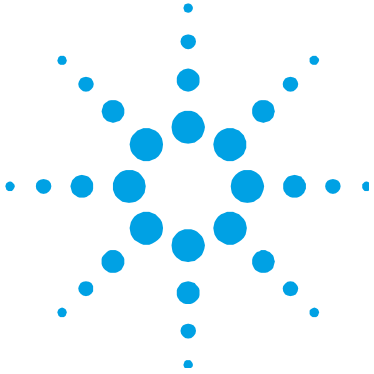

Turbo-V 70 75 Vdc Box Controller

Model
SQ 188

User Manual

87-900-938-01 (F)
04/2011

Agilent Technologies

Notices

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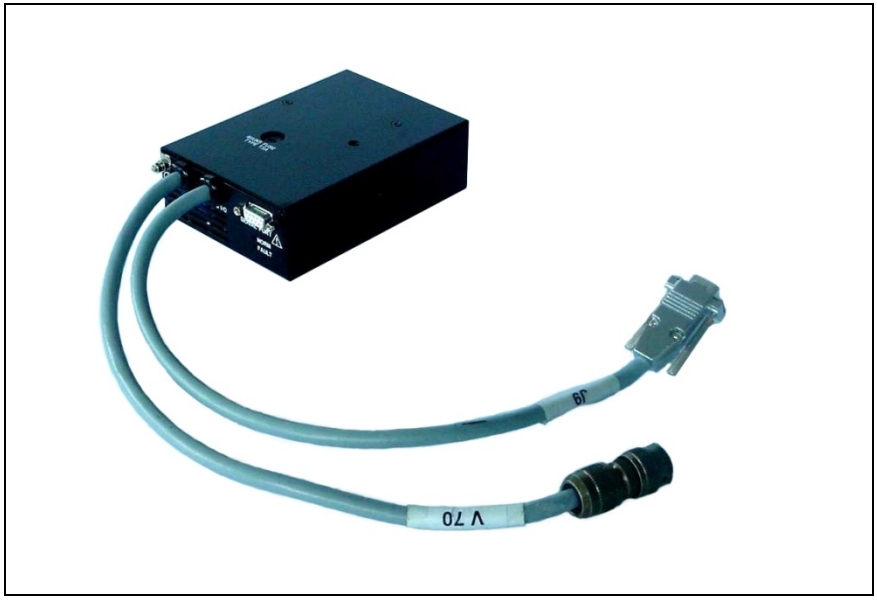
CAUTION

A **CAUTION** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a **CAUTION** notice until the indicated conditions are fully understood and met.

WARNING

A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

Turbo-V 70 75 Vdc Box Controller



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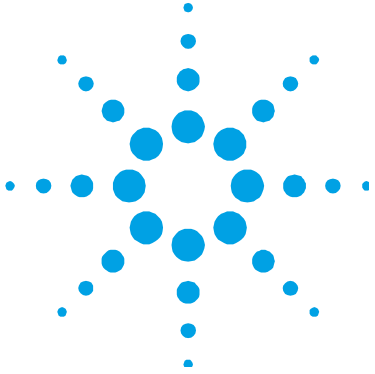

1 Instructions for Use

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Introduction

Operators and service personnel must be aware of all hazards associated with this equipment. They must know how to recognize hazardous and potentially hazardous conditions, and know how to avoid them. The consequences of unskilled, improper, or careless operation of the equipment can be serious.

This product must only be operated and maintained by trained personnel. Every operator or service person must read and thoroughly understand operation/maintenance manuals and any additional information provided by Agilent.

All warnings and cautions should be read carefully and strictly observed. Address any safety, operation, and/or maintenance questions to your nearest Agilent office.

The following format is used in this manual to call attention to hazards:

CAUTION! Cautions are used when failure to observe instructions could result in damage to equipment, whether Agilent supplied or other associated equipment.

WARNING! **Warning are used when failure to observe instructions or precautions could result in injury or death.**

NOTE Information to aid the operator in obtaining the best performance from the equipment.

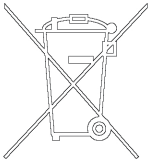
Disposal

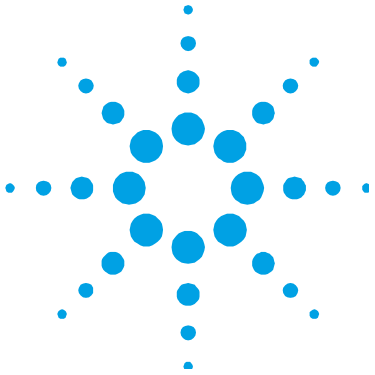
Meaning of the "WEEE" logo found in labels

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.





2 Technical Information

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Description

The Turbo-V 70 box controller is a microprocessor-controlled, solid-state, frequency converter with self-diagnosis and protection features.

The controller drives the Turbo-V 70 pump series by controllling the voltage and current respect to the speed reached by pump.

It incorporates all the facilities required for the operation of the Turbo-V 70 pump series: pump start/stop, digital current and speed control, analog signals for external indicators.

The power is externally supplied.

All the input/output connections are performed on:

- 9 pin “D” type male connector attached to a cable 400 mm long for I/O and Electrical DC supply.
- Pump connection with 400 mm long cable.
- 9 pin “D” type connector for RS232 connection.

Turbo-V 70 75 Vdc Box Controller Description

The controller is a solid-state frequency converter which is driven by a single chip microcomputer and is composed of a PCB which includes all the circuitry necessary for its operation.

The microcomputer generates the variable output voltage according to the software and the gas load condition of the pump.

Moreover, it manages signals from sensors, input/output connection information, and gives output for a fully automatic operation.

