Turbo-V 70 Controller

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° _____

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

VARIAN

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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-authorised interference with the equipment or any action contrary to that provided for by specific national standards. The Turbo-V 70 series controllers are microprocessor-controlled, solid-state, frequency converters with self-diagnostic and self-protection features.
The controllers drive (within ten steps) the Turbo-V 70 pump during the starting phase by controlling the voltage and current respect to the speed reached by the pump. They incorporate all the facilities required for the automatic operation of the Turbo-V 70 pump series. Remote start/stop, pump status signals, forepump start/stop, interlock control (for pressure switch, water flow switch, etc.) capability, are provided via auxiliary connectors. 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.

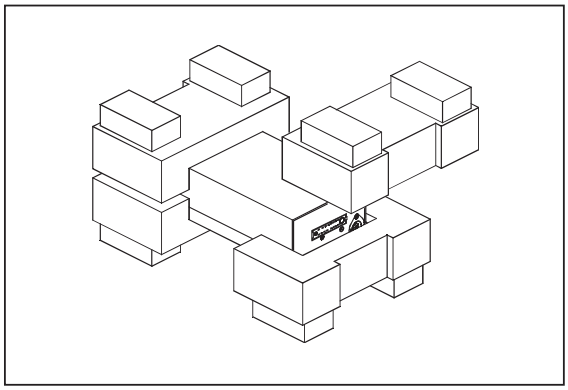
STORAGE

When transporting and storing the controllers, the following environmental requirements should be satisfied:

- temperature: from -20 °C to + 70 °C
- relative humidity: 0 - 95% (without condensation).

PREPARATION FOR INSTALLATION

The controller 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 controller, ensure that it is not dropped or subjected to any form of impact. Do not dispose of the packing materials in an unauthorized manner. The material is 100% recyclable and complies with EEC Directive 85/399.



Controller Packing

The controller model 969-9506 is factory set for a power supply: of 120 Vac.
If a change in line voltage operation is desired, proceed as follows:

- Disconnect the power cord from the controller P17 connector.
- Select the operating voltage on the left panel.
- Check voltage selector for correct set and connect power cord to P17 connector.

INSTALLATION

WARNING!

Connection to the mains must be made in accordance with the local law. Always connect the ground wire and use a properly grounded power socket to avoid electrical shock. High voltage developed in the controller can cause severe injury or death. Before servicing the unit, disconnect the input power cable.

NOTE

The Turbo-V controller can be used as a bench unit or a rack module, but it must be positioned so that free air can flow through the holes. Do not install or use the controller 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:

- temperature: from O °C to +40 °C
- relative humidity: 0 - 95% (without condensation).

To connect the controller to the pump use the specific cable supplied with the controller.

NOTE

The controller model 969-9506 is not equipped with the pump cable. It can be requested as an accessory; detailed information is supplied in the paragraph "Accessories and Spare Parts" of the appendix "Technical Information". It must be connected between the controller connector J16 and the pump connector. The two connectors at the two cable extremity cannot be connected in a wrong way.

USE

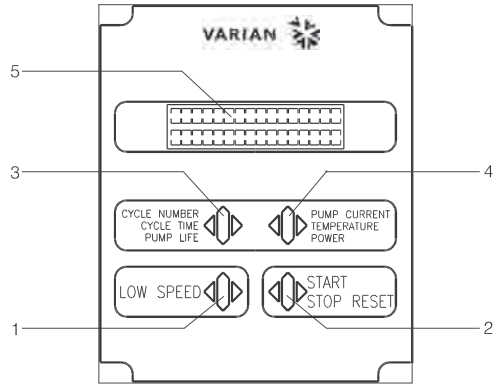
This paragraph describes the fundamental operating procedures. Detailed information and operating procedures that involve optional connections or options are supplied in the paragraph "USE" of the appendix "Technical Information". Some procedures can be executed with controller model 969-9506 only when the accessory "Hand held terminal" is available. Make all vacuum manifold and electrical connections and refer to Turbo-V pump instruction manual prior to operating the Turbo-V controller.

WARNING!

To avoid injury to personnel and damage to the equipment, if the pump is laying on a table make sure it is steady. Never operate the Turbo-V pump if the pump inlet is not connected to the system or blanked off.

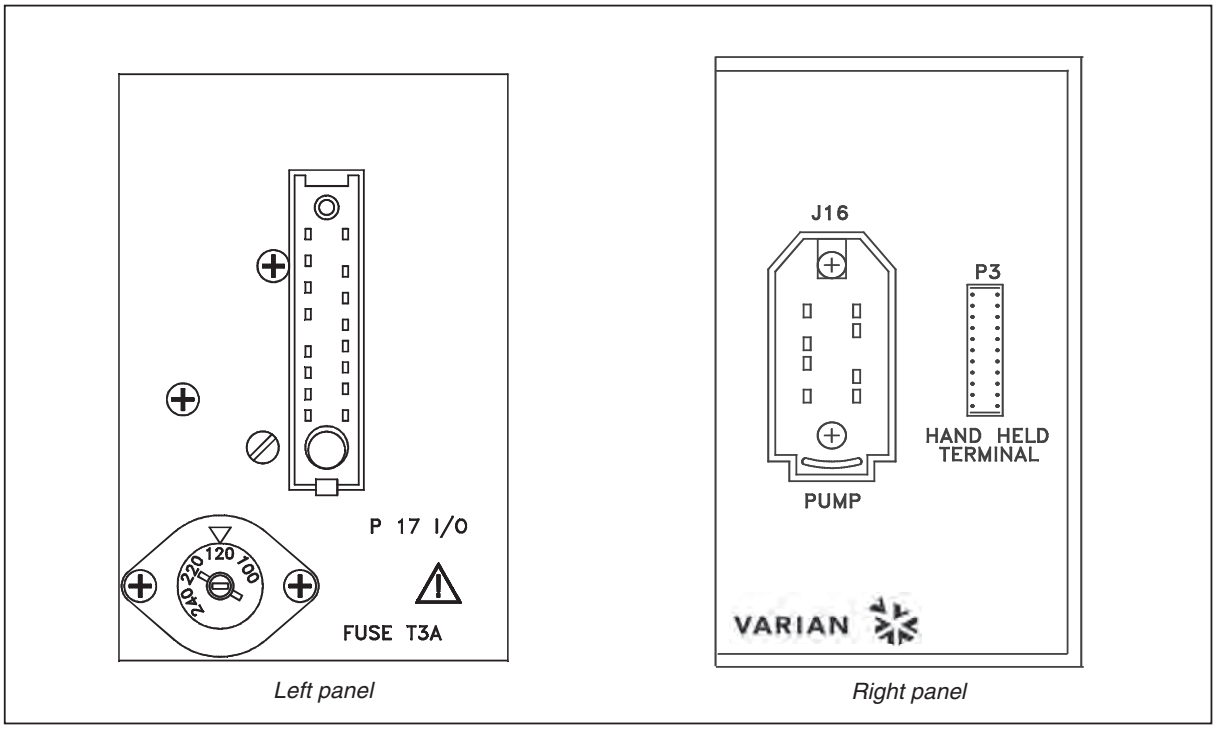
Controller controls, indicators and connectors

The following paragraph illustrates the hand held terminal control panel and interconnection panel.
More details are contained in the appendix "Technical Information".



1. Keyboard push-button for LOW SPEED mode selection. It is active only when the front panel operation has been selected. Pressed once, the pump runs at about 2/3 of the nominal speed. To unselect the mode, press the push-button again.
2. Keyboard push-button for START, STOP, RESET mode selection. It is active only when the front panel operation has been selected. By pressing once the starting phase begins; if pressed again it stops the pump. If the pump has been stopped automatically by a fault, this push-button must be pressed once to reset the controller and a second time to restart the pump.
3. Keyboard push-button to recall on the display the cycle number, cycle time and pumplife.
4. Keyboard push-button to recall on the display the pump current, pump temperature, pump power and rotational speed. It is always active regardless of the operating mode selected. Push-buttons 3 and 4, if pressed together for at least 2 seconds put the controller in a routine where it is possible to program some operation parameters.
5. LCD back-lighted alphanumeric display: dot matrix 2 lines x 16 characters.

