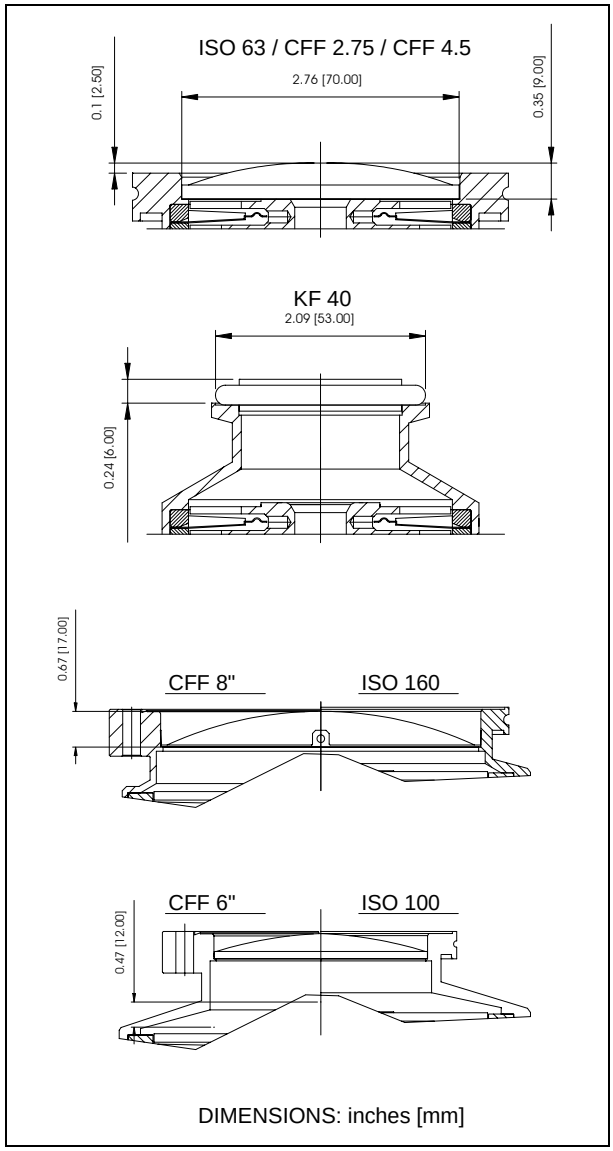


The screen can be mounted on each pump.

The screen can be removed as shown in the following figure.

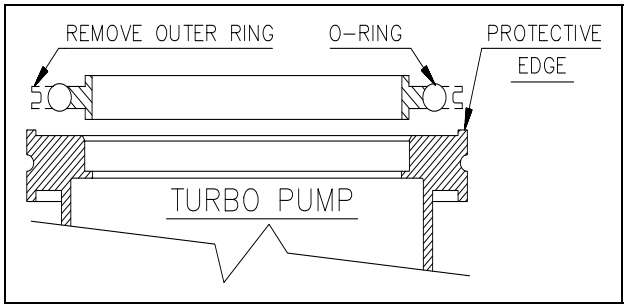


The following figure shows the overall flange dimensions with the protection screen fitted on pump with ISO flange and pump with CFF flange (dimensions are in inches [mm]).

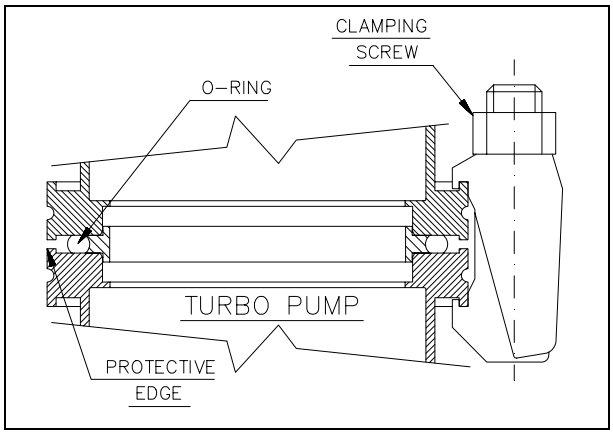


HIGH VACUUM FLANGE CONNECTION

To connect the Turbo pump to the ISO inlet flange, remove the outer ring and position the centering ring as shown in the figure.



Then fix the two flanges with the clamps or claws as shown in the figure.



For ConFlat flange connections we recommend using Varian hardware.

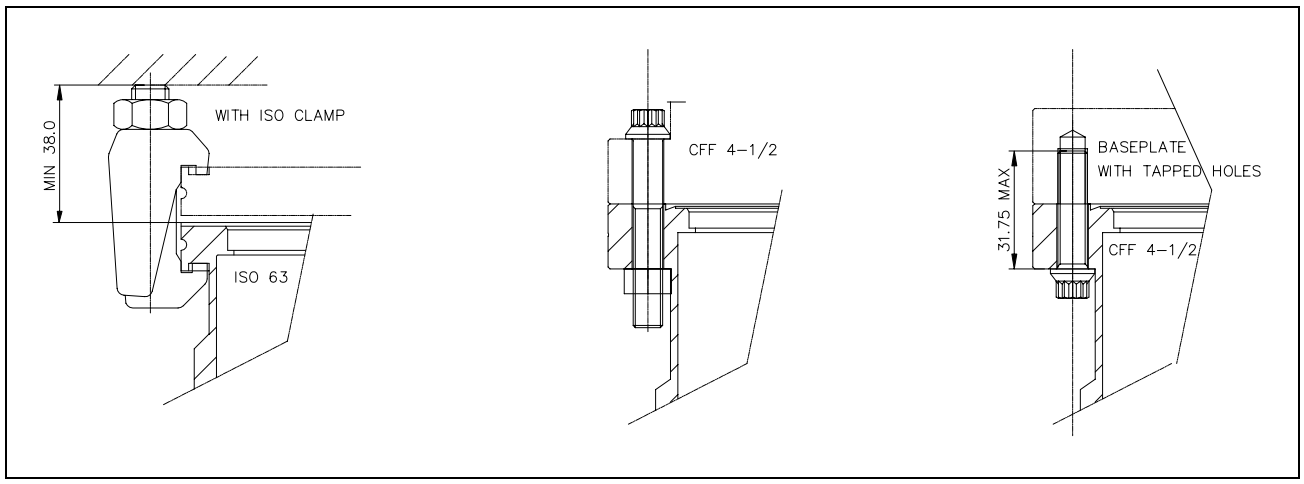
To facilitate assembly and dismantling, apply Felpro C-100 high temperature lubricant to the screw threads protruding from the flange and between the nuts and flange.

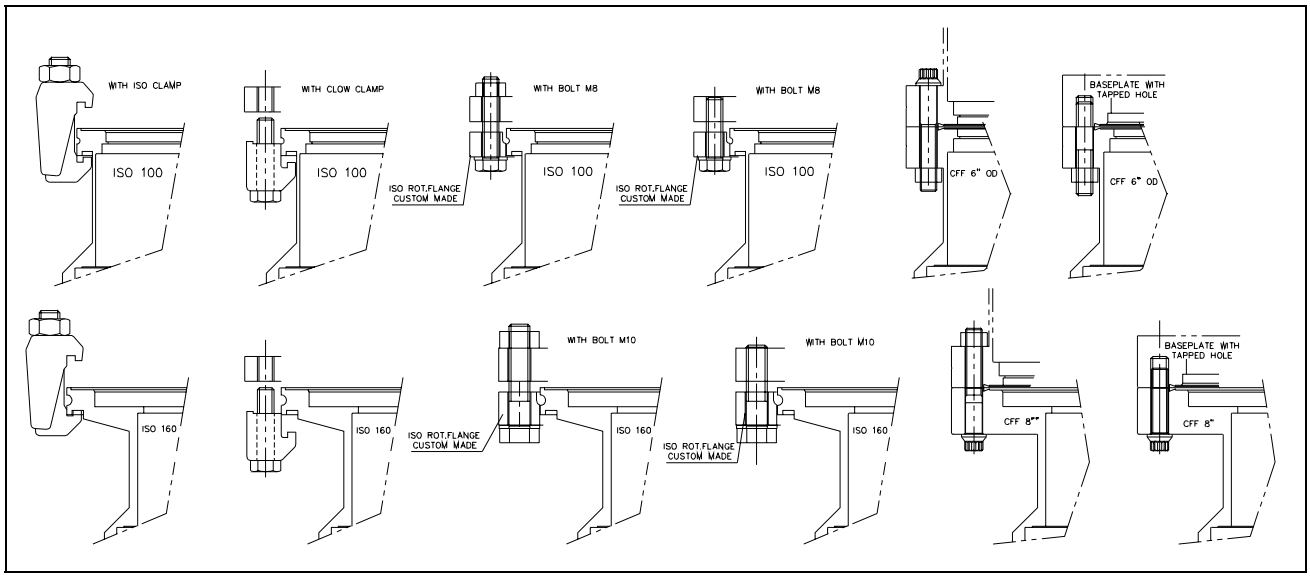
Attach the units and tighten each one in turn. Repeat the sequential tightening until the flange faces meet.

