VARIAN
vacuum technologies

Turbo-V 550 Controller

Model 969-9444
Model 969-9544

- *(I) MANUALE DI ISTRUZIONI*
- *(D) BEDIENUNGSHANDBUCH*
- *(F) NOTICE DE MODE D'EMPLOI*
- *(E) MANUAL DE ISTRUCCIONES*
- *(P) MANUAL DE ISTRUÇÕES*
- *(NL) BEDRIJFSHANDLEIDING*
- *(DK) ISTRUKSTIONSBOG*
- *(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*

87-900-873-01 (F)
JULY 2006

Turbo-V 550 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°

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

VARIAN

GE NERAL 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 people, non-authorized interference with the equipment or any action contrary to that provided for by specific national standards. The Turbo-V 550 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 550 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 550 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.

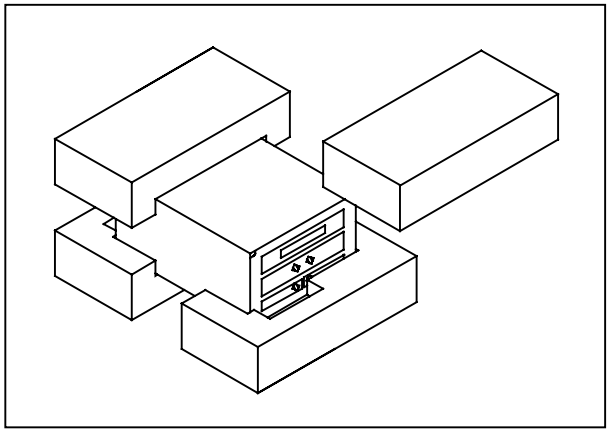
STORAGE

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.



Controllers packing

Each controller is factory set for a specific power supply:

- model 969-9444 is factory set for 220 Vac operation
- model 969-9544 is factory set for 120 Vac operation

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

- Disconnect the power cord from the controller socket.
- On power entry module, check back door for voltage selector set.
- Using a small screw driver, pull out the voltage selector and fuses.
- Select the operating voltage then firmly insert the voltage selector and fuses in place.
- Check voltage selector window for correct set and connect power cord.

INSTALLATION

WARNING!

The Turbo-V controller must be powered with 3-wire power cord (see orderable parts table) and plug (internationally approved) for user's safety. Use this power cord and plug in conjunction with a properly grounded power socket to avoid electrical shock and to satisfy CE requirements . 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 controllers model 969-9444 and 969-9544 are supplied with the pump cable fixed to the controller rear panel.

See the appendix “Technical Information” for detailed Information about the above mentioned and the other connections, and about the options installation.

USE

This paragraph describes the fundamental operating procedures. Detailed information and operating procedures that envolve optional connection or option are supplied in the paragraph “USE” of the appendix “Technical Information”. Make all vacuum manifold and electrical connections and refer to Turbo-V pump instruction manual before operating the Turbo-V controller.

WARNING!

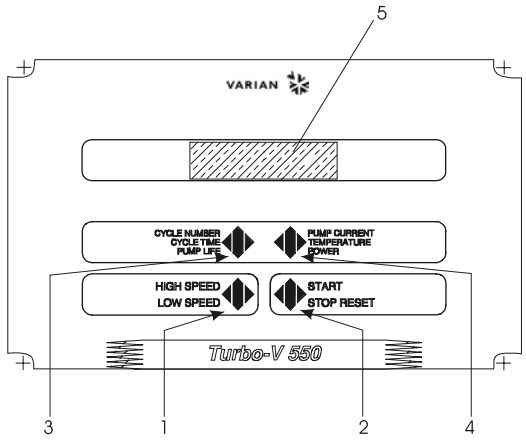
To avoid injury to personnel and damage to the equipment, if the pump is laying on a table make sure it is steady. Never operate the Turbo-V pump if the pump inlet is not connected to the system or blanked off.

NOTE

The input signal J1 connector should be left in position including the shipping links if no external connections are made. The forepump and Turbo-V pump can be switched on at the same time.

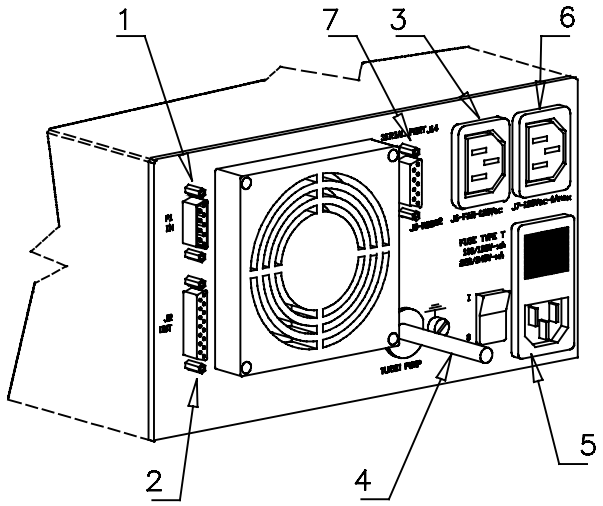
Controller controls, indicators and connectors

The following paragraph illustrates the Controller 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.

Controller 969-9444, 969-9544 front panel



1. Logic input signals connectors (mating connector supplied with link).
2. Logic output signals connector and pump current monitor.
3. Power output connector (120 Vac,1 A for pump cooling fan).
4. Pump cord.
5. Controller power entry module consisting of mains fuses, voltage change over, mains socket and EMC filter.
6. Power output connector (120 Vac) for vent device, forepump contactor coils etc.
7. Provision for RS232 communication port connector (provide as an option).

Controller 969-9444 and 969-9544 rear panel

USE PROCEDURE

Controller Startup

To startup the controller plug the power cable into a suitable power source and set the line switch to the position 1.

Starting the pump

To start the pump press the START push-button on the controller front panel.

Pump Shutdown

To shutdown the pump press the STOP push-button on the controller front panel.

MAINTENANCE

The Turbo-V 550 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 pump is to be scrapped, it must be disposed off 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.

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.

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.
PUMP WAITING INTERLOCK	The interlock signal of P1 connector is activated by an interruption of the link between pin 3 and 8 of J1 connector, or because the external interlock signal is open.	Reset the short circuit between pin 3 and pin 8 of J1 connector, or close the external interlock signal.
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 (6 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 16 A).	Check connections and shortages between pump and controller. Press the START push-button twice to start the pump.
SYSTEM OVERRIDE	The pump is stopped by an emergency stop signal provided via a remote contact.	Remove the controller power cable and check the emergency condition. Then reconnect the power cable and press the START push-button twice to start the pump.
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.

TURBO-V 550 CONTROLLER DESCRIPTION

The controller is available in two versions:

- Model 969-9444 (220 Vac, 50-60 Hz)
- Model 969-9544 (120 Vac, 50-60 Hz)

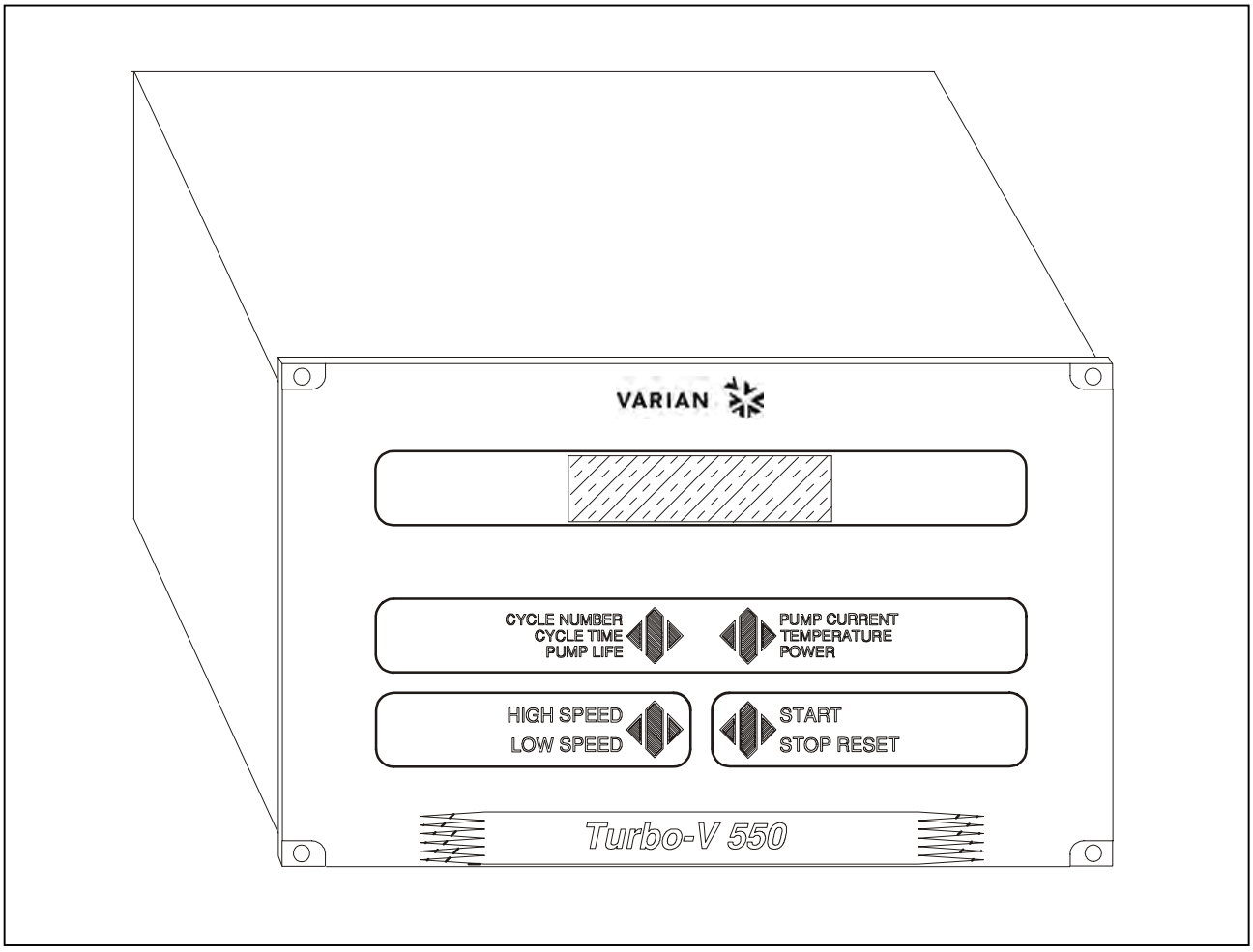
The models are provided with a front panel with an LCD alphanumeric display to indicate the operating conditions/parameters of the Turbo-V pump and a keyboard, and a rear panel with input/output connectors.
The following figure is a picture of the Turbo-V controllers. The controller is a solid-state frequency converter which is driven by a single chip microcomputer and is composed of:

- Power transformer
- Front panel display and keyboard
- Rear panel with input/output connectors

PCB including: power supply and 3-phase output, analog and input/output section, microprocessor and digital section, display and keyboard circuits. 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, and gives outputs for a fully automatic operation.
An EEPROM internal to the microprocessor is used to store pump operating parameters and the input/output programmed information.