Hand Held Terminal Control Panel



Left panel *Right panel*

Right and left panels of controller 969-9506

USE PROCEDURE

Controller and Pump Startup

To startup the controller and the pump apply mains to P17 connector.

Pump Shutdown

To stop the pump, you need to set jumpers b7-a5 on P17 connector, or press the STOP button on the Hand Held Terminal if the controller is configured in FRONT Mode.

MAINTENANCE

The Turbo-V 70 series controller does not require any maintenance. Any work performed on the controller must be carried out by authorized personnel. When a fault has occurred it is possible to use the Varian repair service. Replacement controllers are available on an advance exchange basis through Varian.

WARNING!

Before carrying out any work on the controller, disconnect it from the supply.

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

ERROR MESSAGES

For a certain type of failure, the controller will self-diagnose the error and the messages described in the following table are displayed.
The error messages are displayed only when the option hand held terminal is available.

MESSAGE	DESCRIPTION	REPAIR ACTION
CHECK CONNECTION TO PUMP	Wrong connection between the pump and the controller.	Check connection between controller and pump. Press the START push-button twice to start the pump.
FAULT: OVERTIME SX	Within each step of the soft start mode the rotational speed of the pump does not reach the planned value within 15 minutes. (X) is the step number from 0 to 9 indicating the step number not passed).	Verify that system has no leaks. Press the START pushbutton twice to start the pump.
FAULT: PUMP OVERTEMP.	The upper bearing/pump temperature exceeds 60 °C.	Wait until the temperature decrease below threshold value. Press the START push-button twice to start the pump.
FAULT: CONTROLLER OVERTEMPERATURE	The controller transformer temperature exceeds 90 °C.	Wait until the temperature decrease below threshold value. Press the START push-button twice to start the pump.
FAULT: TOO HIGH L0AD	In normal operation (after the starting phase) the current drawn by the pump is higher than programmed (1.5 A)	Check that the pump rotor is free to rotate. Press the START push-button twice to start the pump.
FAULT: SHORT CIRCUIT	After the starting phase the output connection is shorted (output current higher than 2.2 A).	Check connections and shortages between pump and controller. Press the START push-button twice to start the pump.
FAULT: R2 DELAY OVER	The pump rotational speed decreased below the programmed speed thereshold value, and the controller OFF is selected, when R2 deenergizes.	Check for system leaks or gas load conditions. To restart the pump apply the reset signal to **b8** pin of **P17** connector.
OVERVOLTAGE	Controller power supply circuitry is faulty, or the Controller received a spike.	Press the START push-button twice to start the pump. Should the message still be present, call the Varian service.
CONTROLLER FAILURE	Fuse blown on the power supply secondary of the transformer.	Contact Varian for Maintenance.

TURBO-V 70 CONTROLLER DESCRIPTION

The controller, factory set for 120 Vac, 50-60 Hz input voltage, is a solid-state frequency converter which is driven by a single chip microcomputer and is composed of:

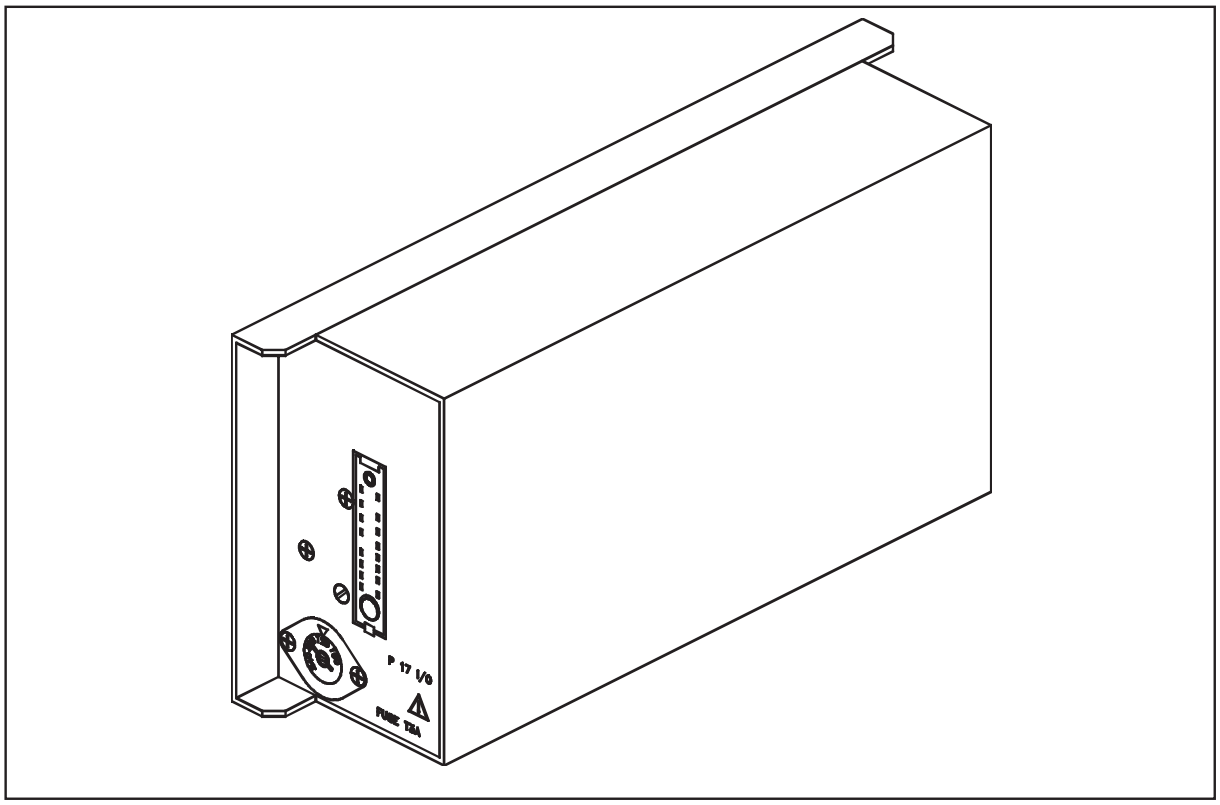
- Power transformer
- Left panel with input/output connector
- Right panel with pump connector and hand-held terminal connector
- PCB including: power supply and 3-phase output, analog and input/output section, microprocessor and digital section, display and keyboard circuits
- PCB external input/output interface
- The power supply converts the single phase (50-60 Hz) AC mains supply into a 3-phase, low voltage, medium frequency output which is required to power the Turbo-V pump.

The microcomputer generates the variable output frequency and controls the 3-phase output voltage according to the software and the gas load condition of the pump.

Moreover, it manages signals from sensors, input/output connection information to be displayed on the hand-held terminal, and gives outputs for a fully automatic operation.

A dedicated non-volatile RAM is used to store pump operating parameters and the input/output programmed information upon failure for a period of 10 years accumulated off time.

The controller can be operated by remote signals via the left panel connector and may be monitore/reprogrammed using the optional hand-held terminal via the right panel connector.