☞ CAUTION

Exercise care when tightening nuts and bolts to avoid creating dents in the envelope as this may cause the pump rotor to lock.

HIGH VACUUM FLANGE CONNECTION CONFIGURATIONS

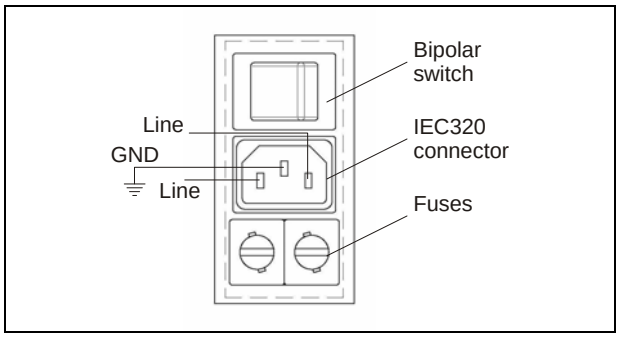




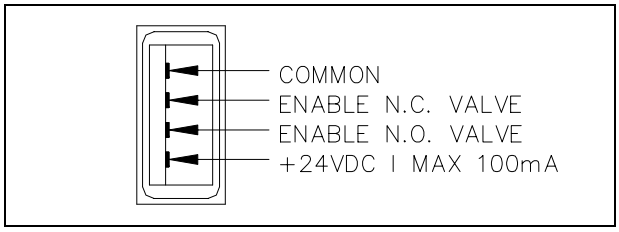
INTERCONNECTIONS

Input power connector

The following figure show the input power connector.



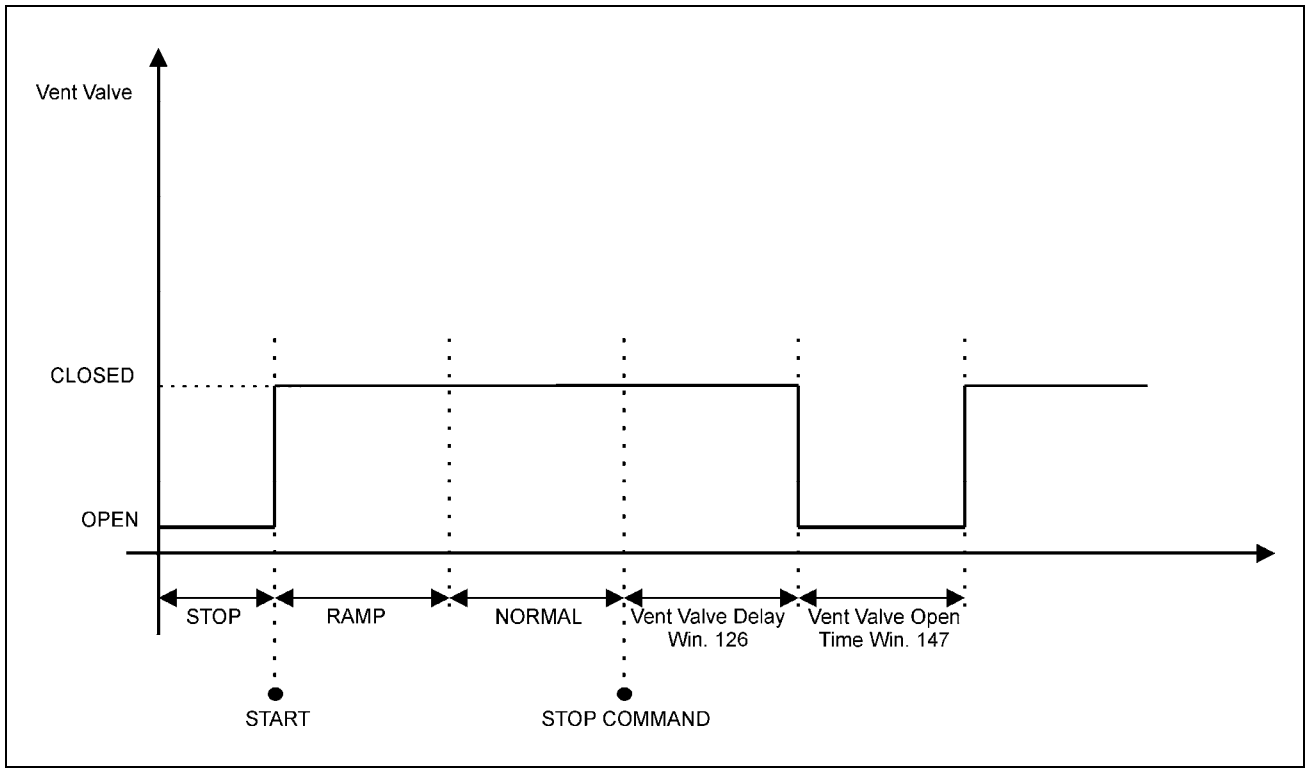
P3 – Vent



Vent Connector

This is a dedicated 24 Vdc connector to control the optional vent valve (available on request).

The vent valve can be driven by controller automatically or by serial line.



Vent Valve Diagram in "Auto" mode

Gauge Connector

TPS-compact is equipped with new generation gauge reading card able to drive/read a Varian "EyeSys Mini-IMG" gauge or a Varian Full Range Gauge FRG-700.

The EyeSys Mini-IMG is a vacuum measurement instrument based on the inverted magnetron ion gauge design (see orderable parts table).

The gauge pressure operation range goes from $6.6x10^{-3}$ mbar [$5x10^{-3}$ Torr] to $6.6x10^{-9}$ mbar [$5x10^{-9}$ Torr] and its operation temperature range goes from 0°C to 50°C [32°-122°F].

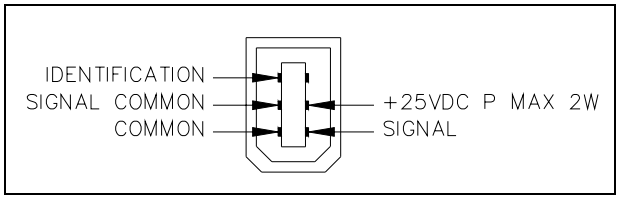
The FRG-700 Full Range Gauge is a combined technologies gauge (Inverted Magnetron plus Pirani Gauge).

FRG-700 measure from $5x10^{-9}$ mbar to atmosphere ($3.8x10^{-9}$ Torr to atmosphere) and its temperature range goes from 5°C to 55°C [41°-131°F].

Pressure data is available on three independent reading channels:

1. On-board display (data expressed in mbar, Torr or Pa) – (see Pressure Display Module picture)
2. Serial communication line (Win 224)
3. Analogical output.

Pressure gauge can be connected/disconnected from the TPS-compact during normal operation.