The controller can be operated via:

- Front panel switches
- Remote signals via rear panel connectors
- RS 232/485/422 serial link (option).



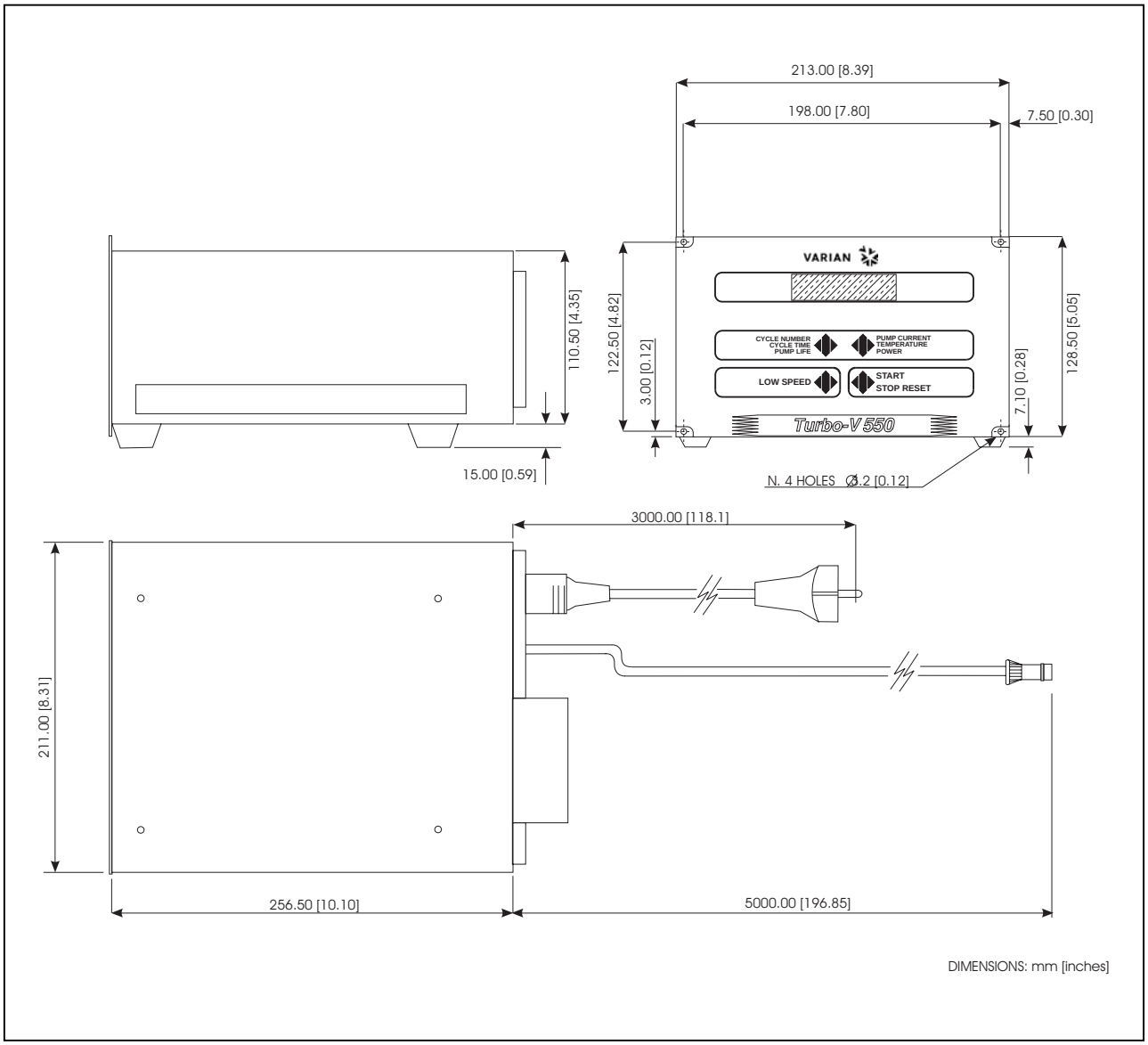
Turbo-V 550 controllers

CONTROLLER SPECIFICATIONS

Input:	
Voltage	100, 120, 220, 240 Vac ±10%, 1-phase
Frequency	47 to 63 Hz
Power	600 VA maximum
Output:	
Voltage	54 Vac nominal ±10%
Frequency	700 Hz ±2%
Power	420 W maximum
water cooling	320 W
air cooling	220 W
Operating temperature	0°C to +40 °C
Storage temperature	-20°C to +70°C
Fuse (mains)	2 x T4A(slow blow) for 220 or 240 input Voltage 2 x T8A(slow blow) for 100 or 120 input Voltage
P1 optoisolator input	Minimum ON 3mA Maximum 5mA
J2 optoisolator output	24 Vdc, 60 mA
J6 output (fan)	120Vac, 1A disregarding the mains
J7 output (forepump coil, etc.)	120 Vac, 1A 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	
P1	External INPUT signals (pins)
J2	OUTPUT signals (sockets)
J6	Output fan Voltage
J7	Valve, forepump socket
J14	RS 232/422/485 connection (optional)
Interconnecting cables	Mains cable (3-wire, 3-meter long) Pump cable (6-wire, 5-meter long)
Weight (both models)	10.7 kg (24 lbs)

CONTROLLER OUTLINE

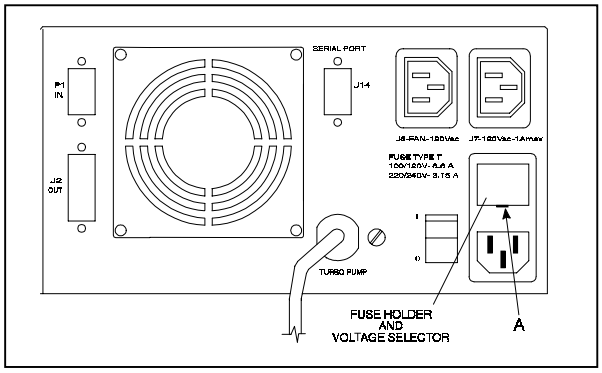
The outline dimensions for the Turbo-V 550 controllers are shown in the following figures:



Controller models 969-9444 and 969-9544 outline

FUSE HOLDER AND VOLTAGE CHANGER ASSEMBLY

The following figure shows the location of this assembly.



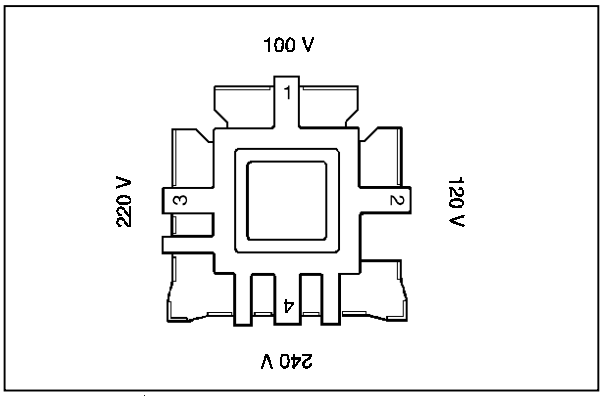
Rear panel

Proceed as follows to replace one or both fuses:

- Remove the assembly by levering in position **A** with a small screwdriver.

- Replace the fuse.

  Use only T-type fuses of the following characteristics:
  - 100/120 Vac 6.3 A
  - 220/240 Vac 3.15 A

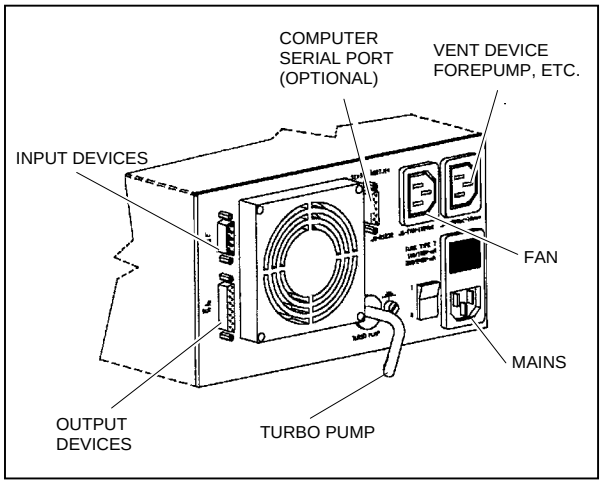


Voltage Changer

To change the power supply voltage rating after having removed the assembly as explained above, extract the voltage changer and then reposition it to view the desired voltage rating.

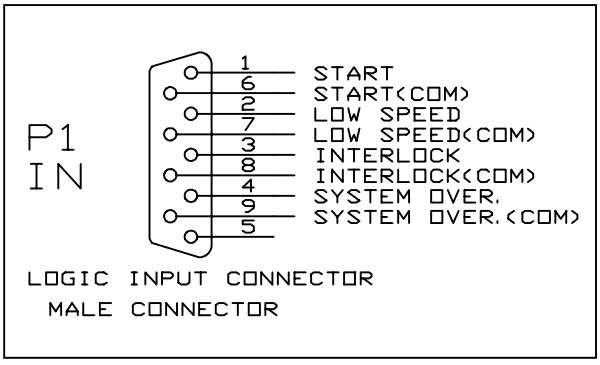
INTERCONNECTIONS

The following figure shows the Controller interconnections.