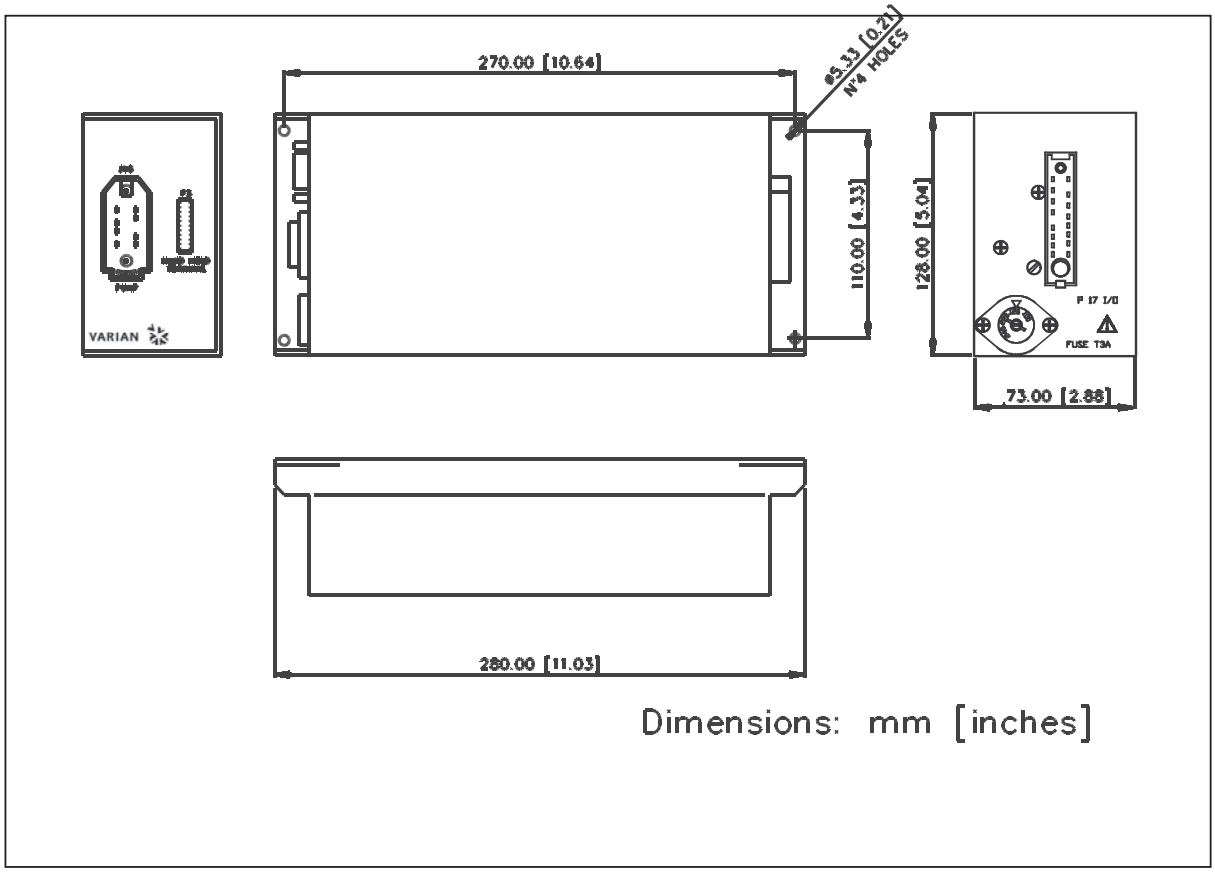
Turbo-V 70 Controller

CONTROLLER SPECIFICATIONS

Input:	
Voltage	100, 120, 220, 240 Vac ±10%,
Frequency	1-phase
Power	47 to 63 Hz
	350 VA maximum
Output:	
Voltage	54 Vac nominal ±10%, 3-phase
Frequency	1250 Hz, ±2%
Power	150 W maximum
Operating temperature	0 °C to +40 °C
Storage temperature	-20 °C to +70 °C
Fuse (mains)	T3.15 A (slow blow) disregarding the mains
Radio interference suppression	EN 55011 class A group 1 EN 61010-1 IEC1000-4-2, 1000-4-3, 1000 4-4
Auxiliary connectors:	
P17	INPUT/OUTPUT mains and signals (pins)
J16	Pump connector (sockets)
P3	Hand-held terminal connector (pins)
Weight:	3.8 Kg (8.4 lbs)

CONTROLLER OUTLINE

The outline dimensions for the Turbo-V 70 controllers are shown in the following figure.



Controller outline

Inspect the controller for any shipping damage.

WARNING!

High voltage developed in the controller can cause severe injury or death. Before servicing the unit, disconnect the input power cable.

NOTE

The Turbo-V controller must be positioned so that free air can flow through the holes. Connection to the mains must be made in accordance with the local law. Always connect the ground wire and use a properly grounded power socket to avoid electrical shock.

Line Voltage Change Over

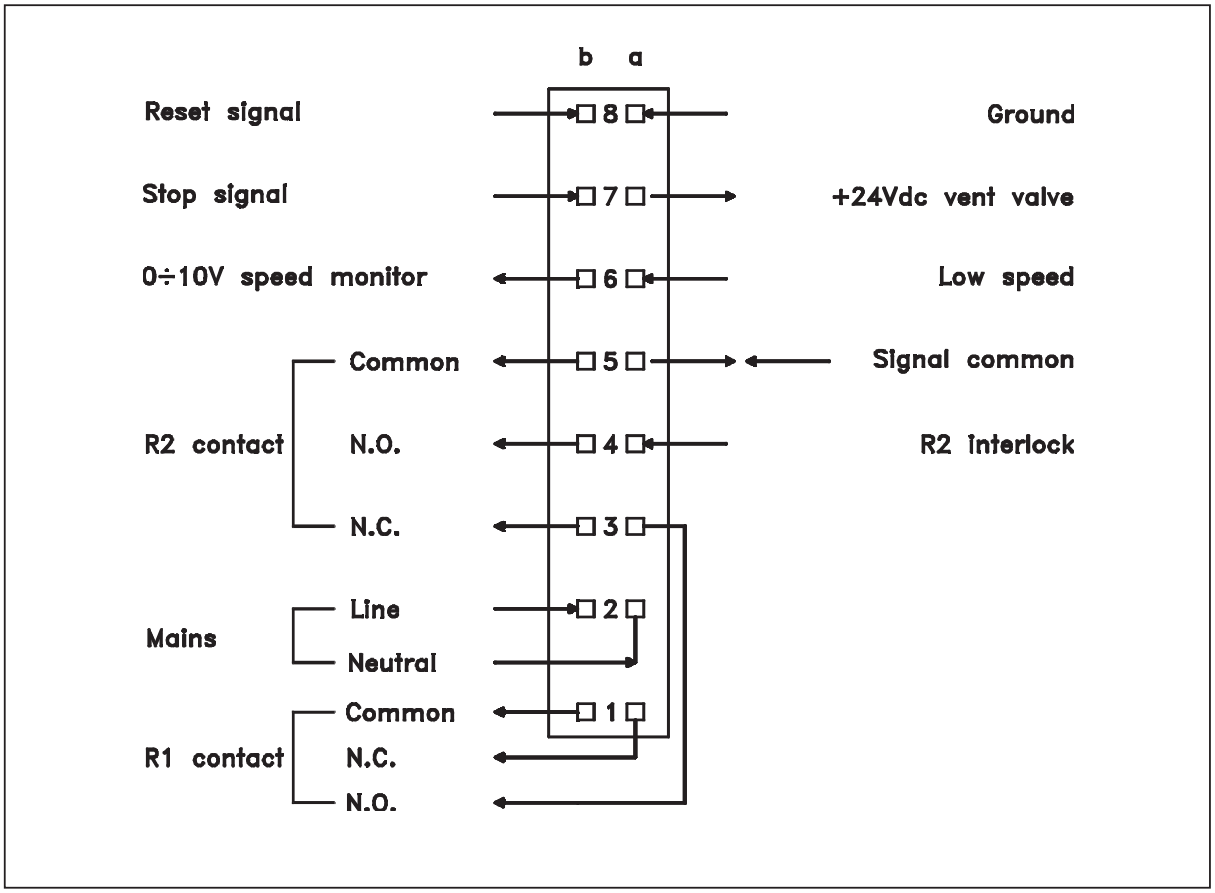
The controller is factory-set for 120 Vac operation.

If a change in line voltage operation is desired, proceed as follows:

- Disconnect the INPUT/OUTPUT connector J17.
- Select the desired operating voltage on left hand panel.
- Check voltage selector window for correct set and insert connector J17.

Input/Output Connector

Input/output signals and mains must be connected to J17 mating connector (not provided). Make the connections with AWG 20 (0.5 mm^2) to the pins indicated in the following figure, to obtain the desired capability.