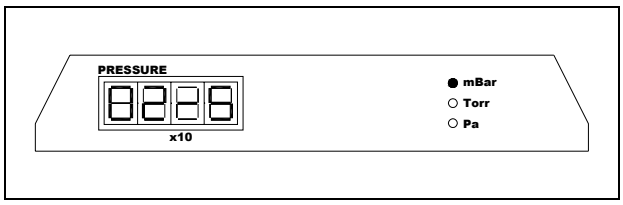


Gauge Connector

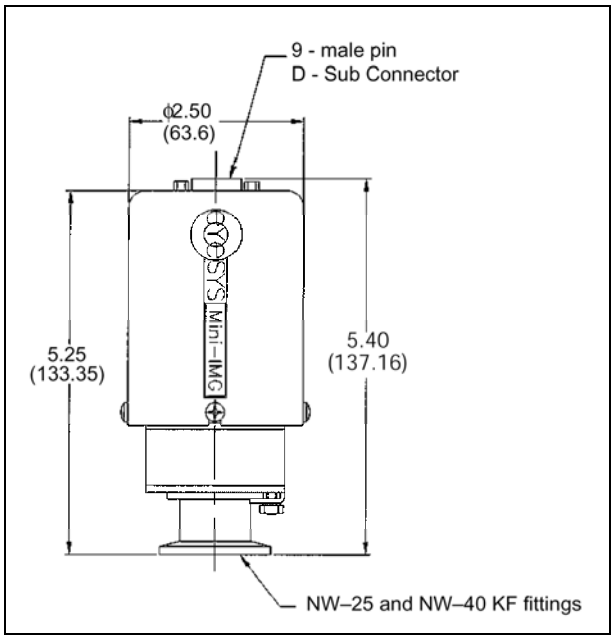
NOTE

The Mini-IMG gauge is intended for high vacuum use, so with pressure above 50 mTorr the signal is misinterpreted and a "false" pressure is displayed. Use a transition gauge to understand if the reading is really under 50 mTorr or not.

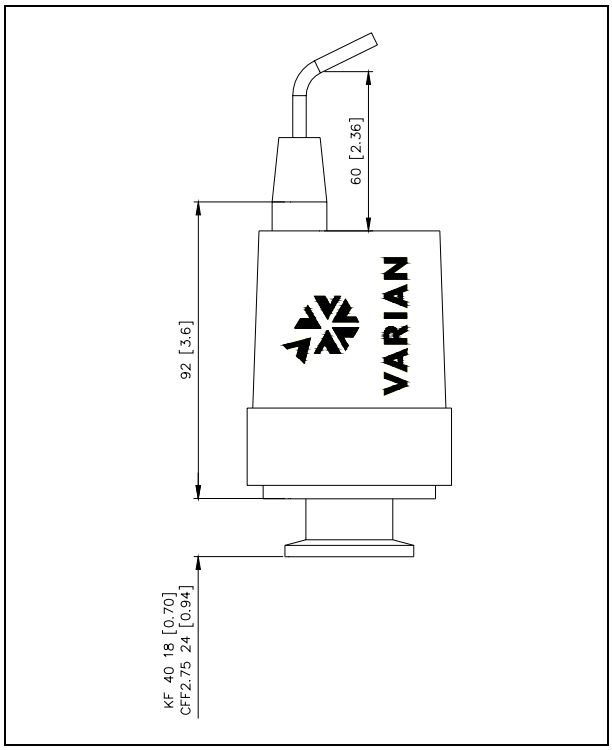
Pressure Display Module



Pressure display module

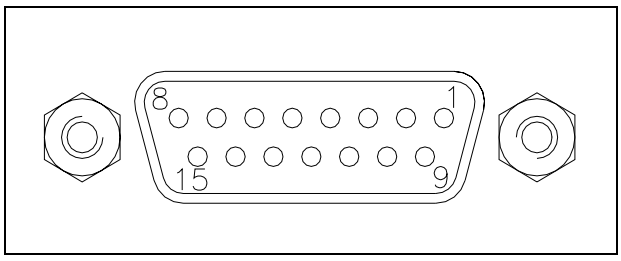


EyeSys Mini-IMG gauge dimension



FRG-700 gauge dimension

J5 – IN-OUT



This connector carries all the input and output signals to remote control the TPS-compact.

It is a 15-pins D type connector; the available signals are detailed in the table, the following paragraphs describe the signal characteristics and use.

PIN N.	SIGNAL NAME	INPUT/ OUTPUT
1	START/STOP (+)	IN
2	START/STOP (-)	IN
3	INTERLOCK (+)	IN
4	INTERLOCK (-)	IN
5	SPEED SETTING (+)	IN
6	SPEED SETTING (-)	IN
7	SOFT START (+)	IN
8	SOFT START (-)	IN
9	+24 Vdc I_{max} = 30 mA	OUT
10	NORMAL OUTPUT (relay) V_{max} = 125V I_{max} = 200 mA	OUT
11	PROGRAMMABLE SET POINT	OUT
12	NORMAL OUTPUT	OUT
13	FAULT OUTPUT	OUT
14	PROGRAMMABLE ANALOG SIGNAL (+)	OUT
15	• GROUND • PROGRAMMABLE ANALOG SIGNAL (-)	OUT

Signal description

START/STOP: input signal to start or stop the pump. Without the supplied cover connector the turbomolecular pump automatically starts, if you want to stop the turbo-pump from outside, you have to connect the START/STOP (+) signal to the +24 Vdc pin and the START/STOP (-) signal to the GROUND pin (this is the default configuration of the cover connector).

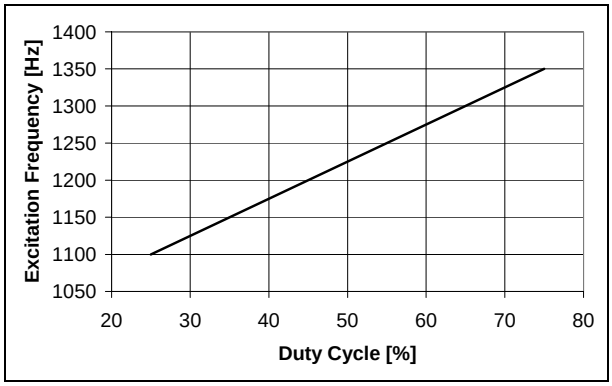
INTERLOCK: input signal to control the pump rotation. With the supplied cover connector the INTERLOCK (+) signal is connected to the +24 Vdc pin and the INTERLOCK (-) signal to the GROUND pin; in this condition the pump is stopped.

SOFT START: this input is used to provide a "soft start" to the pump; in this condition the ramp-up time could be up to 20 min.

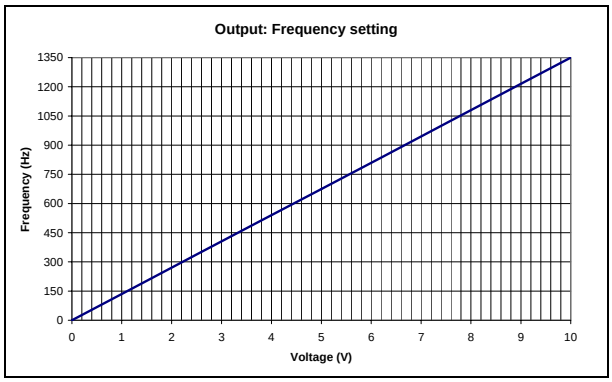
SPEED SETTING: PWM input signal to set the pump speed. The PWM signal characteristics must be the following:

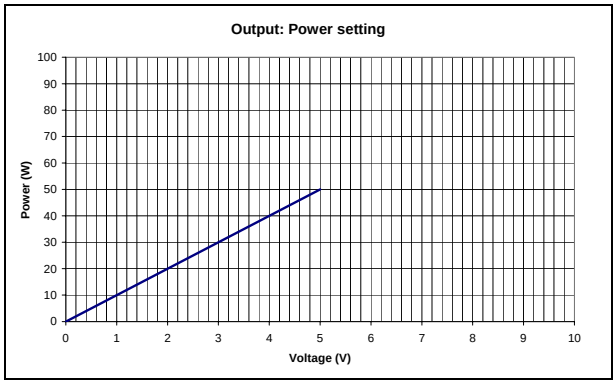
- frequency: 100 Hz +/-20%

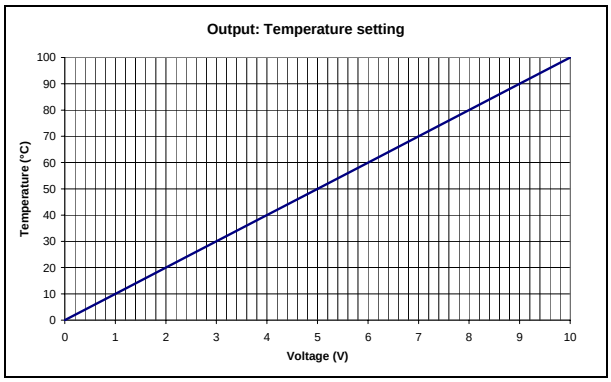
- amplitude: 24 V max
- duty cycle range: from 25% to 75%
- corresponding to a pump speed from 1100Hz to 1350Hz (see the following diagram).