Controller models 969-9444 and 969-9544 interconnection

Connection P1
Logic Input Interconnections



P1 input connector

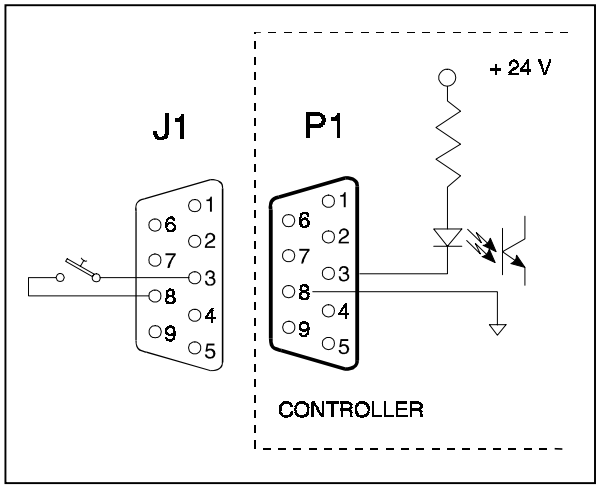
All the logic input to the controller must be connected at J-1 mating connector. With the provided J1 mating connector (shipped with pin 3 and pin 8 shorted) make the connections with AWG 24, (0.24 mm) or smaller wire to the pins indicated in the figure to obtain the desired capability. The following table describes the signals available on the connector.

PIN	DESCRIPTION
1-6	Remote START/STOP optically isolated from the internal circuit, requires a permanently closed contact (relay contact. transistor, etc.). When the contact closes. the turbopump starts, and when the contact opens. the turbopump is stopped. With the remote mode operation selected, the front panel push-button is inoperative.
2-7	Remote LOW SPEED optically isolated from the internal circuit, requires a permanently closed contact (relay contact, transistor. etc.). When the contact closes, the turbopump runs at low speed and when the contact opens, the turbopump reverts to high speed mode. With the remote mode operation selected, the front panel push-button is inoperative.
3-8	INTERLOCK optically isolated from the internal circuit, this signal can be used to delay the starting of the turbopump. requires a permanent closed contact before starting the turbopump.
4-9	SYSTEM OVERRIDE optically isolated from the internal circuit, this signal is used to stop the pump in emergency condition, requires a closed contact. When the contact is closed, the turbopump and the interconnected devices are stopped.

NOTE

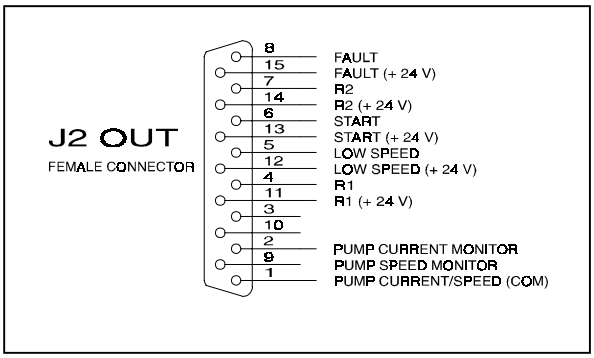
Pin 3-8 must be shorted to allow the Turbo-V 550 pump to start if no interlock contact is connected. if, after starting the pump, the interlock contact opens, it has no effect on the operation and the pump continues to turn.

The following figure shows a typical contact logic input connection and the related simplified circuit of the controller.



Typical logic input

Connection J2
Logic Output Interconnections



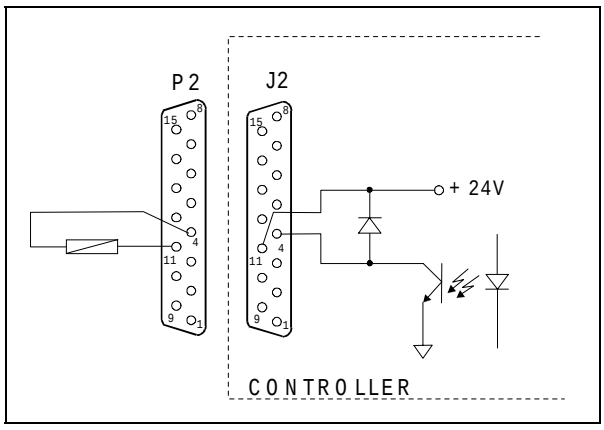
Logic output connector

All the logic output from the controller must be connected at P2 mating connector. With the optional P2 mating connector make the connection with AWG 24 (0.25 mm) or smaller wire to the pins indicated in the figure to obtain the desired capability. The following table describes the signals available on the connector.

PIN	DESCRIPTION
1-2	Analog output Voltage of DC current drawn by the turbopump (pin 2 positive, pin 1 negative). 1 Vdc proportional to 1 A.
4-11	R1 signal 24 V, 60 mA, optically isolated output (pin 11 positive, pin 4 negative). The output Voltage will be present when the rotational speed of the pump is higher than the selected speed threshold.
5-12	LOW SPEED signal, 24 V, 60 mA, optically isolated output (pin 12 positive, pin 5 negative). The output Voltage will be present when the low speed mode is selected. either through. the front panel. the remote signal, or RS 232.
6-13	START signal 24 V, 60 mA, optically isolated output (pin 13 positive, pin 8 negative). The output Voltage will be present when the START push-button on front panel is pressed or the remote start is present. or the function has been requested by RS 232, until NORMAL operation is reached.

PIN	DESCRIPTION
7-14	R2 signal 24 V, 60 mA, optically isolated output (pin 14 positive, pin 7 negative). The output Voltage will be present upon the programmed condition delay YES or delay NO (see the cycle diagram in the following pages). If YES is selected, R2 is off and the output is zero over all run up time, then: a) If running speed > speed threshold R2 = OFF b) If running speed < speed threshold R2 = ON If NO is selected: a) If running speed > speed threshold R2 = OFF b) If running speed < speed threshold R2 = ON
8-15	FAULT signal 24 V, 60 mA, optically isolated output (pin 15 positive. pin 8 negative). The output Voltage will be present when a fault condition is displayed on the front panel display.
1-9	Analog output voltage (0 - 10 V) of pump speed (pin 9 positive, pin 1 negative).

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.

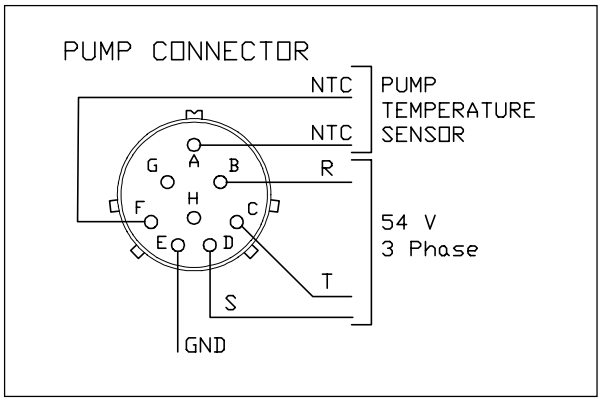


Typical output connection

Controller-to-Pump Connection

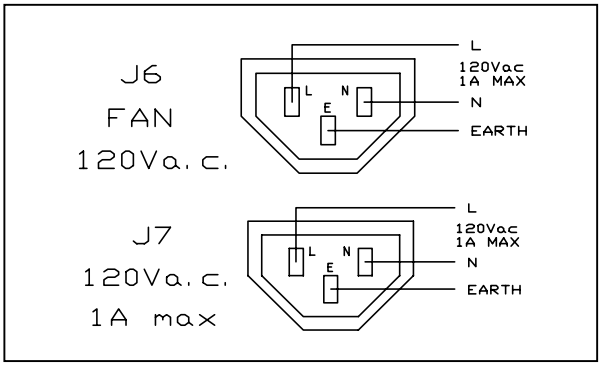
A five-meter long cable is to connect the controller to the pump. The following figures show the controller output connector configuration where pins:

- A-F = pump temperature sensor
- B-C-D = 54 Vac 3-phase output to pump motor stator
- E = ground



Controller-to-pump connector (applicable to model 969-9444 and 969-9544)

Connection J6 and J7 - Accessories and Options Interconnections



J6 and J7 connectors

The 120 Vac, 1 A maximum (independent of line Voltage) output Voltage is present when the main power switch is set to 1 position and after START push-button is pressed and will remain present until a fault condition is displayed on the front panel display or the turbopump is stopped.
The connector J6 is a power output for a pump cooling fan, the connector J7 is for vent device, forepump connector coils, etc. The maximum current that can be drawn from J6+J7 is 1 A.

To make connections, remove the plug and wire the pins (maximum wire size 18 AWG, 1 mm^2) as indicated in the figure to obtain the desired capability.

CAUTION!

On the J6+J7 outlets the output Voltage is 120 Vac with the maximum current of 1 A. If more than one device is connected, be sure to draw not more than 120 VA to avoid controller damage. Use a relay coil with a maximum surge power of 65 VA.

NOTE

Forepump relay coil is an independent user supplied item.

OPTIONAL SERIAL PORT

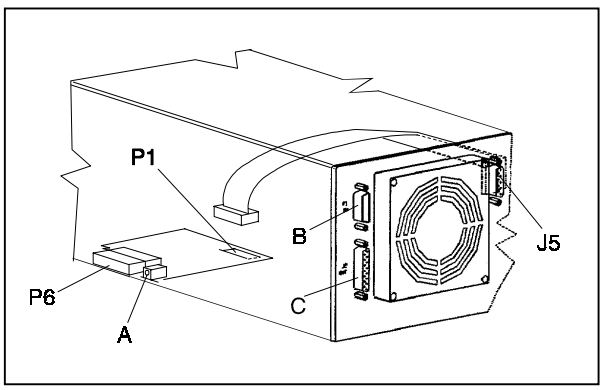
NOTE

The Controller can be read when set in the Front/Remote mode, (read window only enabled), while it can be written to and read when set in the Serial mode (write window enabled).