P17 I/O Connector

Mains and Input Signals

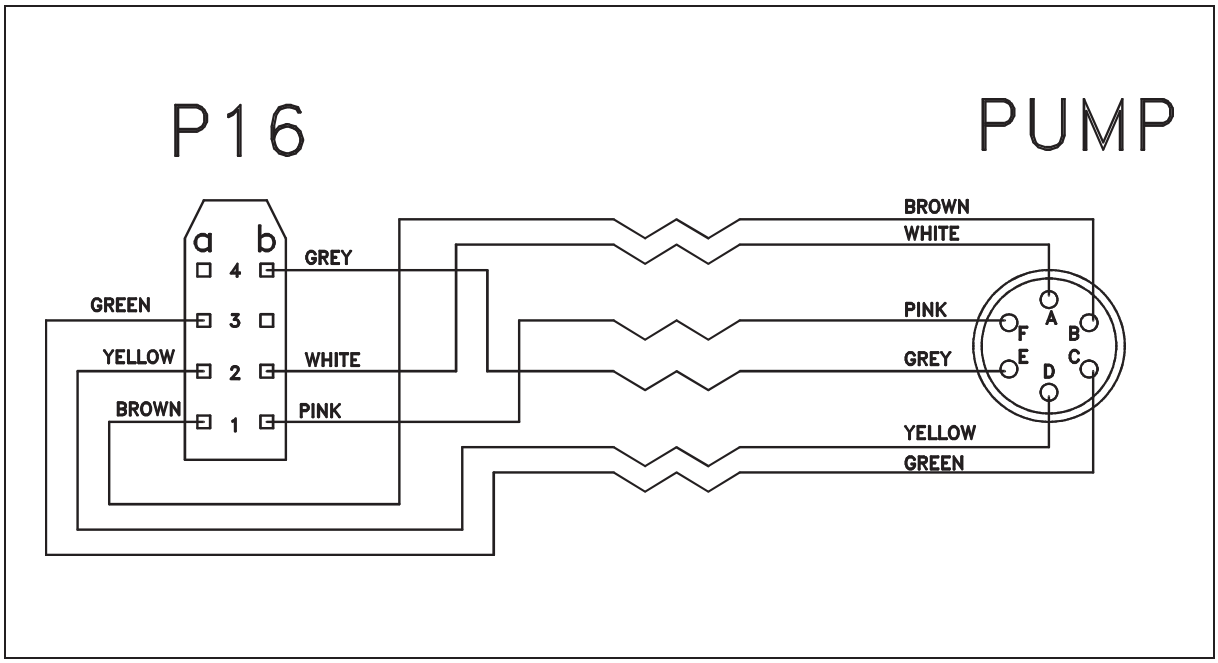
PIN	DESCRIPTION
a8	GROUND power connection
a2	MAINS neutral connection
b2	MAINS line connection
a5	SIGNAL COMMON connection for all input/output signals
a6-a5	Remote LOW SPEED, requires a permanently closed contact (relay contact, transistor etc). When the first time contact closes, the turbopump runs at low speed and when the contact opens, the turbopump reverts to high speed mode.
a4-a5	R2 INTERLOCK, requires a permanent closed contact to set at infinite the run-up time. After closure, when the contact is reopened, the run-up time is set to zero minutes.
b7-a5	Remote STOP signal, requires a closed contact and it is used to stop the pump. When the conract is closed, the turbopump and the interconnected devices are stopped.
b8-a5	Remote RESET, requires a momentarily closed contact for at least 0.5 seconds to reset the pump after failure.

Output Signals

PIN	DESCRIPTION
a5	SIGNAL COMMON connection for all input/output signals.
b6-a5	ANALOG OUTPUT SPEED signal 0 to +10 Vdc proportional to pump rotational speed 0 to 75 KRPM.
a7-a5	VENT VALVE output voltage. +24 Vdc without load; +6.5 Vdc with vent valve load (430 ohm). The output voltage is present when the turbopump is started, and will remain present for about 5 more seconds after the turbopump is stopped or after a power failure.

J16 Pump Connection

The pin configuration of the cable that connects the controller to the pump using a 0.5 mm^2 (AWG 20) wires is shown in the following figure.



Controller-to-pump cable

USE

General

Make all vacuum manifold and electrical connections and refer to Turbo-V pump instruction manual before to operating the Turbo-V controller.

WARNING!

To avoid injury to personnel and damage to the equipment, if the pump is laying on a table make sure it is steady. Never operate the Turbo-V pump if the pump inlet is not connected to the system or blanked off.

The controller is factory-set to operate via remote signals with a Soft Start mode that allows the pump to rump-up to Normal speed slowly. The minimum ramp-up time is 75 seconds and the maximum is about 45 minutes. Differents default selection has been made as per customer demans.

To modify the default values and to program the controller, connect the hand-held terminal to the Turbo-V controller.

NOTE

When the Turbo-V 70 pump is baked by a membrane pump, the Soft Start mode should be deselected.

Startup

If the forepump and the vent device are not operated by the controller, close the vent valve and switch on the forepump.
Apply mains to the I/O connector. Voltage and frequency output will be at the maximum level; then the frequency will decrease to a value proportional to the pump rotational (9 KRPM if the pump is completely stopped) and then it will accelerate until the normal condition has been reached.

The controller with the Soft Start mode allows the pump to ramp-up to Normal speed slowly with a minimum ramp-up time of 75 seconds and a maximum of about 45 minutes.If the Soft Start mode is deselected, the ramp-up will be done within 75 seconds.

Monitor Mode

After the mains is applied to the I/O connector the pump starts and the display shows in the following figure.

S	O	F	T		S	T	A	R	T		O	N		
		[	-	-	-	-	-	-	-	-	-	]		

Where the sign minus (-) become a square (▯) when the pump finish the ramp-up step. The active step is indicated by a flashing square (▯).

- As the ten steps are fully covered, the pump will reach the Normal operation. If during the Soft Start mode the current drawn by the pump exceed 1.4 A the speed of the pump is decreased to maintain the maximum power allowable (1.4 A).

  If within each step of the Soft Start mode the rotational speed of the pump do not rech the planned value within 15 minutes the display shows:

F	A	U	L	T	:									
O	V	E	R	T	I	M	E	:	S	X				

where **X** = the step number from 0 to 9 indicating the step number not passed.
When this message is displayed the pump is stopped.

- If the Soft Start mode has been deselected the display will change and shows:

P	U	M	P		I	S		S	T	A	R	T	I	N	G
1	2			X	X		K	R	P	M					

where:

1 2 = contrast inverted identifies the set point condition:
– **1** is displayed when relay R1 is de-energized and the related output is zero voltage.
– **2** is displayed when relay R2 is energized.
XX KRPM = indicates the actual theoretical rotational speed of the pump as a function of the controller output frequency (range 9 to 75 KRPM).

After START command, frequency output will be at the maximum level, then the frequency will decrease to a value proportional to the pump rotational speed (9 KRPM if the pump is completely stopped).

The pump will accelerate to its normal rotational speed and when this speed is reached, the display will be as follows, even if any previous display selection was made, and the normal condition has been reached.

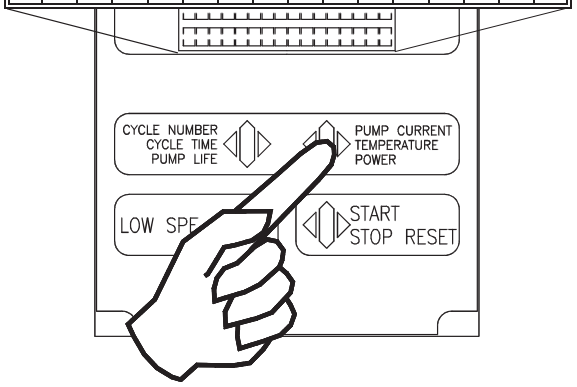
N	O	R	M	A	L		O	P	E	R	A	T	I	O	N
				X	X		K	R	P	M					

where: **XX** =indicates the rotational speed (75 KRPM for high speed, or 50 KRPM for low speed).