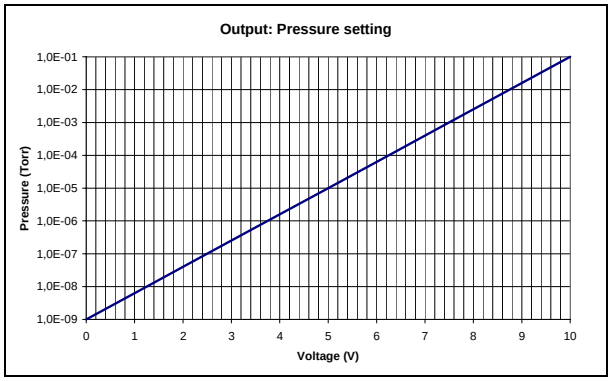


PROGRAMMABLE ANALOG SIGNAL: this output signal is a voltage (from 0 to 10 Vdc) proportional to a reference quantity (frequency or power or Temperature or Pressure) set by the user. The default setting is the frequency (see the following example diagram).





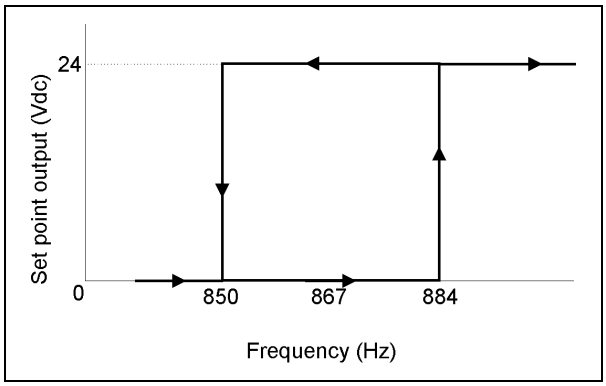




FAULT: this open collector output signal is ON when a system fault condition is detected.

PROGRAMMABLE SET POINT: this open collector output signal is enabled when the reference quantity chosen (frequency, power or time or pressure or normal) is higher than the set threshold. The signal can be "high level active" (that is the output is normally OFF and becomes ON when activated), or "low level active" (that is the output is normally ON and becomes OFF when activated). Moreover, if the reference quantity is the frequency or the power or pressure drawn, it is possible to set the hysteresis (in % of the threshold value) to avoid bouncing.

For example:
- reference quantity: frequency
- threshold: 867 Hz
- hysteresis: 2%
- activation type: "high level"



It is possible to delay the set point checking for a programmable delay time.
The PROGRAMMABLE SET POINT signal has the following default settings:
- reference quantity: frequency
- thereshold: 867 Hz
- hysteresis: 2%
- activation type: high level
- delay time: 0 second

NOTE

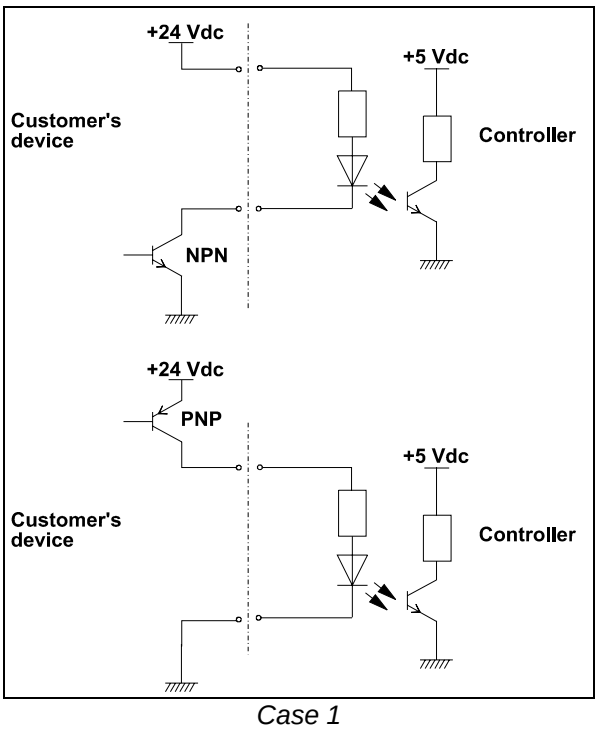
The Navigator Software (optional) allows the operator to set all the programmable feature.

How to connect the open collector input of the controller

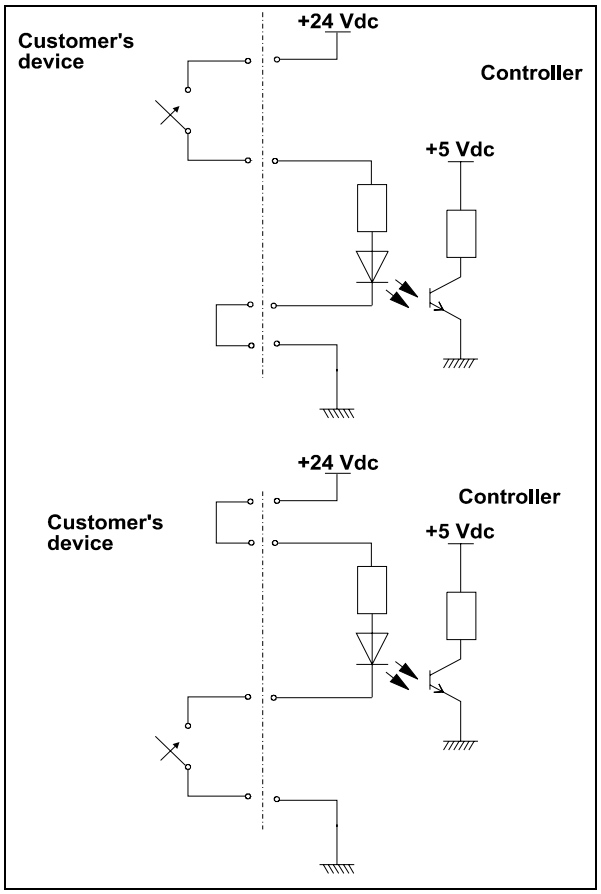
Here below there are the typical connections of the open collector input of TPS-compact to an external system. Two cases are considered:

1. the customer supplies the 24 Vdc
2. the customer does not supply the 24 Vdc.

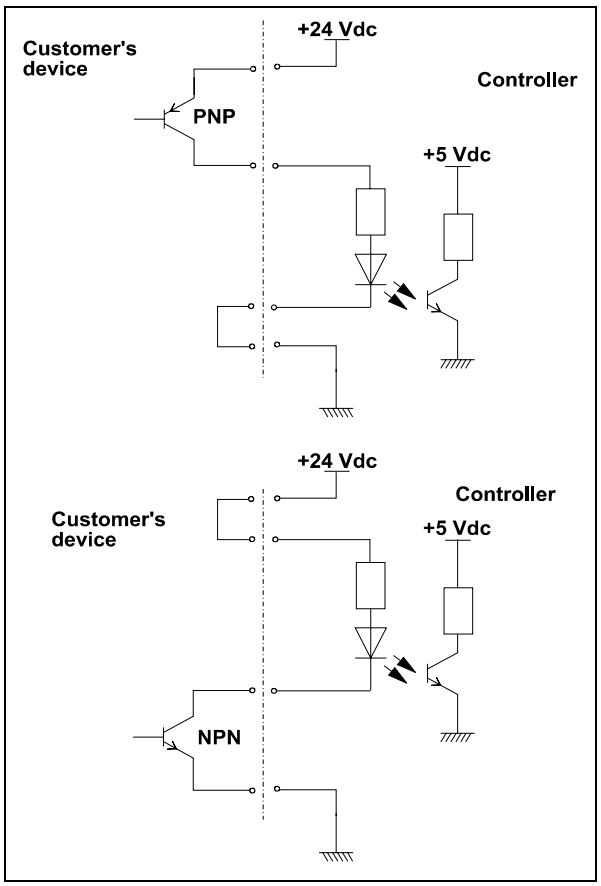
Please note that on the connector a 24 Vdc, 30 mA voltage, a GROUND signal and the open collector pin are available.