Serial Port Installation

Optional RS 232/422/485 kits are available for both models. To install them, proceed as follows:

- Switch off the power and disconnect the power cord.
- Unscrew the cover screws and remove the cover.
- On rear panel, remove the connector plate, and then secure connector J5 to the frame using the turrets provided.
- On rear panel, remove the fixing turrets of connectors **B** and **C** and then remove the controller.
- Attach the interface board connector to connector P6 on the controller and then secure it in place using screw **A** (3x6), which is not provided.
- Insert the flat cable through the rear panel and plug it into the socket **P1** located on the Interface board.
- Restore the main board into its original position.
- Install and tighten the connector screws and turrets.
- Replace the cover.



Serial port connector installation

RS 232 Communication Port

Communication serial port connections and mini- mum connection configuration are shown in the following figures. The communication port mating connector is supplied with the RS 232 PCB (AMP/Cannon or equivalent 9-pin "D" type male connector). The external cable (not supplied) between the host computer and the controller requires some crossed wires so that signals are connected correctly.

For example, the Transmit data signal from controller (pin 2) must be connected to the host computer's Receive data line (pin 3) 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 shroud on the O-subconnector. The cable should be secured to the connector with screws.

RS 232-422 Communication Descriptions

Communication format:

- 8 data bit
- no parity
- 1 stop bit
- The baud rate is programmable via front panel from 600 to 9600 baud. The controller is factory-set for 9600 baud operation.

NOTE

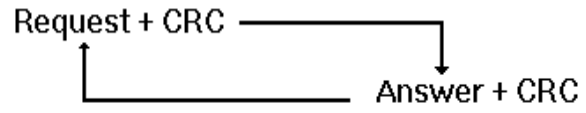
When a baud rate of 2400, 4800, 9600 baud is used, the requested information from Host to controller must be sent with a minimum interval of 1 second to avoid the controller hang-up.

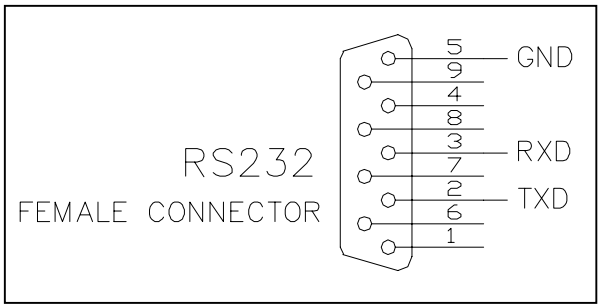
Communication protocol:

Host = Master

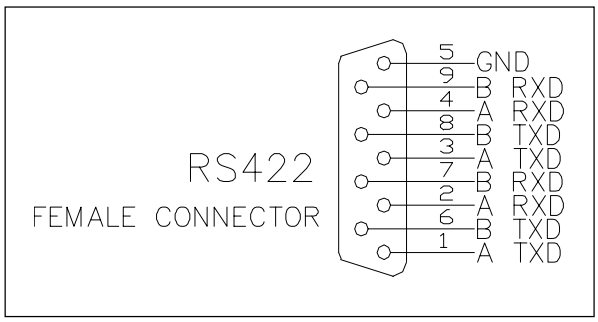
Controller = Slave

The communication is performed in the following way:





Communication RS 232 serial port connections



Communication RS 422 serial port connections

Request is an ASCII character identifying the action that must be performed by the controller or the requested information.

Allowed ASCII characters:

- "A" = START
- "B" = STOP
- "C" = Low Speed ON
- "D" = Low Speed OFF
- "E" = Request for operational parameters
- "F" = Pump times zeroing
- "G" = Parameters reading
- "H" = Parameters writing
- "I" = Request for operating status
- "J" = Request for numerical reading
- "K" = Request for counters reading.
- "L" = Software version
- "N" = Print to host serial mode change
- "O" = Host to print serial mode change
- "P" = Front panel operation mode selection
- "Q" = Remote operation mode selection
- "R" = RS 232 operation mode selection
- "S" + "number" = Baud rate selection

The command "N", "O", "P", "Q", "R" and "S" are always acknowledged in any chosen operation mode.

CRC corresponds to the sum (with inverted sign) of all the preceding bytes.

e.g., the START command "A" in ASCII code = 41; inverted it will be: FF + 1 - 41 = BF.

CHARACTER	ASCII	CONVERTED ASCII FOR CRC CALCULATION
"A"	41h	-
CRC	-	BFh
"B"	42h	-
CRC	-	BEh
"C"	43h	-
CRC	-	BDh
"D"	44h	-
CRC	-	BCh
"E"	45h	-
CRC	-	BBh
"F"	46h	-
CRC	-	BAh
"G"	47h	-
CRC	-	89h
"H"	48h	-
"I "	49h	-
CRC	-	B7h
"J"	4Ah	-
CRC	-	B6h
"K"	4Bh	-
CRC	-	B5h
"L"	4Ch	-
CRC	-	B4h
"N"	4Eh	-
CRC	-	B2h
"O"	4Fh	-
CRC	-	B1h
"P"	50h	-
CRC	-	B0h
"Q"	51h	-
CRC	-	AFh
"R"	52h	-
CRC	-	AEh
"S"	53h	-
"ACK"	06h	-
CRC	-	FAh
"NACK"	15h	-
CRC	-	EBh

Answer = after a request from the host, the Turbo-V150HT controller will answer in one of the following ways:

- ACK
- NACK
- Message

When the Request is "A, "B", "C", "D", "F", "N", "O", "P", "Q", "R", the Turbo-V 550HT controller will Answer the ACK or NACK.

When the Request is "E, the **Answer** will contain the complete set of the following parameters:

BYTES	MEANING
LSB X X X X 1 X X X MSB X	0000=STOP 0001=WAITING INTERLOCK 0010= STARTING 0011 = NORMAL OPERATION 0100= HIGH LOAD 0101= "" "" 0110 =FAILURE 0111=APPROACHING LOW SPEED ... ...
2÷5	Cycle Time
6÷9	Pump Life
10÷11	Pump Temperature
12	Current*
13	Voltage*
14÷17	Frequency
18÷19	Cycle #
20	R1 Status
21	R2 Status
22	CRC

*The values for current and voltage are given as numbers, scaled from 0 to 255, where 0 corresponds to 0 V and 255 to the full scale voltage (100 V) or current (10 A).

When the ***Request*** is "G", the ***Answer*** will contain a string of 12 characters with the following parameters:

BYTES	MEANING
1	Speed adjust value (in KRPM)
2-3	Pump cycles number (integer coded in 2 bytes)
4	Speed threshold
5-8	Run up time in seconds (long coded in 4 bytes)
9	Deat time (0 = NO 1 = YES)
10	Soft Start mode (0 = NO 1=YES)
11	Water cooling (0 = NO 1=YES)
12	CRC

When the configuration parameters have to be changed, send a ***Request*** string with "H" characters of the following type:

"H" + ... DATA .... + CRC

The CRC is calculated on the string consisting of H + DATA.

The following parameters can be changed:

BYTES	MEANING
1	Speed adjust value (in KRPM)
2	Speed threshold
3-6	Run up time in seconds (long coded in 4 bytes)
7	Deat time (0 = NO 1 = YES)
8	Soft Start mode (0 = NO I=YES)
9	Water cooling (0 = NO I=YES)
10	CRC

When the ***Request*** is "I" (Status readings), the ***Answer*** will contain a string of 2 characters with the following parameters:

BYTES	MEANING
	0000 = STOP
	0001 = WAITING INTERLOCK
LSB X	0010 = STARTING
X	0011 = NORMAL OPERATION
X	0100 = HIGH LOAD
X	0101 = " " " "
	0110 = FAILURE
	0111 = APPROACHING LOW SPEED
1	
X	R2 status (0 = OFF 1 = ON)
X	R1 status (0 = OFF 1 = ON)
X	...
MSB X	...
2	CRC

When the ***Request*** is "J" (Numerical readings), the ***Answer*** will contain a string of 5 characters with the following parameters:

BYTES	MEANING
1	Current (0-255 scaled)
2	Voltage (0-255 scaled)
3	Rotational speed KRPM
4	Pump temperature °C (0-70 temperature reading, 255 = fail)
5	CRC

When the ***Request*** is "K" (Counters readings), the ***Answer*** will contain a string of 11 characters with the following parameters:

BYTES	MEANING
1-4	Cycle time
5-8	Pump life
9-10	Cycle number
11	CRC

When the ***Request*** is "L" (software version), the ***Answer*** will contain a string of 12 characters with the following parameters:

BYTES	MEANING
1-3	Software version
4-7	CRC 16 EPROM
8-11	CRC 16 parameters
12	CRC

On request a sample program in QBasic language is available by Varian.

When the configuration parameters have to be changed, send a ***Request*** string with the letter “S” and a series of characters as shown below:

"S" + ... DATA .... + CRC

The CRC is calculated on the string consisting of S + DATA.

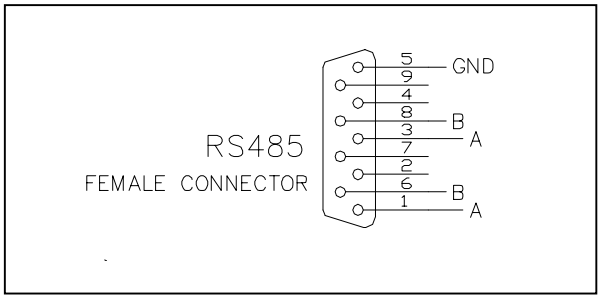
This field is structured as follows:

BYTES	MEANING
1	0 ÷ 4
2	CRC

The values assumed by byte “1” have the following meaning:

- 0 = 600 baud
- 1 = 1200 baud
- 2 = 2400 baud
- 3 = 4800 baud
- 4 = 9600 baud

RS 485 Communication Description



Communication RS 485 serial port connections

Transmission Channel Characteristics

levels:	RS 485
baud rate:	9600/4800/2400/1200/600 programmable
character length:	8 bits
parity:	none
stop bit:	1 bit
protocoll:	master (PC) / slave (converter)
max. devices:	32

Message Structure

(request and answer have the same format)

The master system (PC) starts every session sending the following message to the slave units connected:

<STX> / <ADDR> + <WINDOW> + <COMMAND> + <DATA> + <ETX> + <CRC>

where:

<STX> = 0x02

<ADDR> = 0x80 + device number (0...31)

0xFF: brodcasting command (recognized by all the devices, it doesn't implicate any answer) (for RS 485 only)

<WINDOWS>= ' 000 '...' 999' window number the meaning of the window depends to the device type

<COMMAND>= 0x30: window value reading
0x31: window writing

<DATA> = alphanumeric ASCII string containing, in the case of writing operation,the parameter to input into the window addressed by the field <WINDOW>This field may have variable length according to the data type contained in the window where you are working in. In the case of Reading request of a window, the data field doesn't exist.