During acceleration of the pump or during any operating condition, it is always possible to select the other parameters to be displayed (PUMP CURRENT or CYCLE NUMBER push-buttons). If this is the case when the pump reaches the normal speed, the display reverts to the previous figure.

- At any time by pressing the CURRENT push-button and the display shows:

I	=	0	.	0	0	A				P	=			0	W
X			.	.		K	R	P	M		X	X	°	C	

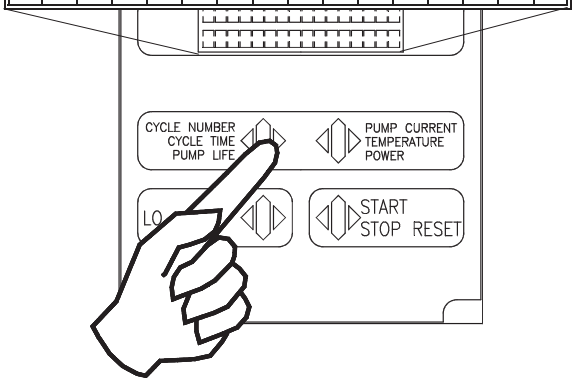


where:

- **I** = is the DC current drawn by the pump range (0.00 to 9.99 Ampere)
- **P** = is the DC power drawn by the pump (range 0 to 999 Watt)
- **KRPM** = is the theoretical rotational speed of the pump as a function of the controller output frequency (range 9 to 75 KRPM)
- °**C** = is the temperature of the outer ring of the upper bearing (range 00 to 99 °C)
- **X** = during operation a selected set point condition (1 or 2 contrast inverted) appears when the programmed threshold speed value is not reached.

- Press the CYCLE NUMBER and the display shows:

X	X	X	X	C	Y	C	L	E		X	X	X	X	X	m
P	U	M	P		L	I	F	E		X	X	X	X	X	h



where:

- **CYCLE** = are the cycles performed (range 0 to 9999)
- **m** = is the elapsed time related to the cycle number displayed (range 0 to 99999 minutes)
- **PUMP LIFE** = is the total operation time of the pump (range 0 to 99999 hours).

PROGRAM MODE

FRONT / REMOTE/ 232 Selection

- Press CYCLE NUMBER and PUMP CURRENT push-buttons together for at least 2 seconds and the processor enters in a routine where it is possible to program the controller.
  In this routine, the CYCLE push-button is used for choosing/changing the value or condition; the PUMP CURRENT push-button is used to enter and confirm the value. At any time it is possible to exit this routine by pressing the CYCLE and PUMP CURRENT push-buttons at the same time for at least 2 seconds.
  The display shows:

S	O	F	T		S	T	A	R	T		M	O	D	E	
S	E	L	E	C	T	I	O	N	:		X	X	X		

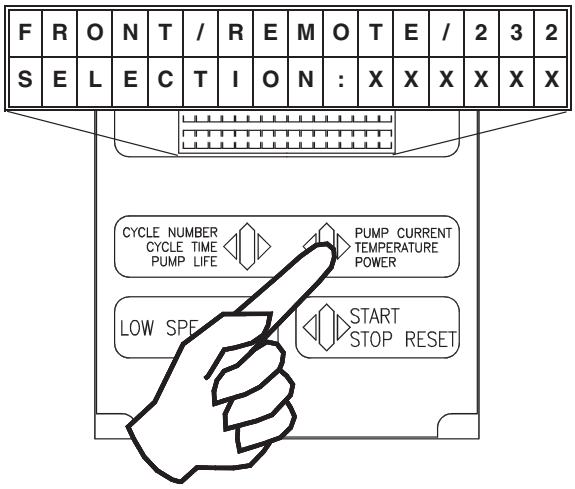
where: **XXX** = YES or NO.

If YES is selected, the Soft Start mode allows the pump to ramp-up the Normal speed within ten steps.
When NO is selected, the Soft Start mode is deselected and the ramp-up of the pump will be done within 75 seconds.
The controller is factory set to YES.

NOTE

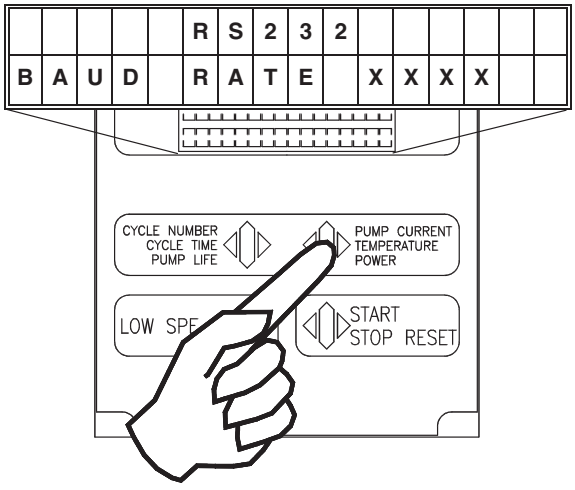
The Soft Start mode may be deselected/selected only when the pump is stopped.

If necessary press CYCLE NUMBER to select YES or NO, then enter the selection by pressing the PUMP CURRENT push-button. The display shows:



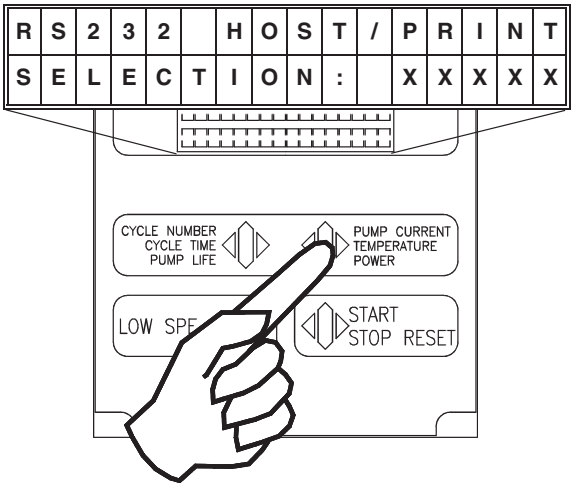
where: **XXXXXX** = means the word FRONT or REMOTE, or RS 232 depending on the last selection.

After choosing the desired selection by pressing the CYCLE push-button, press the PUMP CURRENT push-button to enter the value.
The display shows:



where: **XXXX** = means 600, 1200, 2400, 4800, 9600 baud rate for the host computer or printer communication.

If necessary, select the desired value by pressing the CYCLE NUMBER, then enter the value by pressing the PUMP CURRENT push-button.
The display shows:



where: **XXXX** == means HOST or PRINT.

Select HOST or PRINT by pressing the CYCLE push-button. With the RS 232 connected, a bidirectional communication is established by selecting HOST. Data are sent to an external computer every time the external computer asks for the values. The data available are:

- Pump/controller operating condition
- Cycle time
- Pump life
- Pump temperature
- Pump current
- Pump voltage
- Controller output frequency
- Cycle number
- R1 condition
- R2 condition
- Life time and cycle # zeroing
- Configuration parameter readings
- Configuration parameter setting

If PRINT is selected and a printer is connected on RS 232 line, a unidirectional communication is established and every minute the data are sent to the printer, even if the pump is not running.

The set of data available are:

- Pump speed KRPM
- Pump temperature
- Pump current A
- Pump power W
- R1 condition
- R2 condition

The controller is factory-set to HOST.

- Confirm the selection by pressing the PUMP CURRENT push-button.

The display will be as shown in the following figure.