Case 1



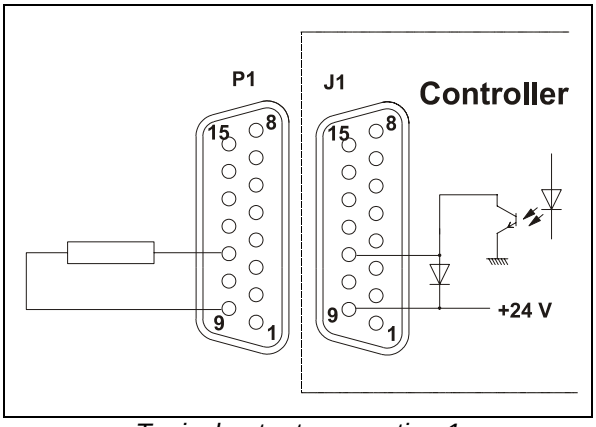
Case 2 with relay utilisation



Case 2 with transistor utilisation

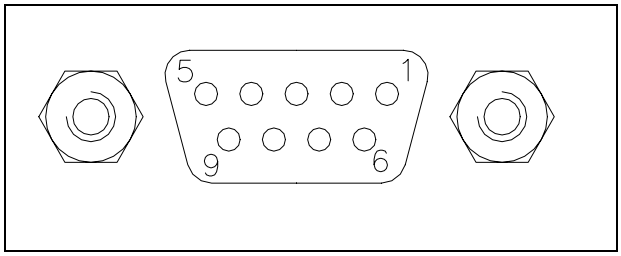
How to connect the outputs of the controller

The following figure shows a typical logic output connection (relay coil) but any other device may be connected e.g. a LED, a computer, etc., and the related simplified circuit of the controller. The figure example refers to the programmable set point signal on pins 11 and 9.



Typical output connection 1

J6 – Serial



This is a 9 pin D-type serial input/output connector to control via an RS 232 or RS 485 connection the TPS-compact.

PIN N.	SIGNAL NAME
1	+5 V (OUT)
2	TX (RS232)
3	RX (RS232)
4	Not used
5	GND
6	A + (RS485)
7	Not used
8	B - (RS485)
9	Not used

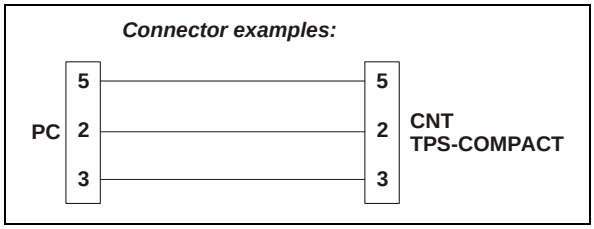
A serial communication kit with a serial cable and the Navigation Software is available (optional).

RS 232/RS 485 COMMUNICATION DESCRIPTION

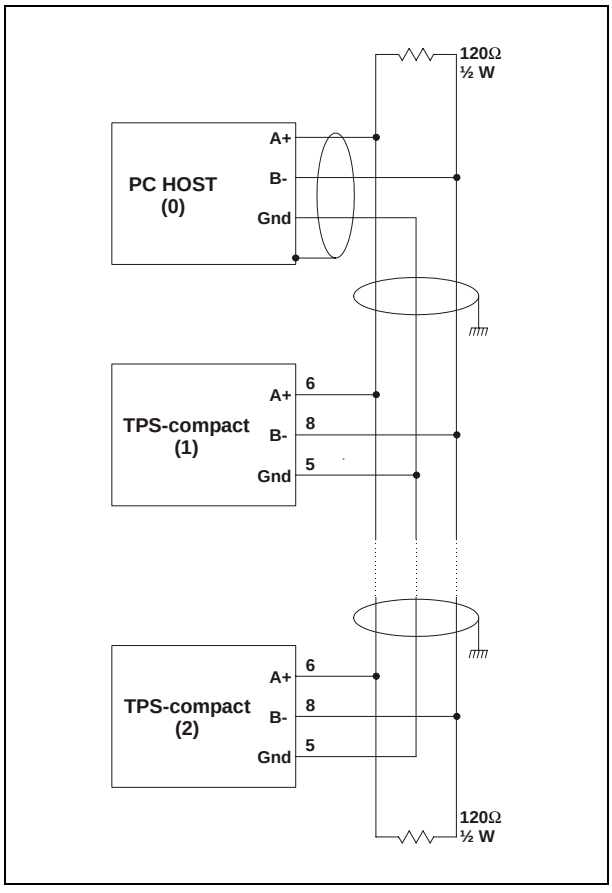
Both the RS 232 and the RS 485 interfaces are available on the connector J6.
The communication protocol is the same (see the structure below), but only the RS 485 manages the address field. Therefore to enable the RS 485 is necessary to select the type of communication as well as the device address by means of the software.

Communication Format

- 8 data bit
- no parity
- 1 stop bit
- baud rate: 600/1200/2400/4800/9600 programmable



RS 232 Connection



RS 485 Connection

The communication port mating connector is supplied with the RS232 PCB (AMP/Cannon or equivalent 15-pin “D” type male connector).

For example, the Transmit data signal from controller (pin 2) must be connected to the host computer’s receive data line (pin 2) and vice versa. Consult the host computer’s instruction manual for its serial port connections.

NOTE

Varian cannot guarantee compliance with FCC regulations for radiated emissions unless all external wiring is shielded, with the shield being terminated to the metal shround on the 0-subconnector. The cable should be secured to the connector with screws.

Serial Communication Descriptions

This unit can communicate by two different protocol:

- protocol (old system) “letter”
- “Window” protocol (new system).

These two protocols can be used as well with 232 or 485 media.

NOTE

Please use “Window” protocol for new development.

WINDOW PROTOCOL

Description

Communication Format

- 8 data bit
- no parity
- 1 stop bit
- baud rate: 600/1200/2400/4800/9600 programmable

Communication Protocol

The communication protocol is a MASTER/SLAVE type where:

- Host = MASTER
- Controller = SLAVE

The communication is performed in the following way:

1. the host (MASTER) send a MESSAGE + CRC to the controller (SLAVE);
2. the controller answer with an ANSWER + CRC to the host.

The MESSAGE is a string with the following format:
<STX>+<ADDR>+<WIN>+<COM>+<DATA>+<ETX>+<CRC>

where:

NOTE

When a data is indicated between two quotes (‘...’) it means that the indicated data is the corresponding ASCII character.

<STX> (Start of transmission) = 0x02

- <ADDR> (Unit address) = 0x80 (for RS 232) <ADDR> (Unit address) = 0x80 + device number (0 to 31) (for RS 485)
- <WIN> (Window) = a string of 3 numeric character indicating the window number (from ‘000’ to ‘999’); for the meaning of each window see the relevant paragraph.
- <COM> (Command) = 0x30 to read the window, 0x31 to write into the window
- <DATA> = an alphanumeric ASCII string with the data to be written into the window. In case of a reading command this field is not present. The field length is variable according to the data type as per the following table:

DATA TYPE	FIELD LENGTH	VALID CHARACTERS
Logic (L)	1	‘0’ = OFF ‘1’ = ON
Numeric (N)	6	‘-‘, ‘.’, ‘0’ . . . ‘9’ right justified with ‘0’
Alphanumeric (A)	10	from blank to ‘_’ (ASCII)

- <ETX> (End of transmission) = 0x03
- <CRC> = XOR of all characters subsequent to <STX> and including the <ETX> terminator. The value is hexadecimal coded and indicated by two ASCII character.