<ETX>= 0x03

<CRC>= XOR among all the characters following <STX>= (with exception of <STX>), including the end character <ETX> hexadecimally encoded by two ASCII characters.

1) When a slave device is addressed by the master: In case of reading request of the value contained in a window, the slave answers a string equal to the one sent by the master but in addition there is the field <DATA> containing the value of the window.The format of the field <DATA> depends to the window type.

The different types are:

	Length	**Characters Permitted**
Logic (L)	1	'0'=OFF '1'=ON
Numeric (N)	6	'0'...'9' (Justifield to the right with '0')
Alphanumeric (A)	max 10	' '...'_'

EXAMPLES:

Command : START
Source : PC
Destination : Inverter

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

Source : Inverter
Destination : PC

02	80	06	03	38	35
STX	ADDR	ACK	ETX	CRC	

Command : STOP
Source : PC
Destination : Inverter

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

Source : Inverter
Destination : PC

02	80	06	03	38	35
STX	ADDR	ACK	ETX	CRC	

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

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

Source : Inverter
Destination : PC

02	80	06	03	38	35
STX	ADDR	ACK	ETX	CRC	

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

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

Source : Inverter
Destination : PC

02	80	06	03	38	35
STX	ADDR	ACK	ETX	CRC	

Command : LOW SPEED (ON)
Source : PC
Destination : Inverter

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

Source : Inverter
Destination : PC

02	80	06	03	38	35
STX	ADDR	ACK	ETX	CRC	

Command : LOW SPEED (OFF)
Source : PC
Destination : Inverter

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

Source : Inverter
Destination : PC

02	80	06	03	38	35
STX	ADDR	ACK	ETX	CRC	

Command : CURRENT
Source : PC
Destination : Inverter

02	80	32	30	30	30	03	38	31
STX	ADDR	WINDOW			RD	ETX	CRC	

Source : Inverter
Destination : PC

02	80	32	30	30	30	30	30	30	2E	30	30	03	39	46
STX	ADD	WINDOW			RD	000.00						ETX	CRC	

Command : FREQUENCY
Source : PC
Destination : Inverter

02	80	32	30	33	30	03	38	32
STX	ADDR	WINDOW			RD	ETX	CRC	

Source : Inverter
Destination : PC

02	80	32	30	33	30	30	30	30	30	33	38	03	38	39
STX	ADD	WINDOW			RD	000038						ETX	CRC	

Command : ERR-CODE
Source : PC
Destination : Inverter

02	80	32	30	36	30	03	38	37
STX	ADDR	WINDOW			RD	ETX	CRC	

Source : Inverter
Destination : PC

02	80	32	30	36	30	30	30	30	30	30	30	03	38	37
STX	ADD	WINDOW			RD	000000						ETX	CRC	

WIN	R	W	T	DESCRIPTION
000	X	X	L	START/STOP
001	X	X	L	LOW SPEED [0=OFF / 1=ON]
100	X	X	L	SOFT START [0=NO / 1=YES]
101	X	X	L	DEAT TIME [0=NO / 1=YES]
102	X	X	L	WATER COOLING [0=NO / 1=YES]
103	X	X	N	SPEED THRESHOLD
104	X	X	N	RUN UP TIME (0÷359.999 sec)
106	X	X	N	SPEED ADJUST
107	X	X	N	MODE (0, 1, 2) [FRONT, REMOTE, SERIAL]
108	X	X	N	BAUD_RATE (0-4) [600, 1200, 2400, 4800, 9600]
109		X	L	PUMP LIFE RESET (TYPE “ON” TO RESET)
200	X		N	CURRENT [A]
201	X		N	VOLTAGE [V]
202	X		N	POWER [W]
203	X		N	FREQUENCY [Krpm]
204	X		N	TEMPERATURE (0÷99) [°C]
205	X		N	PUMP STATE (0÷6) [STOP, WAITING INTERLOCK, STARTING, NORMAL, HIGH LOAD,
				FAILURE, APPROACHING]
206	X		N	ERROR CODE (0÷7) [NO ERROR, OVERVOLTAGE, SHORT CIRCUIT,CHECK CONN.,
				TOO HIGH LOAD, OVERRIDE, OVERTEMP PUMP, OVERTEMP CONTR.]
207	X		L	STATE R1 [0=OFF / 1=ON]
208	X		L	STATE R2 [0=OFF / 1=ON]
300	X		N	CYCLE TIME (0-999.999) IN MINUTES
301	X		N	CYCLE NUMBER (0- 65.535) IN COUNTS
302	X		N	PUMP LIFE (0-999.999) IN HOURS
400	X		A	CRC PROGRAM LISTING
402	X		A	CRC PARAMETER LISTING

WIN = Window
R = Read
W = Write

T = Type:
L = Logical
N = Numeric
A = Alphanumeric

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.

NOTE

The input signal P1 connector should be left in position including the shipping links if no external connections are made. The forepump and the Turbo-V pump can be switched on at the same time.

NOTE

When the Turbo-V 550 pump is backed by a membrane pump, the Soft Start mode should be deselected.

Startup

- Plug the controller power cable into a suitable power source.
- The display lights, and shows:

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

The controller with the Soft Start mode allows the pump to ramp-up to Normal Speed slowly with a minimum ramp-up time of 80 minutes and a maximum of about 105 minutes.
The Soft Start mode is always operative as default mode. If it is necessary to deselect this mode refer to the selection “Front/Remote/Serial Selection”.
If the Soft Start mode is deselected, the ramp- up will be done within 300 seconds and the display changes as follows:

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

NOTE

If the pump is not connected, the display will be as shown:

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

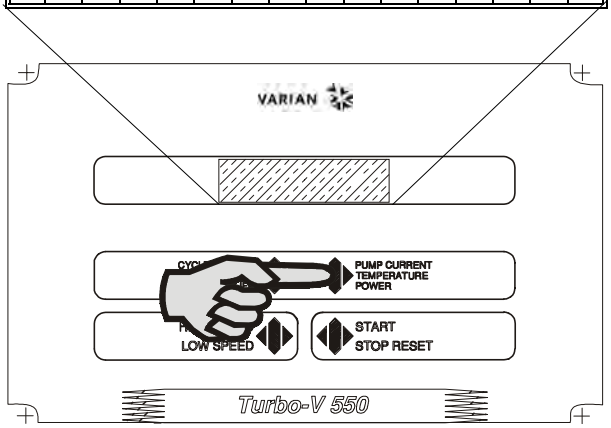
NOTE

After pressing the START push-button, if the P1 connector is not in place with the link or the external interlock connection are open, the display will be as shown in the following figure.
Unplug the controller power cable and verify the P1 connection according to section II.

P	U	M	P		W	A	I	T	I	N	G				
I	N	T	E	R	L	O	C	K							

- Press the CURRENT push-button and the display shows:

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

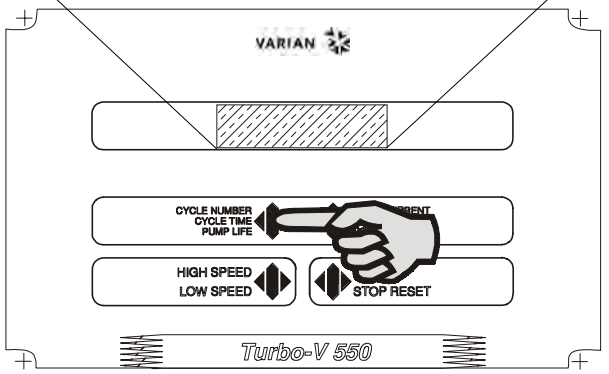


where:

- **I** = is the DC current drawn by the pump range (0.00 to 10.00 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 3 to 42 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 twice 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).

Front / Remote / Serial Selection

Press CYCLE NUMBER and PUMP CURRENT pushbuttons 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 pushbuttons at the same time for at least 2 seconds.

The display shows:

C	O	N	F	I	G	U	R	A	T	I	O	N			

S	O	F	T	W	A	R	E		V	E	R	S	I	O	N
	X	X	X		X	X	X	X		X	X	X	X		

and then:

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.

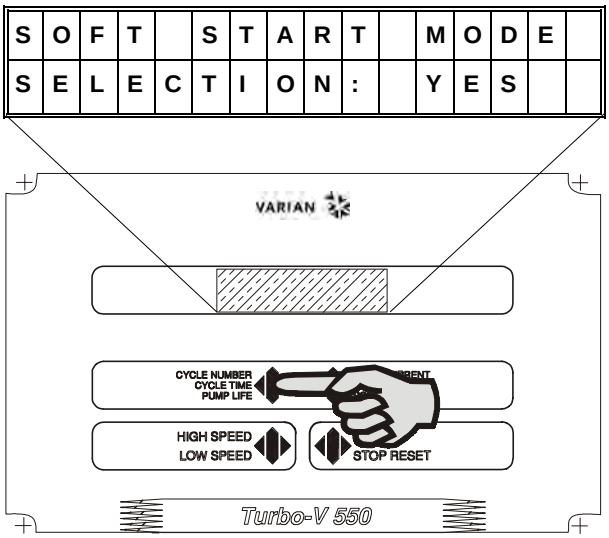
If YES is selected, the Soft Start mode allows the pump to ramp-up the Normal speed within ten steps. When NO is selected, the Soft Start mode is deselected and the ramp-up of the pump will be done within 300 seconds.