Monitor Relay Programming

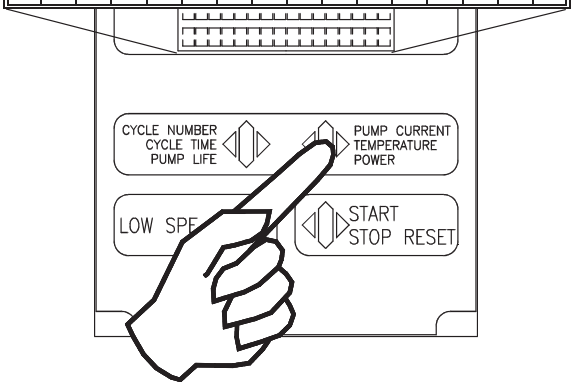
- The display shows:

S	P	E	E	D		T	H	R	E	S	H	O	L	D	
S	E	L	E	C	T	I	O	N	:	X	X	K	R	P	M

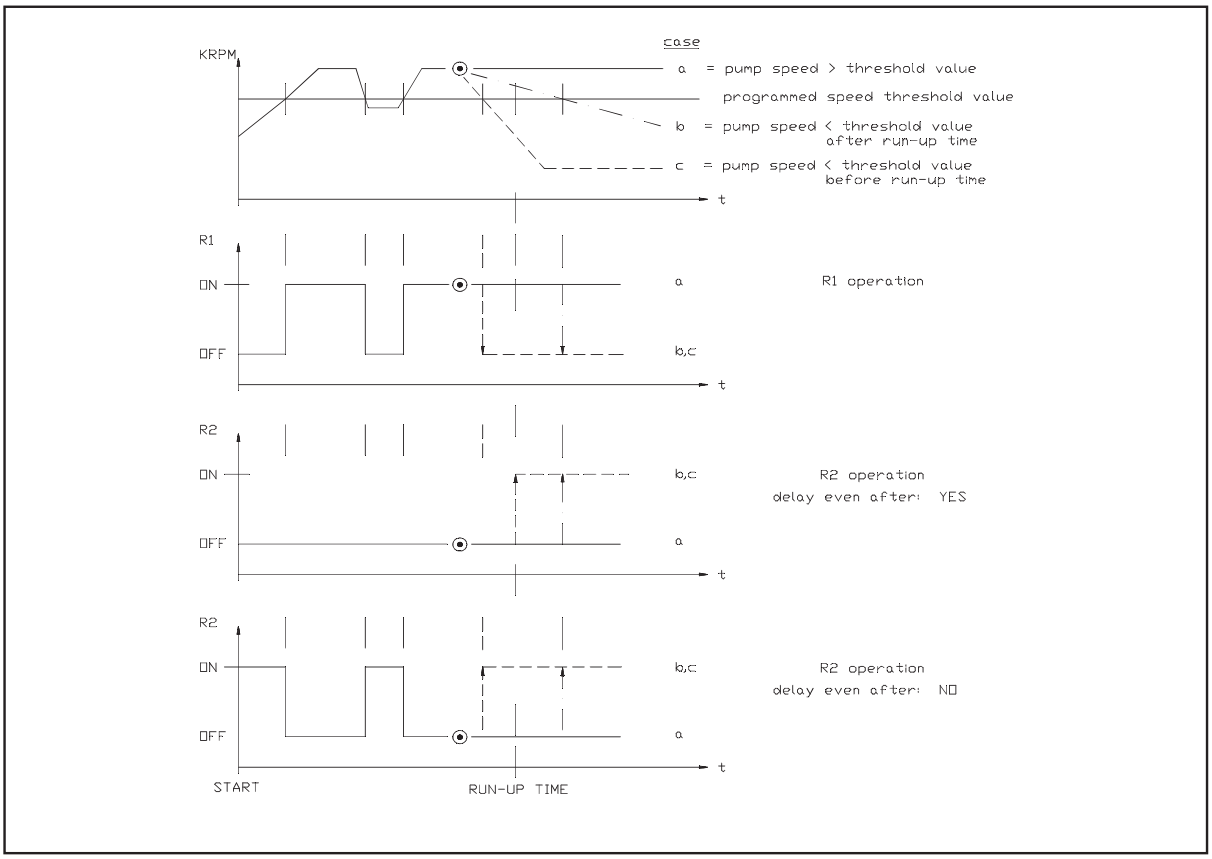
where: **XXKRPM** = is the switch point of relay R1 at the preset turbopump speed, adjustable from 00 to 99 KRPM.
The speed threshold will condition the R1 and R2 operation (see the following cycle diagram) and it is factory-set to 40 KRPM.

Select the first number by pressing the CYCLE NUMBER push-button, then enter the value by pressing the PUMP CURRENT push-button. Do the same for the second number. After pressing the PUMP CURRENT the second time, the display will be as shown in the following figure.

R	U	N	-	U	P		T	I	M	E					
S	E	L	:		X	X	h		X	X	m		X	X	s



where: **RUN-UP TIME** = is the interval time from start to speed threshold value in hours, minutes, seconds. Select from 00 to 99 hours, and from 00 to 59 minutes or seconds.



Cycle diagram

Select the run-up time according to the chamber volume and/or operating cycle feature by pressing the CYCLE NUMBER push-button to select the desired number, then press the PUMP CURRENT push-button to enter the data.

The run up time is factory-set to:
00h 08m 00s.

When the last digit is entered, the display will be as shown in the following figure.

D	E	L	A	Y		E	V	E	N		A	F	T	E	R
	T	H	R	E	S	H	O	L	D	:		X	X	X	

where:

XXX = YES or NO.

By pressing the CYCLE NUMBER push-button, select YES or NO.

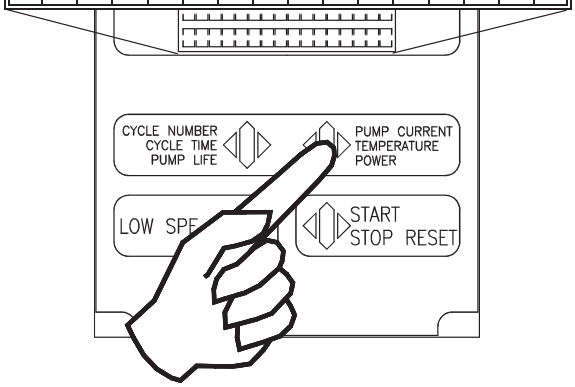
If YES is selected, R2 energizes from the start of the turbopump and deenergizes after the run-up time when the pump rotational speed becomes lower than the programmed speed threshold value.

If NO is selected, R2 energizes from the start of the turbopump and - after the rotational speed of the pump exceeds for the first time - the speed threshold value the R2 deenergizes once the pump speed becomes lower than the programmed speed threshold value.

The function is factory-set to YES.

After selection, press PUMP CURRENT to confirm; the display will be as shown in the following figure.

C	O	N	T	R	O	L	L	E	R		O	F	F		
W	H	E	N		R	2		O	F	F	:		X	X	X



where:
XXX = YES or NO.

If YES is selected when R2 deenergizes the controller, and the interconnecting devices are automatically switched off.

This function is factory set to YES.

After selection, press PUMP CURRENT to confirm; the display will be as shown in the following figure.

Reset Command

- The display shows:

P	U	M	P		L	I	F	E		X	X	X	X	X	h
			R	E	S	E	T	?		X	X	X			

where:
- **PUMP LIFE** = is the elapsed operating time range 000 to 99999 hours.
- **RESET XXX** = YES or NO.

If YES is selected, the pump life shall be reset to 000. After selecting YES, press the PUMP CURRENT push-button to enter the command and the display shows as follows.

NOTE

When PUMP LIFE is reset to 000, the CYCLE number is also reset to 000.

Operating the Pump

After the starting period, if the system has a vacuum leak or the pressure in the pump/chamber is high (from 1 mbar to atmosphere), the pump continues to operate indefinitely.
If the gas load at the turbopump inlet flange continues to stay high, the power drawn by the turbopump increases up to the maximum value. Than the Turbo-V pump is slowed down in proportion to the gas load at least until it reaches about 9 KRPM.

This will occur either in NORMAL operation or with the LOW SPEED selected.
As soon as the gas load decreases, the pump will automatically accelerate to reach normal operation.
The pump can be stopped at any rotational speed and can be restarted at any rotational speed from either the front panel buttons or the remote connections.
The controller automatically synchronizes the output to the rotational speed of the pump and then accelerates linearly up to the nominal speed or within steps if the Soft Start has been selected.