The addressed SLAVE will respond with an ANSWER whose structure depends from the MESSAGE type.
When the MESSAGE is a reading command, the SLAVE will respond transmitting a string with the same structure of the MESSAGE.

NOTE

Using the RS 485 interface, the message structure remains identical to the one used for the RS 232 interface, the only difference being that the value assigned to the ADDRESS <ADDR>.

The controller can answer with the following response types;

RESPONSE TYPE	RESPONSE LENGTH	RESPONSE VALUE	DESCRIPTION
Logic	1 byte	-	After a read instruction of a logic window
Numeric	6 bytes	-	After a read instruction of a numeric window
Alphanumeric	10 bytes	-	After a read instruction of an alphanumeric window
ACK	1 byte	(0x6)	The command execution has been successfully completed
NACK	1 byte	(0x15)	The command execution has been failed
Unknown Window	1 byte	(0x32)	The specified window in the command is not a valid window
Data Type Error	1 byte	(0x33)	The data type specified in the command (Logic, Numeric or Alphanumeric) is not accorded with the specified Window
Out of Range	1 byte	(0x34)	The value expressed during a write command is out of range value of the specified window
Win Disabled	1 byte	(0x35)	The specified window is Read Only or temporarily disabled (for example) you can't write the Soft Start when the Pump is running)

Examples:

Command: START
Source: PC
Destination: Controller

02	80	30	30	30	31	31	03	42	33
STX	ADDR	WINDOW			WR	ON	ETX	CRC	

Source: Controller
Destination: PC

02	80	06	03	38	35
STX	ADDR	ACK	ETX	CRC	

Command: STOP
Source: PC
Destination: Controller

02	80	30	30	30	31	30	03	42	32
STX	ADDR	WINDOW			WR	OFF	ETX	CRC	

Source: Controller
Destination: PC

02	80	06	03	38	35
STX	ADDR	ACK	ETX	CRC	

Command: SOFT-START (ON)
Source: PC
Destination: Controller

02	80	31	30	30	31	31	03	42	32
STX	ADDR	WINDOW			WR	ON	ETX	CRC	

Source: Controller
Destination: PC

02	80	06	03	38	35
STX	ADDR	ACK	ETX	CRC	

Command: SOFT-START (OFF)
Source: PC
Destination: Controller

02	80	31	30	30	31	30	03	42	33
STX	ADDR	WINDOW			WR	OFF	ETX	CRC	

Source: Controller
Destination: PC

02	80	06	03	38	35
STX	ADDR	ACK	ETX	CRC	

Command: READ PUMP STATUS
Source: PC
Destination: Controller (with address = 3)

02	83	32	30	35	30	03	38	37
STX	ADDR	WINDOW			RD	ETX	CRC	

Source: Controller (with address = 3 in stop status)
Destination: PC

02	83	32	30	35	30	30	30	30	30	30	03	38	37
STX	ADDR	WINDOW			DATA (STATUS)						ETX	CRC	

Command: READ SERIAL TYPE
Source: PC
Destination: Controller (with address = 3 in 485 mode)

02	83	35	30	34	30	03	38	31
STX	ADDR	WINDOW			RD	ETX	CRC	

Source: Controller
Destination: PC

02	83	35	30	34	30	31	03	42	30
STX	ADDR	WINDOW			RD	DATA	ETX	CRC	

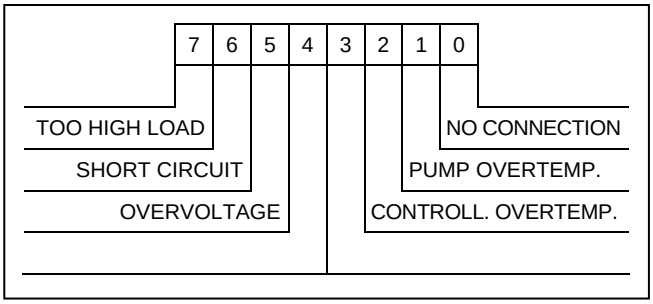
Window Meanings

N.	Read/ Write	Data Type	Description	Admitted Values
000	R/W	L	Start/Stop (in remote/ mode the window is a read only)	Start = 1 Stop = 0
001	R/W	L	Low Speed Activation (in remote/ mode the window is a read only)	No = 0 Yes = 1 (default = 0)
008	R/W	L	Remote or Serial configuration	Remote = 1 Serial = 0 (default = 1)
100	R/W	L	Soft Start (write only in Stop condition)	YES = 1 NO = 0
101	R/W	N	R1 Set Point type	0 = Frequency 1 = Power 2 = Time 3 = Normal 4 =Pressure (default = 0)
102	R/W	N	R1 Set Point valve (expressed in Hz, W or s)	(default = 867)
103	R/W	N	Set Point delay: time between the pump start and the set point check (seconds)	0 to 999999 (default = 0)
104	R/W	L	Set Point signal activation type: the signal can be "high level active" or "low level active"	0 = high level active 1 = low level active (default = 0)
105	R/W	N	Set point hysteresis (in % of value)	0 to 100 (default = 2)
106	R/W	L	Water cooling (write only in stop)	0 = NO 1 = YES
107	R/W	L	Active Stop (write only in stop)	0 = NO 1 = YES (default = 0)
108	R/W	N	Baud rate	600 = 0 1200 = 1 2400 = 2 4800 = 3 9600 = 4 (default = 4)
109	W	L	Pump life/ cycle time/ cycle number reset	To reset write ‘1’
110	R/W	L	Interlock type (default = 1)	Impulse = 0 Continuous = 1
111	R/W	L	Analog output type: output voltage signal proportional to frequency or power	0 = frequency 1 = power (default = 1) 2 = Pump temperature 3 = Pressure
117	R/W	N	Low Speed frequency (Hz)	1100 to “Maximum rotational frequency” (win 120) (default = 1100)
120	R/W	N	Rotational frequency setting (Hz)	1100 to 1350 (default = 1350)
122	R/W	L	Set vent valve on/off	0 = Closed 1 = Open (default = 1)
125	R/W	L	Set the vent valve operation	Automatic = 0 (see note 1.) On command = 1 (see note 2.)
126	R/W	N	Vent valve opening delay (expressed in 0.2 sec)	0 to 65535 (corresponding to 0 to 13107 sec) (default = 15)
147	R/W	N	Vent open time See “vent connector” paragraph	0 = infinite 1 bit = 0.2 sec 1 to 65535
155	R	N	Power limit applied Read the maximum allowable power	watt
157	R/W	N	Gas load type Select the gas load to the pump	Ø = N_2 1 = Ar
161	R/W	N	Pressure Reading Connection Factor Table A1 Appendix A EyeSys Manual	0 to 10 0 = 0 10 = 1 = N_2
162	R/W	A	R1 Set Point Pressure Valve Valid if Win. 101 = 4 Format X.X E. XX Where X = 0 to 9 s = + or -	
163	R/W	N	Pressure unit of measure	0 = mBar 1 = Pa 2 = Torr

N.	Read/ Write	Data Type	Description	Admitted Values
167	R/W	A	Stop speed reading Activates / deactivates the pump speed reading after Stop command	0 = disable 1 = enable (default = 0)
200	R	N	Pump current in mA dc	
201	R	N	Pump voltage in Vdc	
216	R	N	Controller Air Temperature (°C).	0 to 70
224	R	A	Pressure reading Format = X.X E XX	
226	R	N	Rotation Frequency (rpm)	
300	R	N	Cycle time in minutes (zeroed by the reset command)	0 to 999999
301	R	N	Cycle number (zeroed by the reset command)	0 to 9999
302	R	N	Pump life in hours (zeroed by the reset command)	0 to 999999
310 to 347	Reserved to Varian service			
358	R/W	N	Tip-seal life (R) Tip-seal life reset (W)	0 = reset
400	R	A	CRC EPROM (QE)	QE8XXXX (where “XXXX” are variable)
401	R	A	Boot CRC (BL)	BL2XXXX (where “XXXX” are variable)
402	R	A	CRC Param. (PA)	PA8XXXX (where “XXXX” are variable)
404	R	A	CRC Parameter structure	"XXXX"
406	R	A	Program Listing Code	"XXXXXXXXXX"
407	R	A	Parameter Listing Code	"XXXXXXXXXX"
500	Reserved to Varian service			
503	R/W	N	RS 485 address	0 to 31 (default = 0)
504	R/W	L	Serial type select	0 = RS 232 1 = RS 485 (default = 0)