The controller factory default is set to YES.

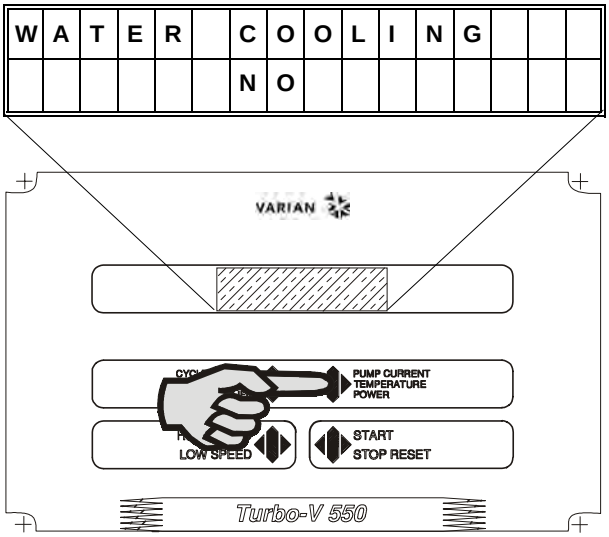
NOTE

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

- Press CYCLE NUMBER to select YES or NO

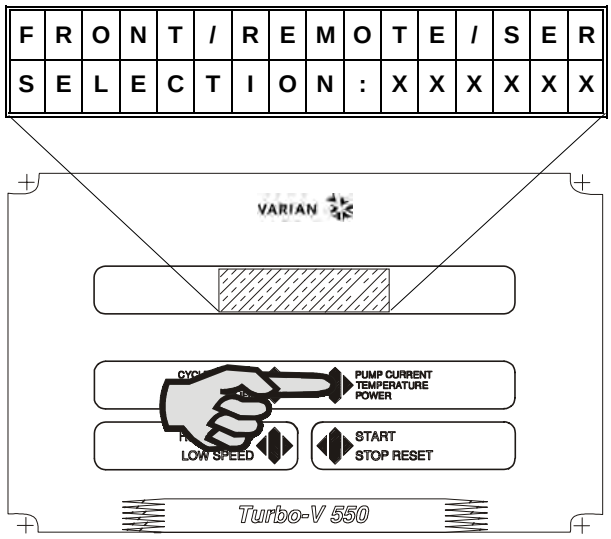


- Press PUMP CURRENT push-button and the display shows:



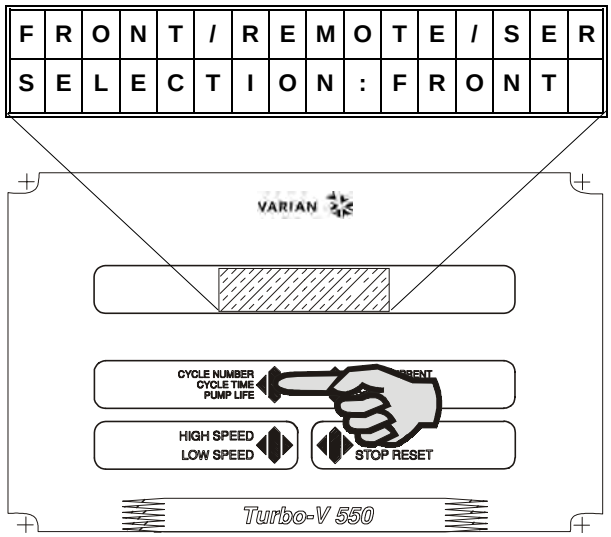
If necessary press CYCLE NUMBER to select YES or NO.

- Enter the selection by pressing the PUMP CURRENT push-button, and the display shows:

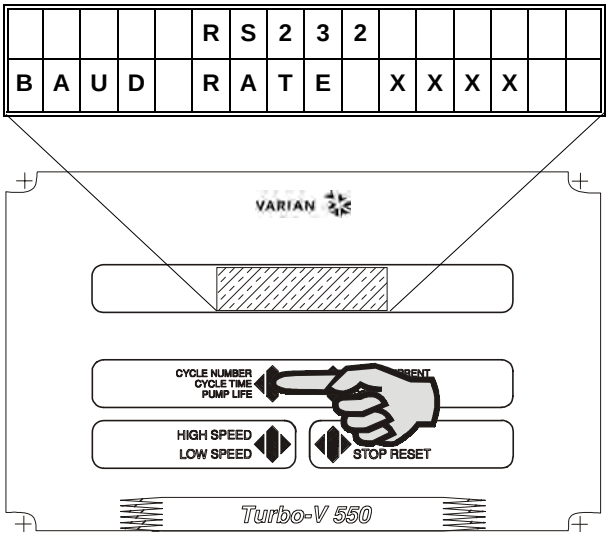


where: **XXXXXX** = means the word FRONT. REMOTE, or SER depending on the last selection.
The controller is factory-set for FRONT panel operation.

- Choose the desired selection by pressing the CYCLE push-button.

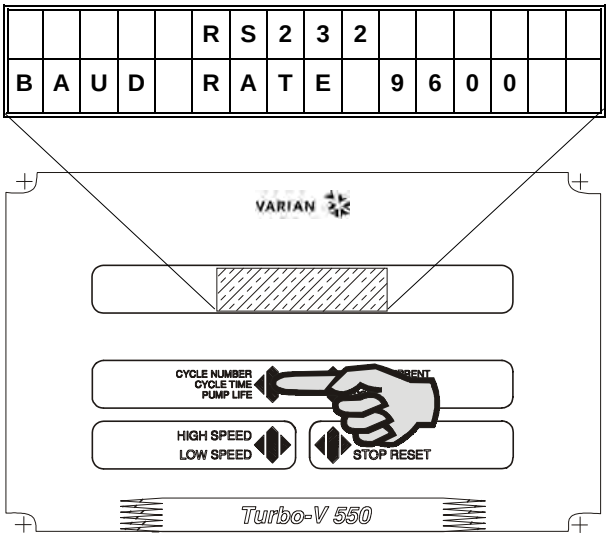


- Press the PUMP CURRENT push-button to enter the value and if the serial option is installed, the display shows:

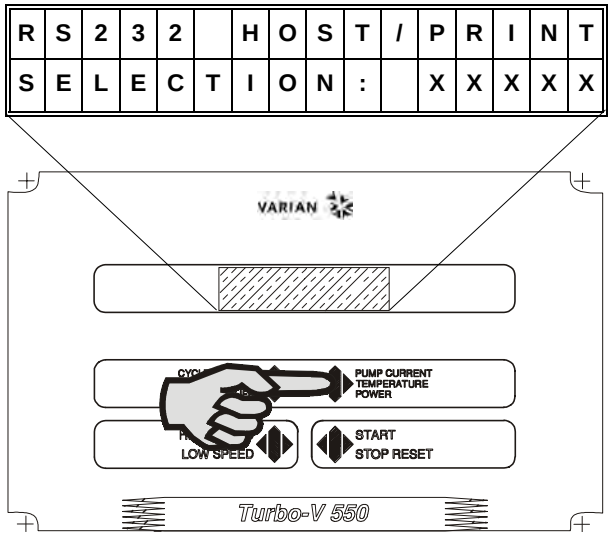


where: **XXXX** = means 600, 1200, 2400, 4800, 9600 baud rate for the host computer or printer communication. The controller is factory-set for 9600 baud rate operation.

- Select the desired value by pressing the CYCLE NUMBER

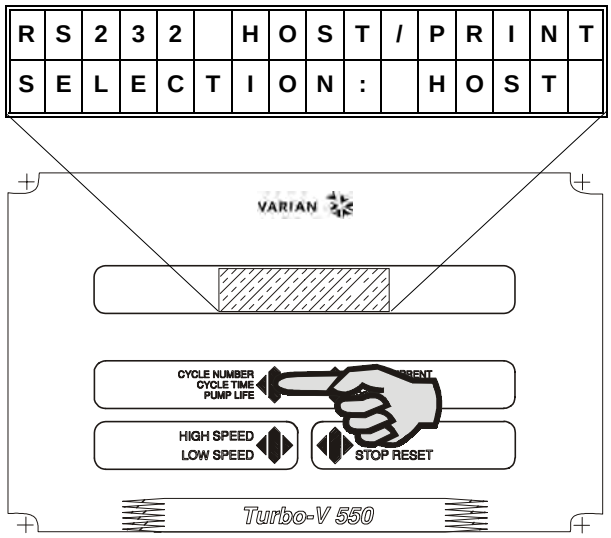


- Enter the value by pressing the PUMP CURRENT push-button and, if the serial option is installed, the display shows:



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

- Select HOST or PRINT by pressing the CYCLE push-button.



With the RS 232 connected, a bi-directional 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:

- Speed adjust
- 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

Note that the new input value are put in effect only at the next STOP/START of the pump.

If PRINT is selected and a printer is connected on RS 232 line, an 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.
- In this way you enter into an operating phase named "Monitor Relay Programming" described in the following paragraph.