Low Speed Operation

NOTE

With the FRONT panel operation selected, the remote and RS 232 operations are inoperative; conversely, the CYCLE NUMBER and PUMP CURRENT pushbuttons are always active, even when the operating mode selected is REMOTE or RS 232.

This feature is provided for operating the pump at moderate high pressure with high gas throughput. To operate in this low speed mode, engage the LOW SPEED push-button once if the display shows:

N	O	R	M	A	L		O	P	E	R	A	T	I	O	N
				X	X		K	R	P	M					

or twice if the display shows other parameters, either before starting the pump or after it is operating.
If LOW SPEED is selected before starting the pump, the display shows:

R	E	A	D	Y		F	O	R		L	O	C	A	L	
S	O	F	T		S	T	A	R	T					L	S

The pump reaches the Normal high speed, then decrease the speed to the low speed value and the display shows:

A	P	P	R	O	A	C	H	I	N	G		L	S		
				X	X		K	R	P	M				L	S

If the Soft Start has been deselected the display shows:

P	U	M	P		R	E	A	D	Y	:		P	U	S	H
	S	T	A	R	T		B	U	T	T	O	N		L	S

where: **LS** = means low speed mode is selected.

After starting, a **LS** appears on the right bottom corner of the following displays:

S	O	F	T		S	T	A	R	T		O	N			
		[	-	-	-	-	-	-	-	-	-	]	L	S

P	U	M	P		I	S		S	T	A	R	T	I	N	G
1	2			X	X		K	R	P	M			L	S	

N	O	R	M	A	L		O	P	E	R	A	T	I	O	N
				X	X		K	R	P	M			L	S	

With normal LOW SPEED operation, the pump will run at about 2/3 of its nominal speed and achieves a base pressure somewhat higher than the standard specifications. If the gas load becomes higher, the controller output frequency and voltage start to decrease automatically, and the Turbo-V pump is slowed down in proportion to the gas load until it reaches about 9 KRPM.

If the LOW SPEED mode is selected after normal operating condition is reached, the display shows:

A	P	P	R	O	A	C	H	I	N	G			L	S	
				X	X		K	R	P	M				L	S

while approaching the low speed value.

When the low speed mode is deselected, the pump starts to accelerate to its rotational speed.
When this is reached, the display will be as shown in the following figure.

N	O	R	M	A	L		O	P	E	R	A	T	I	O	N
				X	X		K	R	P	M					

Pump Shutdown

With the FRONT panel operation, press the front panel STOP pushbutton; the power from the turbopump is removed and the pump will begin to slow down.

When a stop signal is provided via a remote contact, the display will be as shown in the following figure.

	E	X	T	E	R	N	A	L		S	W	I	T	C	H
				b	7		C	L	O	S	E	D			

Power Failure

In the event of a power failure (momentary or long term), the Turbo-V controller will stop the turbopump and all the interconnected pumps/devices. The Turbo-V vent valve device, if used, will vent the turbopump only if the power failure is longer than the preset delay time. When power is restored, the Turbo-V controller automatically restarts the interconnected devices and the turbopump in the proper sequence.

The display shows:

P	U	M	P		I	S		S	T	A	R	T	I	N	G
1	2			X	X		K	R	P	M					

until normal operation achieved.

Remote Control Mode Operation

If remote signals are used to operate the controller, it must be programmed for remote operation (see paragraph "FRONT/REMOTE/232 Selection") and when ready to start, the display shows as in the following figure.

As soon as the remote operation is selected the pump will start automatically if b7 stop signal is not applied.

R	E	A	D	Y		F	O	R		R	E	M	O	T	E
S	O	F	T		S	T	A	R	T						

If the Soft Start has been deselected the display shows:

P	U	M	P		R	E	A	D	Y	:		U	S	E	
	R	E	M	O	T	E		S	T	A	R	T			

With or wihout Soft Start mode selected the START/STOP and LOW SPEED front panel pushbuttons are inoperative, while the CYCLE NUMBER and PUMP CURRENT pushbuttons are always active.

ERROR MESSAGES

For a certain type of failure, the controller will self-diagnose the error and the following messages will be displayed if the hand-held terminal is connected.

NOTE

If the pump is not connected, the display will be as shown in the following figure.

C	H	E	C	K		C	O	N	N	E	C	T	I	O	N
			T	O		P	U	M	P						

Check connection between controller and pump, then press START RESET pushbutton twice to start the pump.

NOTE

If within each step of the soft start mode the rotational speed of the pump do not reach the planned value within 15 minutes the display will be as shown in the following figure.

F	A	U	L	T	:									
O	V	E	R	T	I	M	E	:	S	X				

Verify that systems has no leaks than press STOP RESET pushbutton twice to start the pump.

NOTE

If the upper bearing/pump temperature exceeds 60 °C, the pump is shut off, and the display will be as shown in the following figure.

F	A	U	L	T	:			P	U	M	P			
	O	V	E	R	T	E	M	P	.					

The message will stay on until the temperature decreases below threshold value. Press the STOP RESET pushbutton twice to start the pump.

NOTE

If the controller transformer temperature exceeds 90°C, the pump is shut off, and the display will be as shown in the following figure.

F	A	U	L	T	:	C	O	N	T	R	O	L	L	E	R
	O	V	E	R	T	E	M	P	E	R	A	T	U	R	E

The message will stay on until the temperature decreases below threshold value. Press the STOP RESET pushbutton twice to start the pump.

NOTE

If in normal operation (after the starting phase) the current drawn by the pump is higher than programmed (1.5 A), the pump and the inter-connected devices are switched off and the display will be as shown in the following figure.

F	A	U	L	T	:									
T	O	O		H	I	G	H		L	O	A	D		

Check that pump rotor is free to rotate then press the STOP RESET pushbutton twice to start the pump.

NOTE

After the starting phase if the output connection is shorted (output current higher than 2.2 A), the display will be as shown in the following figure.

F	A	U	L	T	:									
S	H	O	R	T		C	I	R	C	U	I	T		

Check connections and shortages between pump and controller, then press the STOP RESET pushbutton twice to start the pump.

NOTE

If the pump rotational speed decreased below the programmed speed threshold value, and the controller OFF is selected, when R2 deenergizes, the display will be as shown in the following figure.

F	A	U	L	T	:									
R	2		D	E	L	A	Y		O	V	E	R		

Check for system leaks or gas load conditions, then apply the reset signal b8 to restart the pump.

The following message is displayed if the fuse of the transformer secondary blows:

			C	O	N	T	R	O	L	L	E	R		
				F	A	I	L	U	R	E				

Since no operation can be carried out, contact VARIAN.

CONTROLLER TEST

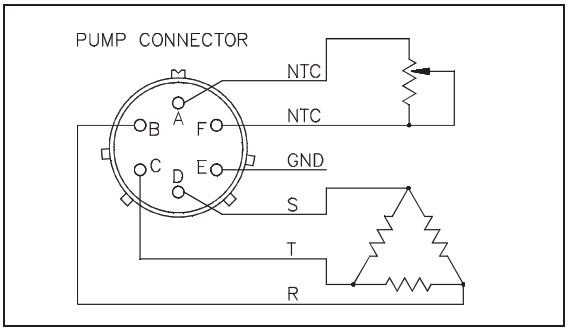
a) Equipment required

- Digital voltmeter (DVM) true RMS.
- Dummy load: 3 x 48Ω, 50 W each or 3 x 78Ω, 50 W each.

Potentiometer 50 KΩ, 1/4 W minimum.

b) Test set up

- Remove the pump connector from the turbopump.
- Disconnect the Turbo-V controller connectors (J17 and P16).
- Remove the cover from the Turbo-V controller.
- Set potentiometer to 30 KΩ and connect it as directed in the following figure.
- Connect the hand-held terminal, check the line voltage selector and connect J17 I/O connector, and select the FRONT panel operation.