NOTES

1. *Automatic means that when the controller stops, the vent valve is opened with a delay defined by window n. 126; when the controller starts, the vent valve is immediately closed.*
2. *On command means that the vent valve is opened or closed by means of window n. 122.*
3. *These commands remove the pump motor supply for a short time. If they are used continuously, they can cause the pump stopping.*



Window N. 206 Bit Description

SERVICE OPTIONS

Varian pumping systems will provide many years of trouble-free operation if the maintenance procedures are observed.
Pumping System cleaning and internal scroll pump tip seal replacement are recommended when Pumping System TMP adsorbed current (with blanked inlet flange) has risen to an unacceptably high level (>500mA) or when the message “TIP-SEAL SERV” appears on the TPS-compact front side display.
The warning message appears after 5000h of operation.
If your TPS-compact exhibits humming or grinding noises from the scroll pump, a major overhaul should be done by Varian Vacuum Technologies. Advance exchange TPS-compact are available to minimize downtime.
The parts needed for Tip-Seal replacement on the internal scroll pump are available in the kit described in Orderable parts Table. This kit contains seals and O-rings, and can be obtained from your Varian dealer.

Cleaning

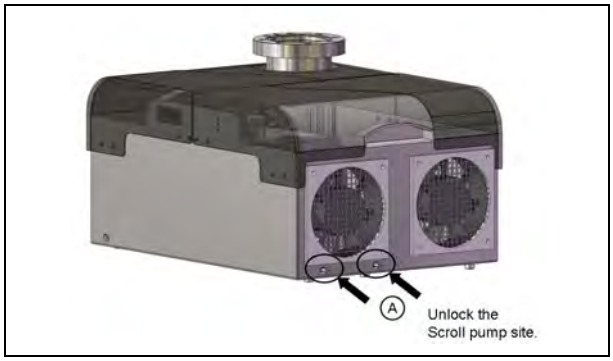
Exterior
The exterior surfaces of the TPS-compact may be cleaned with mild detergents only.

Interior
Internal dry scroll pump do not contain fluid for the cleansing of accumulated dust and debris. Run the pump periodically at atmosphere for a minute or two to flush it out.

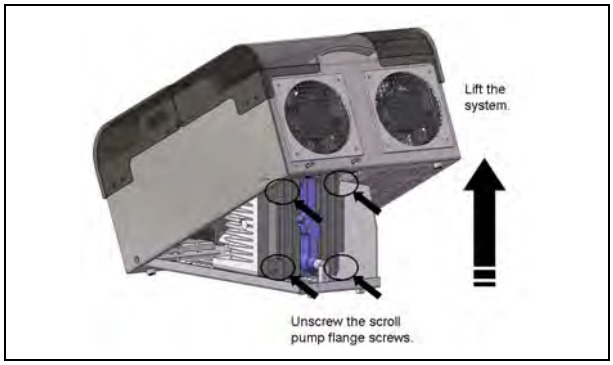
Tip-Seal Replacement

The parts and tools required to replace Tip-Seals are listed below:

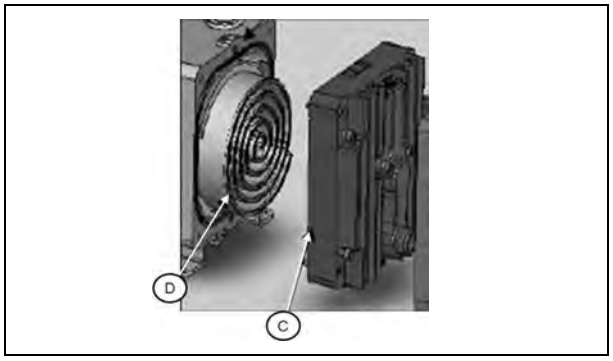
- Tip-Seal Replacement Kit P/N IDP3TS
- 4 mm Allen wrench
- Razor blade or side-cutting pliers
- Compressed air (optional)



Tip-Seal replacement - Figure A



Tip-Seal replacement - Figure B



Tip-Seal replacement - Figure C

To remove the worn tip-seals:
Disconnect the TPS-compact from electrical power.
Unlock the scroll pump support by unscrewing the screws (A) (see the "Tip-Seal replacement - Figure A")

1. Lift the TPS-compact in order to access the Scroll pump site (you'll hear a "click" noise as soon as the upper part of TPS-compact is locked).
2. Remove (4) M5 socket head bolts (B).
3. Remove the outboard housing axially off the frame (C).
4. Remove and discard the worn tip seals (D) and the main O-ring.
5. If compressed air is available, blow any remaining seal debris off the scroll parts. If seal debris is attached to the sides, use a razor or Exacto knife to scrape the debris off.

To install the new seals and O-rings:

1. Unpack the Tip-Seals.
   Two tip seals are provided in the kit; one fits the orbiting scroll and the other fits the outboard housing scroll.
2. Install the correct tip seal into the groove of the orbiting scroll by:
   a. Facing the white plastic surface upwards and inserting the foam backing into the groove. Start from the center and work outward.
   b. Cutting the tip seal off about 1/8" (3 mm) from the outer end of the groove.
3. Install the correct tip seal into the groove of the outboard housing scroll as in step 3.
4. Place the new main O-ring into the groove in the frame.
5. Ensure that the groove is clean.
6. Ensure the sealing face of the outboard housing is clean. Carefully replace the outboard housing by lining up the locating pins. Ensure the tip seal has not fallen out of its groove.
7. Reinstall (4) M5 bolts (B) and torque the (4) M5 bolts to 5.6 N-m (50 in-lb).
8. Unlock the upper part of TPS-compact by sliding the small lever you can find on the bottom side of TPS-compact.
9. Reconnect the TPS-compact to the electrical power mains.
10. Disable the "TIP-SEAL SERV" warning message by serial interface. To disable the Tip-seal Service message you have to reset the Tip-seal hour-meter (Win 358). Write a "0" on the window 358. The message will be showed

again after 5000 h of operation. To check the Tip-seal life you have just to read the Win 358.

WARNING!

If dangerous gases were being pumped, flush the pump with air or inert gas for at least 10 minutes prior to disassembly.

To test the pumping system:

1. Run the TPS-compact for about 5 seconds. Verify that the front fan is running. If you hear loud noises from the Scroll pump this indicates that the tip seal or main O-ring are possibly out of place.
2. Disassemble and repair as necessary.
3. The pump is now ready to return to service.

NOTE

Newly installed tip seals may require several hours of run time to seat properly and enable the pump to meet speed and base pressure specifications.

Troubleshooting Chart

Problem	Possible Causes	Corrective Actions
TMP doesn't reach NORMAL OPERATION	Scroll Pump motor thermal protector open	Allow motor to cool. Identify cause of overload.
	Vacuum system leak	Locate and repair leak.
System will not start	Excessive voltage drop	Check size and length of cable.
	Fuses burnt-out	Check fuses and if necessary replace.
Poor ultimate pressure	Vacuum system leak	Locate and repair leak.
	Water in TPS-compact	Flush the system with air or dry nitrogen.
	Solvent in pump	Flush the system with air or dry nitrogen. Install trap or filter.
	Scroll Pump seals worn out	Replace tip seals.
	Poor conductance to TPS-compact	Replumb with shorter and/or larger diameter tubing.
Hammering noise	Scroll pump overheated	Check ventilation to TPS-compact. Check ambient temperature.
	Debris in Scroll pump	Flush the TPS-compact. Disassemble pump and inspect.
Internal Scroll Pump runs intermittently	Motor thermal protector is cycling open and closed.*	Allow the scroll motor to cool. Identify the cause of the overload.