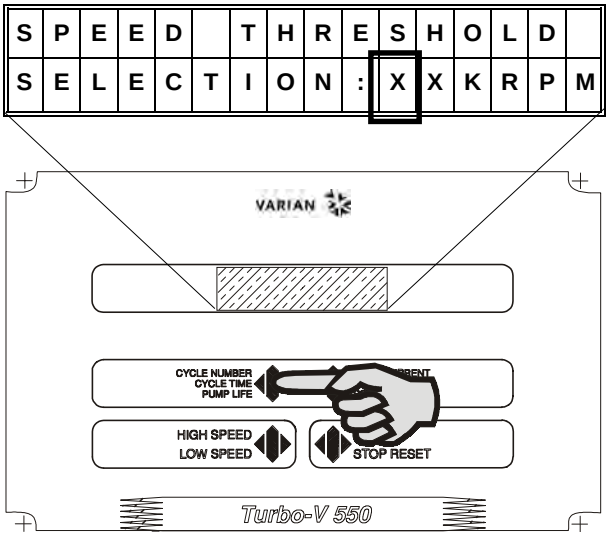
Monitor Relay Programming

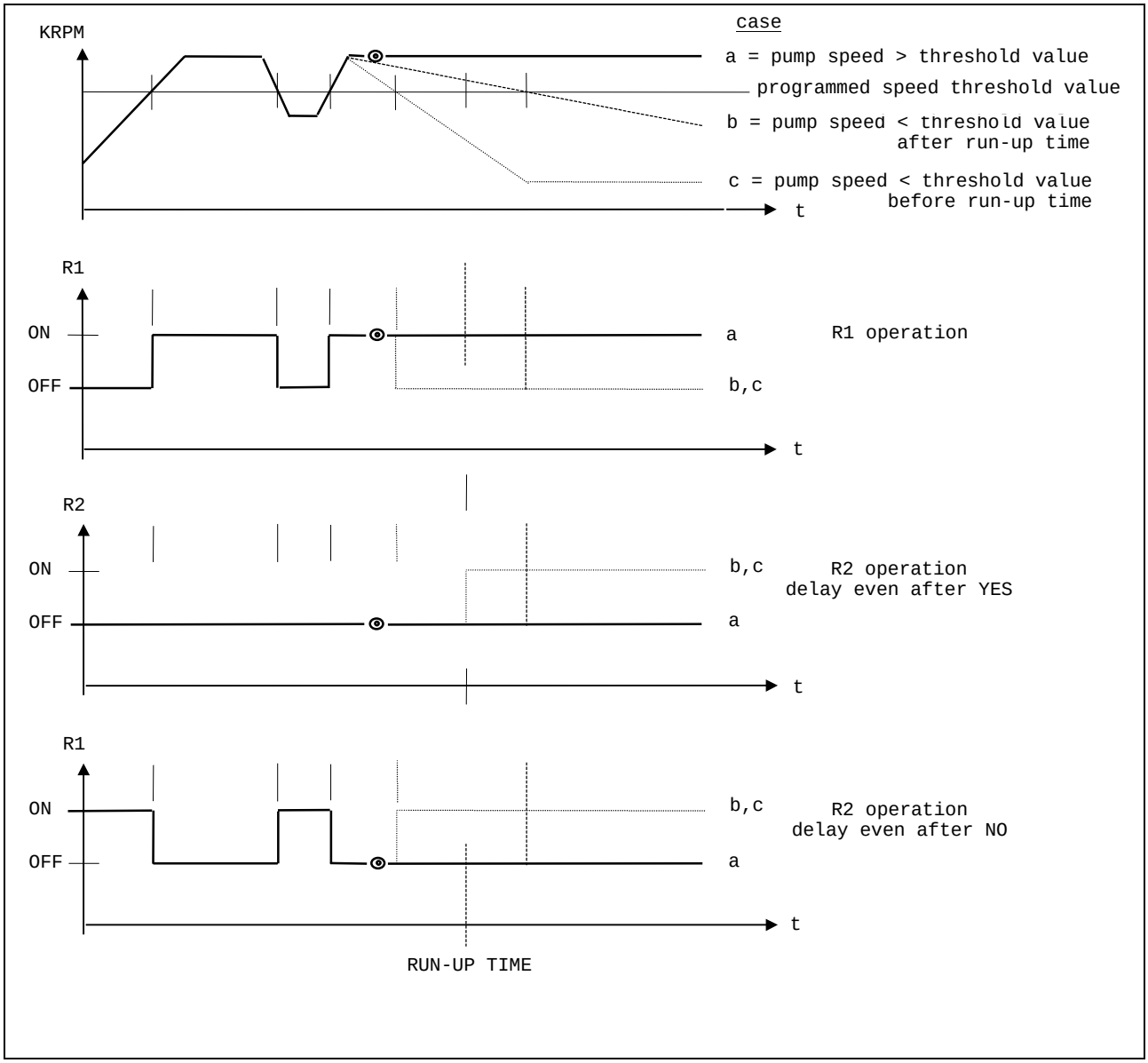
- The display shows:

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.

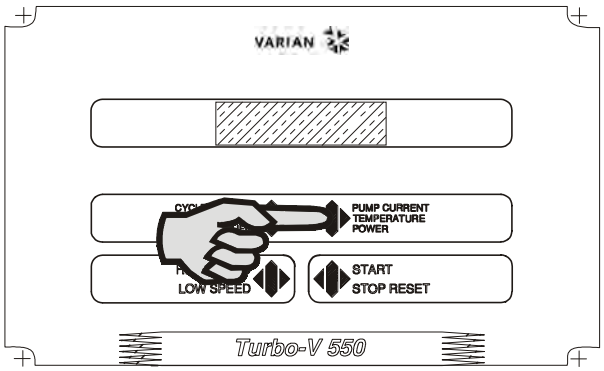
Press the CYCLE NUMBER push-button to select the first number.



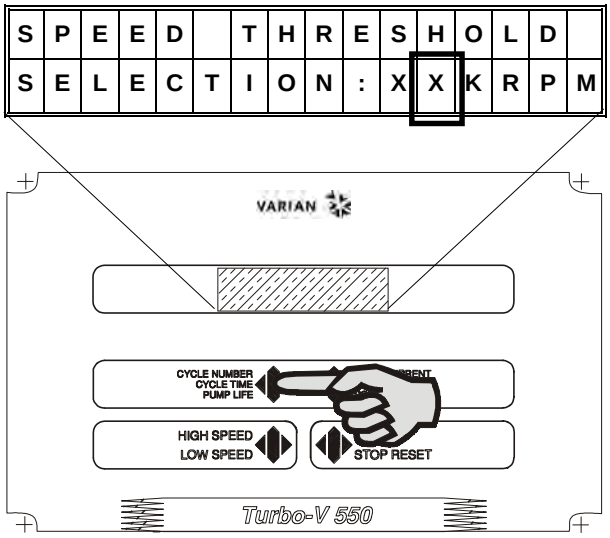


Cycle diagram

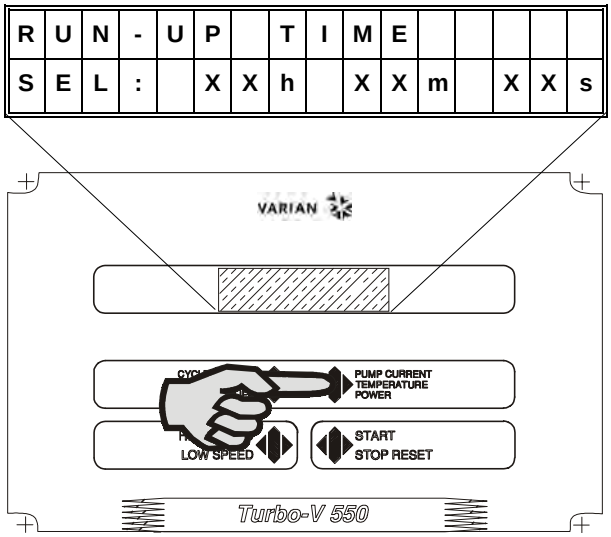
- Enter the value by pressing the PUMP CURRENT push-button.



- Press the CYCLE NUMBER push-button to select the second number.

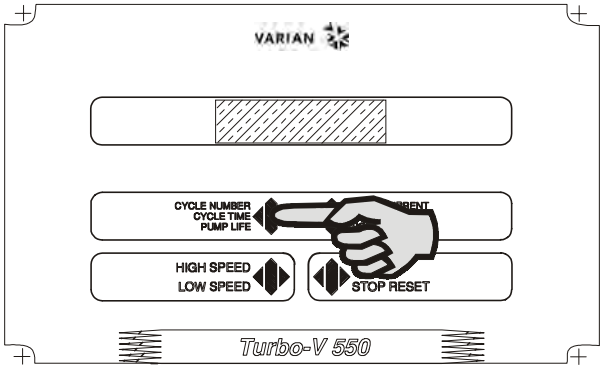


- Enter the value by pressing the PUMP CURRENT push-button, and the display shows:

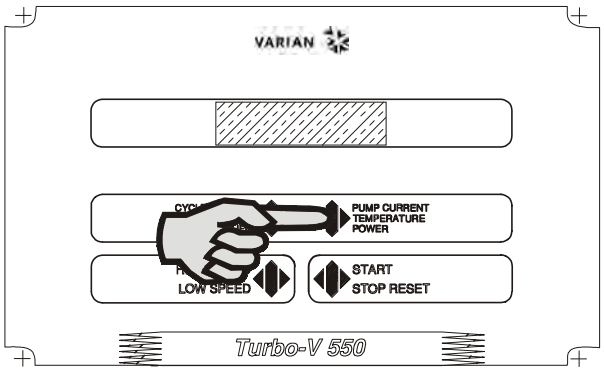


where: **RUN-UP TIME** = is the interval time from start to speed threshold value in hours, minutes, seconds. Select from 00 to 99 hours, and from 00 to 59 minutes or seconds.

Select the run-up time according to the chamber volume and/or operating cycle feature (see the preceding cycle diagram) by pressing the CYCLE NUMBER push-button to select the desired number.



- 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 shows:

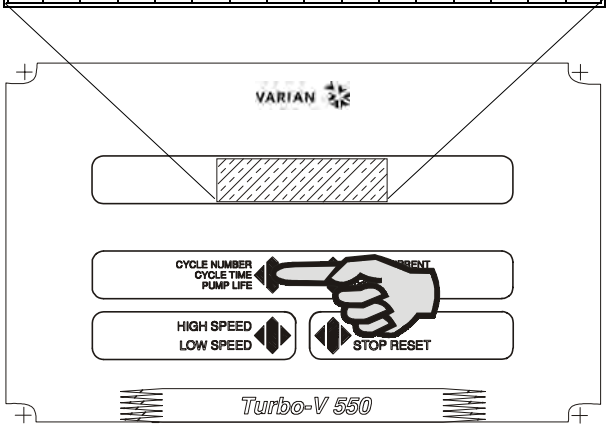
D	E	L	A	Y		E	V	E	N		A	F	T	E	R
	T	H	R	E	S	H	O	L	D	:			X	X	X

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

- Press the CYCLE NUMBER push-button and select YES if relay R2 must operate only after the run-up time or select NO when the R2 operation is needed right from stan of the turbopump and after the rotational speed of the turbopump exceeds for the first time the speed threshold value (see the preceding cycle diagram).