Dummy load connections

Power Supply Test

a) DC voltage test

Check the DC voltages referring to test points indicated in the following figure. The meter should read:

- + 5Vdc ±5%
- ±12 Vdc ±5%
- Ground reference = case of Q3

On the controller front panel, push the START pushbutton and check:

- 54 Vdc ±10% between TP3(-) and TP5(+)
- 24 Vdc ±15% on the fan connector.

b) AC three-phase output voltage test

Connect P16 and on the pump connector connect the DVM in turn between: pins B and C, B and D, C and D.

The meter should read 44 Vac ±15%; a different value of 0.4 Vac is tolerable between phase and phase.

c) Front panel check

On the controller front panel, press the CURRENT pushbutton and check:

- Current 0.00 A
- Power 0.00 W
- Speed 70 KRPM
- Temperature 25 °C ±2 °C

On controller front panel, press STOP and remove J17 from the controller.

Test with Dummy Load

– Connect the 48Ω or the 78Ω dummy loads to the pump connector pins B, C, D, as shown in the previous figure.
– Disconnect the potentiometer, set it to 10 KΩ, and then reconnect it.
– Connect the power cable.

On the hand-held terminal push the START and CURRENT pushbuttons and check the front panel display as shown in the following table.

	During start-up without Soft Start mode		**After start-up**	
	With 48Ω dummy load	**With 78Ω dummy load**	**With 48Ω dummy load**	**With 78Ω dummy load**
Current ±10%	1.4 A	0.6 A	1.3 A	0.45 A
Power ±10%	80 W	40 W	70 W	24 W
Speed ±4 KRPM	34	75	9	75
Temperature ±2 °C	52 °C	52 °C	52 °C	52 °C

– Check the 3-phase ac output voltage.
After start up it should be:
42 Vac with 78Ω dummy load and
42 Vac with 48Ω dummy load.

On the hand-held terminal press the STOP pushbutton and remove J17 from the controller.

Pump over-Temperature Test

– Disconnect the potentiometer, set it to 5KΩ, and then reconnect it.
– Disconnect the dummy loads.
– Connect J17.
– On the hand-held terminal push the START pushbutton, then press the CURRENT pushbutton. The temperature reading should be 71 °C ±2 °C. All the other values should be zero.
– Check the 3-phase ac output voltage.
It should be zero.
– On the hand-held terminal press STOP and remove J17 from the controller.

Functional Test

Perform the functional test with the turbopump, taking care to check the ramp sequence and start up time.

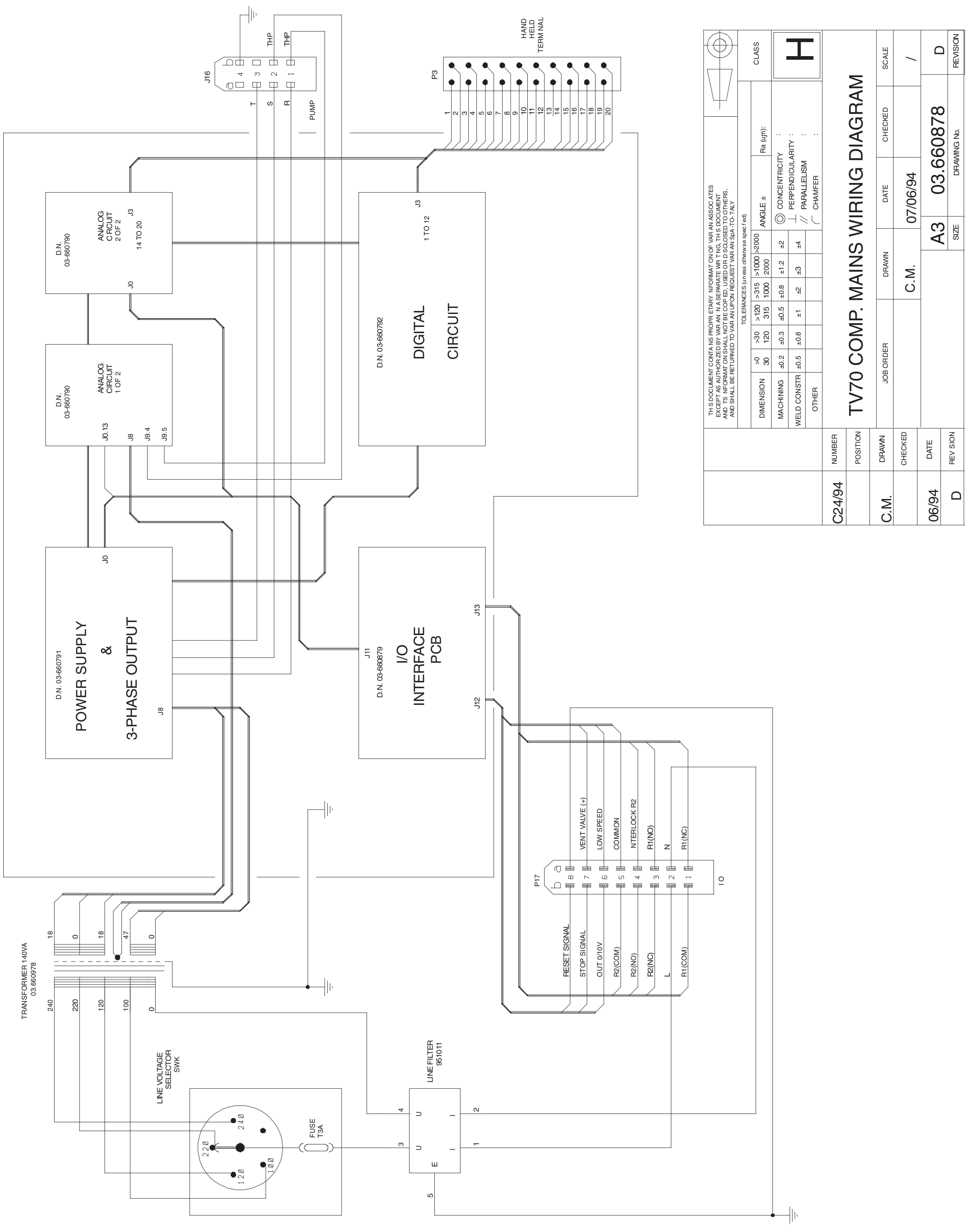
After test, on the hand-held terminal press STOP and select the REMOTE operation. Disconnect J17 and remove the hand-held terminal.

ACCESSORIES AND SPARE PARTS

DESCRIPTION	PART NUMBER
Input/output mating connector	969-9855

OPTIONS

DESCRIPTION	PART NUMBER
Controller to pump cable (3 m extension)	969-9863L0300
Hand held terminal	969-9860


TV70 COMP. MAINS WIRING DIAGRAM
03.660878
DRAWING No.
A3
SIZE
07/06/94
C.M.
D
REVISION
H
CLASS
C24/94
06/94
POWER SUPPLY
&
3-PHASE OUTPUT
D.N. 03-660791
DIGITAL
CIRCUIT
D.N. 03-660792
I/O
INTERFACE
PCB
D.N. 03-660879
ANALOG
CIRCUIT
1 OF 2
ANALOG
CIRCUIT
2 OF 2
D.N.
03-660790
HAND
HELD
TERMINAL
P3
J16
PUMP
THP
P17
TRANSFORMER 140VA
03.660978
LINE VOLTAGE
SELECTOR
SWK
FUSE
T3A
LINE FILTER
951011
RESET SIGNAL
STOP SIGNAL
OUT 0/10V
R2(COM)
R2(NO)
R2(NC)
L
R1(COM)
VENT VALVE (+)
LOW SPEED
COMMON
INTERLOCK R2
R1(NO)
N
R1(NC)
CONCENTRICITY
PERPENDICULARITY
PARALLELISM
CHAMFER
DIMENSION
MACHINING
WELD CONSTR
OTHER
JOB ORDER
DRAWN
CHECKED
DATE
SCALE
NUMBER
POSITION

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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Phone : +1 781 8617200	Phone: +39 011 9979111	
Fax: +1 781 8609252	Fax: +39 011 9979330	

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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