* *The internal Scroll Pump is equipped with an auto-reset thermal motor protector. This protector automatically shuts down the pump when it detects an overload condition, and automatically restarts the pump when the motor has cooled to within an acceptable temperature range.*

ORDERABLE PARTS

TPS-compact	TV 81-M KF40	TV 81-M CFF 2.75"	TV 81-M ISO 63	TV 81-M CFF 4.5"	TV 301 ISO 100	TV 301 CFF 6"	TV 301 ISO 160	TV 301 CFF 8"
120 V	969-8217	969-8218	969-8219	969-8220	969-8221	969-8222	969-8223	969-8224
220 V	969-8225	969-8226	969-8227	969-8228	969-8229	969-8230	969-8231	969-8232
Accessories								
DIY EyesSys Gauge Kit	969-9185	969-9196	969-9186	969-9187	969-9188	969-9197	969-9189	969-9198
DIY Full Range Gauge Kit	969-9190	969-9199	969-9192	969-9193	969-9194	969-9201	969-9195	969-9202
Wheels accessory kit	969-8233	969-8233	969-8233	969-8233	969-8233	969-8233	969-8233	969-8233
US Power cord [5 m]	969-8452	969-8452	969-8452	969-8452	969-8452	969-8452	969-8452	969-8452
EU Power cord [5 m]	969-8450	969-8450	969-8450	969-8450	969-8450	969-8450	969-8450	969-8450
UK Power cord [5 m]	969-8451	969-8451	969-8451	969-8451	969-8451	969-8451	969-8451	969-8451
US Power cord [2 m]	969-9397	969-9397	969-9397	969-9397	969-9397	969-9397	969-9397	969-9397
EU Power cord [2 m]	969-9396	969-9396	969-9396	969-9396	969-9396	969-9396	969-9396	969-9396
UK Power cord [2 m]	969-9398	969-9398	969-9398	969-9398	969-9398	969-9398	969-9398	969-9398
Vibration damper	- -	- -	969-9340	969-9376	969-9344	969-9334	969-9345	969-9335
Inlet screen	969-9309	- -	969-9300	969-9300	969-9302	969-9302	969-9304	969-9304
FRG-700 1.5 m cable	969-9959	969-9959	969-9959	969-9959	969-9959	969-9959	969-9959	969-9959
FRG-700 3 m cable	969-9960	969-9960	969-9960	969-9960	969-9960	969-9960	969-9960	969-9960
FRG-700 5 m cable	969-9961	969-9961	969-9961	969-9961	969-9961	969-9961	969-9961	969-9961
EyeSys Mini-IMG cable [1 m]	969-9943	969-9943	969-9943	969-9943	969-9943	969-9943	969-9943	969-9943
EyeSys Mini-IMG ext. cable	969-9944	969-9944	969-9944	969-9944	969-9944	969-9944	969-9944	969-9944
Serial cable and T-Plus SW	969-9883	969-9883	969-9883	969-9883	969-9883	969-9883	969-9883	969-9883
Tip-seal replacement kit	IDP3TS	IDP3TS	IDP3TS	IDP3TS	IDP3TS	IDP3TS	IDP3TS	IDP3TS

For a complete overview of Varian's extensive product lines, please refer to the Varian catalog.

Request for Return

1. A Return Authorization Number (RA#) **WILL NOT** be issued until this Request for Return is completely filled out, signed and returned to Varian Customer Service.
2. Return shipments shall be made in compliance with local and international **Shipping Regulations** (IATA, DOT, UN).
3. The customer is expected to take the following actions to ensure the **Safety** of workers at Varian: (a) Drain any oils or other liquids, (b) Purge or flush all gasses, (c) Wipe off any excess residues in or on the equipment, (d) Package the equipment to prevent shipping damage, (for Advance Exchanges please use packing material from replacement unit).
4. Make sure the shipping documents clearly show the RA# and then return the package to the Varian location nearest you.

North and South America	**Europe and Middle East**	**Asia and ROW**
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CUSTOMER INFORMATION

Company name: ..……..……..……..……..……..……..……..…..

Contact person: Name: ……..… Tel: …….…..…….……...

Fax: ……..…..…..…… E-Mail: ..……..……..…..…..…..

Ship Method: ……..……..……. Shipping Collect #: ……..…… P.O.#: ……..…….……..

Europe only: VAT reg. Number: ……..……... *USA only:* ☐ Taxable ☐ Non-taxable

Customer Ship To: ……..…… Customer Bill To: ……..……...

……..……... ..……...

……..……... ..……...

PRODUCT IDENTIFICATION

Product Description	Varian P/N	Varian S/N	Purchase Reference

TYPE OF RETURN *(check appropriate box)*

☐ Paid Exchange ☐ Paid Repair ☐ Warranty Exchange ☐ Warranty Repair ☐ Loaner Return
☐ Credit ☐ Shipping Error ☐ Evaluation Return ☐ Calibration ☐ Other …….

HEALTH and SAFETY CERTIFICATION

Varian Vacuum Technologies **CAN NOT ACCEPT** any equipment which contains **BIOLOGICAL HAZARDS** or **RADIOACTIVITY**. Call Varian Customer Service to discuss alternatives if this requirement presents a problem.

The equipment listed above (check one):

☐ **HAS NOT** been exposed to any toxic or hazardous materials

OR

☐ **HAS** been exposed to any toxic or hazardous materials. In case of this selection, check boxes for any materials that equipment was exposed to, check all categories that apply:

☐ Toxic ☐ Corrosive ☐ Reactive ☐ Flammable ☐ Explosive ☐ Biological ☐ Radioactive

List all toxic or hazardous materials. Include product name, chemical name and chemical symbol or formula.

……..

Print Name: ……. Customer Authorized Signature: ……..…….

Print Title: ……... Date: ..…../..…../……

NOTE: If a product is received at Varian which is contaminated with a toxic or hazardous material that was not disclosed, **the customer will be held responsible** for all costs incurred to ensure the safe handling of the product, and **is liable** for any harm or injury to Varian employees as well as to any third party occurring as a result of exposure to toxic or hazardous materials present in the product.

Do not write below this line

Notification (RA)#: ……..…….. Customer ID#: ……..……. Equipment #: ……..

VARIAN

Request for Return

ISO 9001 REGISTERED

FAILURE REPORT

TURBO PUMPS and TURBOCONTROLLERS

☐ Does not start	☐ Noise	POSITION	PARAMETERS		
☐ Does not spin freely	☐ Vibrations	☐ Vertical	Power:		Rotational Speed:
☐ Does not reach full speed	☐ Leak	☐ Horizontal	Current:		Inlet Pressure:
☐ Mechanical Contact	☐ Overtemperature	☐ Upside-down	Temp 1:		Foreline Pressure:
☐ Cooling defective		☐ Other:	Temp 2:		Purge flow:
		……	OPERATION TIME:		

TURBOCONTROLLER ERROR MESSAGE:

ION PUMPS/CONTROLLERS

☐ Bad feedthrough	☐ Poor vacuum
☐ Vacuum leak	☐ High voltage problem
☐ Error code on display	☐ Other

Customer application:

VALVES/COMPONENTS

☐ Main seal leak	☐ Bellows leak
☐ Solenoid failure	☐ Damaged flange
☐ Damaged sealing area	☐ Other

Customer application:

LEAK DETECTORS

☐ Cannot calibrate	☐ No zero/high backround
☐ Vacuum system unstable	☐ Cannot reach test mode
☐ Failed to start	☐ Other

Customer application:

INSTRUMENTS

☐ Gauge tube not working	☐ Display problem
☐ Communication failure	☐ Degas not working
☐ Error code on display	☐ Other

Customer application:

PRIMARY PUMPS

☐ Pump doesn't start	☐ Noisy pump (describe)
☐ Doesn't reach vacuum	☐ Over temperature
☐ Pump seized	☐ Other

Customer application:

DIFFUSION PUMPS

☐ Heater failure	☐ Electrical problem
☐ Doesn't reach vacuum	☐ Cooling coil damage
☐ Vacuum leak	☐ Other

Customer application:

FAILURE DESCRIPTION

(Please describe in detail the nature of the malfunction to assist us in performing failure analysis):

NOTA: Su richiesta questo documento è disponibile anche in Tedesco, Italiano e Francese.
REMARQUE : Sur demande ce document est également disponible en allemand, italien et français.
HINWEIS: Auf Aufrage ist diese Unterlage auch auf Deutsch, Italienisch und Französisch erhältlich.

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