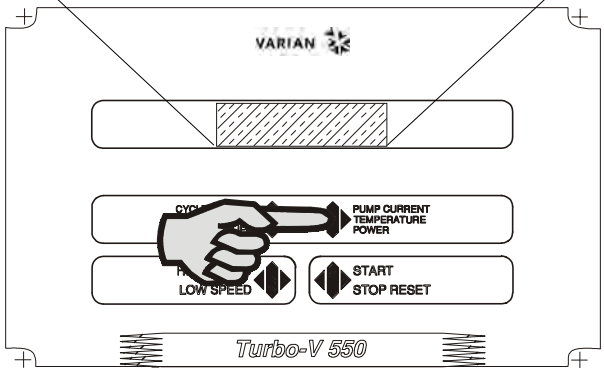
This function is factory-set to YES.

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



- Press PUMP CURRENT to confirm. and 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.

The controller is factory-set to 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:

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

or

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

and the controller is ready to restart (see paragraph "Startup").

NOTE

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

Speed Adjustment

By pressing CYCLE NUMBER and PUMP CURRENT push button together for at least five seconds the processor enters in a routine where it is possible to adjust the rotational speed.

The display shows:

S	P	E	E	D		A	D	J	U	S	T				
			4	2		K	R	P	M						

Press the PUMP push button to select the digit to be changed and when press the CYCLE push button to change the value.
The speed value can be changed from 24 to 42 KRPM. Different values are rejected.
The speed adjustment sets automatically the LOW SPEED frequency to 2/3.

NOTE

The speed can be adjusted only when the pump is stopped.

Starting the Pump

If the forepump and vent device are not operated by the controller, close the vent valve and switch on the forepump.

NOTE

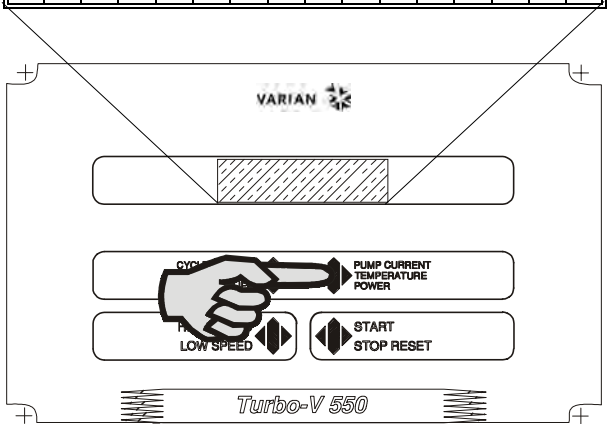
Before starting the pump the cooling mode must be selected.

NOTE

With the FRONT panel operation selected, the REMOTE and RS 232 operations are inoperative; conversely, the CYCLE NUMBER and PUMP CURRENT push-buttons are always active, even when the operating mode selected is REMOTE or RS 232 / 422 / 485.

- Press the START push-button (or use the remote or RS 232 start signal), and the display shows:

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



The minus sign (-) becomes a square (■) when the pump completed 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 200 W the speed of the pump is decreased to maintain the maximum power allowable (200 W).

- 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 and the related output is 24V.

XX KRPM = indicates the actual theoretical rotational speed of the pump as a function of the controller output frequency (range 3 to 42 KRPM).

After START command, frequency output will be at the maximum level, then it will decrease to a value proportional to the pump rotational speed (about 4 KRPM if the pump is completely stopped).
The pump will accelerate to its normal rotational speed.

- During acceleration of the pump or during any operating condition, it is always possible to select the other parameters to be displayed pressing the PUMP CURRENT or the CYCLE NUMBER pushbuttons.

- After the runup time and when the normal rotational 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 (42 KRPM for high speed, or 28 KRPM for low speed).

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 (325 W with water cooling, or 221 W with air cooling).
The Turbo-V pump is slowed down in pro- portion to the gas load at least until it reaches about 4 KRPM.
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

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:

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

or:

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

or:

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**	**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**

and when the pump reaches the low speed value, display reverts to:

N	O	R	M	A	L		O	P	E	R	A	T	I	O	N
				2	8		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 decrease automatically, and the Turbo-V pump is slowed down in proportion to the gas load until it reaches 4 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 accelerates to its rotational speed. During the acceleration, the display shows:

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

Pump Shutdown

Press the front panel STOP push-button or remove the remote signal; the power from the turbopump will be removed and the pump will begin to slow down.

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 " Operating parameter selections ") and when ready to start, the display shows:

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 without Soft Start mode selected the START/STOP and LOW SPEED front panel push-buttons are inoperative, while the CYCLE NUMBER and PUMP CURRENT pushbuttons are always active.

RS 232 Control Mode Operation

If the RS 232 option is installed and the controller has been programmed for RS 232 operation, the controller may be driven by a computer and when ready to operate, the display shows:

P	U	M	P		R	E	A	D	Y	:		U	S	E	
R	S	2	3	2		L	I	N	E						

If the Soft Start has been deselected the display shows:

R	E	A	D	Y		F	O	R		R	S	2	3	2	
S	O	F	T		S	T	A	R	T						

With or without Soft Start mode selected the START/STOP, LOW SPEED functions are under computer control, while the CYCLE NUMBER and PUMP CURRENT front panel pushbuttons are always active.

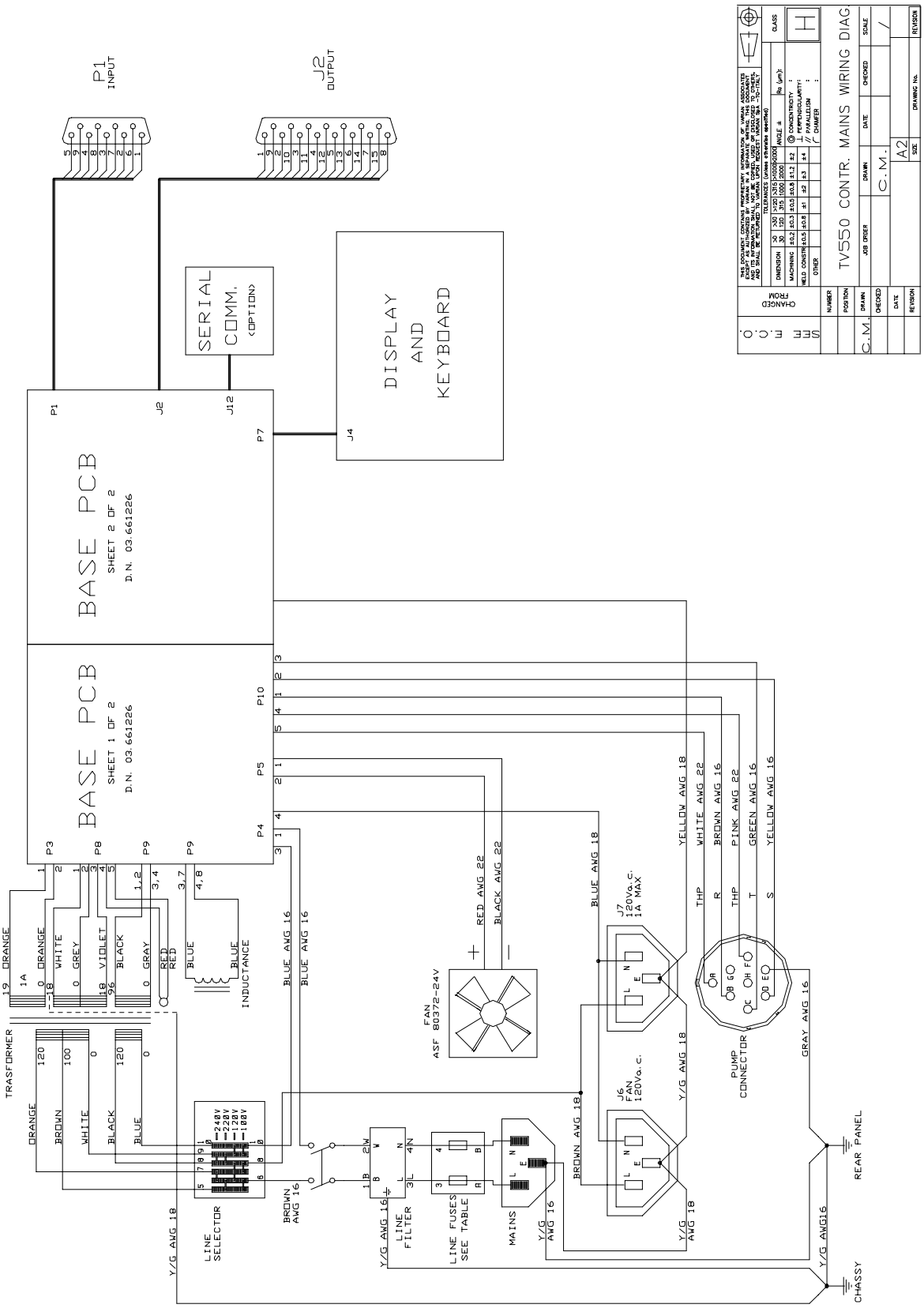
ACCESSORIES AND SPARE PARTS

DESCRIPTION	PART NUMBER
J1 input mating connector	969-9853
P6 and P7 mating plug	969-9854
Mains cable (European plug, 3 m long)	969-9957
Mains cable (American plug, 120 V, 3 m long)	969-9958

OPTIONS

DESCRIPTION	PART NUMBER
Controller to pump extension cable (5 m extension)	969-9951 L0500
RS 485 computer communication kit	969-9856
RS 232 computer communication kit	969-9857
RS 422 computer communication kit	969-9858
P2 output mating connector	969-9852

MAINTENANCE



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**
Varian Vacuum Technologies	Varian SpA	Varian Vacuum Technologies
121 Hartwell Ave	Via Flli Varian 54	Local Office
Lexington, MA 02421	10040 Leini (TO) – ITALY	
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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