The controller can be operated via remote signals through an RS-232 connection.

The controller can be operated in local mode through suitable switches connected between the input pins of the I/O connector.

Controller Specifications

Table 1 Controller Specifications

Input:	
- Voltage	75 Vdc with 2 Vpp max ripple
- Current	1 A max.
Fuse	T 3 A
Output:	
- Voltage	60 Vac nominal ±10%, 3-phase
- Frequency	1250 Hz, ±2%
- Power	54 W maximum
Compliance to Norms:	
- Radio interferences	EN 55011 Class Group 1
- ESD	EN 61000/4/2
- BURST	EN 61000/4/4
- Radiated RF immunity	EN 61000/4/3
- Safety	EN 61010/1
Installation category	II
Operating temperature	0 °C to + 40 °C
Storage temperature	-20 °C to + 70 °C
Cooling	Natural convection
Weight	0.5 Kg (1.1 lbs)

CAUTION! There can be 75 Vdc voltage referred to ground on the pump cable or on the serial connector.

Controller Outline

The outline dimension for the controller are shown in the following figure:

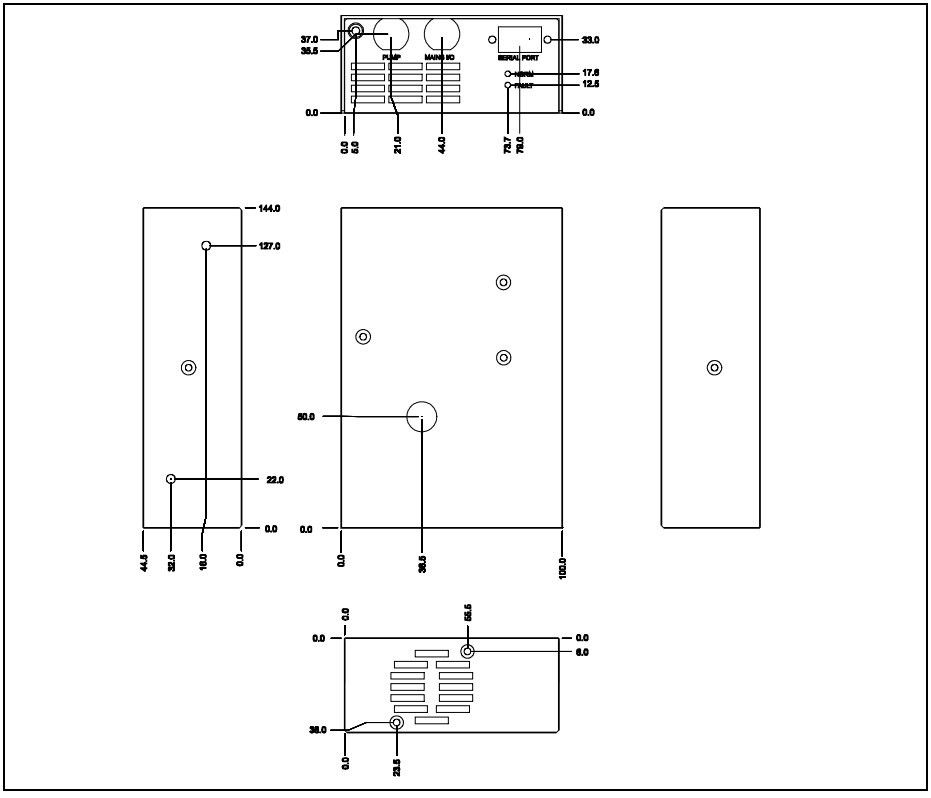


Figure 1 Controller outline

Installation

Inspect the controller for any shipping damage.

Should the controller be connected to a host computer via the-RS-232 interface, a suitable cable must be prepared.

In the following paragraphs are detailed the input/output signals.

NOTE The box installed into the customer system must be positioned so that cold air (forced or natural convection) can flow around.

Pump Connector

The signals of J3 connector are the following:

- Pin C 60 Vac 3-phase output to pump motor stator (phase T).
- Pin D 60 Vac 3-phase output to. pump motor stator (phase S).
- Pin B 60 Vac 3-phase output to pump motor stator (phase R).
- Pins A/F Pump temperature sensor.
- Pin E Ground

Table 2 I/O Specifications

START/STOP:	
- START command	Low <0.8 Vdc
- STOP command	High 4 to 15 Vdc
Analog output:	0 to 10 Vdc (proportional to speed) * (0 to 10 V ≡ 0 to 100 % speed)
- Output impedence	0.1 Ω
- Minimum load:	2 KΩ (5 mA)
Normal operation signal:	
- Open Collector	Speed <80 %: OFF (pull-up to 15 Vdc) Speed >80 %: ON (<0.8 Vdc)
Current rating	60 mA max
Low speed command:	Low (<0.8 Vdc)

Table 3 9-pin “D” Type Connector Pin Assignement

Pin number	Description
1	Start/Stop input: close to pin 5/6 to start the pump
2	Pump in Normal output: closed to pin 5/6 when pump speed is higher than 80% of full speed
3	Earth (Ground)
4	Analog output proportional to pump speed (positive)
5-6	Electrical supply (0 V)
9	Low speed input: close to pin 5/6 to select Low Speed mode
7-8	Electrical supply (75 V) (positive)

* Minimum speed reading in STOP condition = 100 Hz (6 KRPM)

Serial 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 does not require 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 2) and vice versa. Consult the host computer's instruction manual for its serial port connections

NOTE Agilent 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.

CAUTION! In order to avoid possible conflicts on the Serial Line, it is advisable to use a 3 wire shielded cable for the TxD, RxD and GND connections and to leave all the other pins unconnected.

RS 232 Communication Descriptions

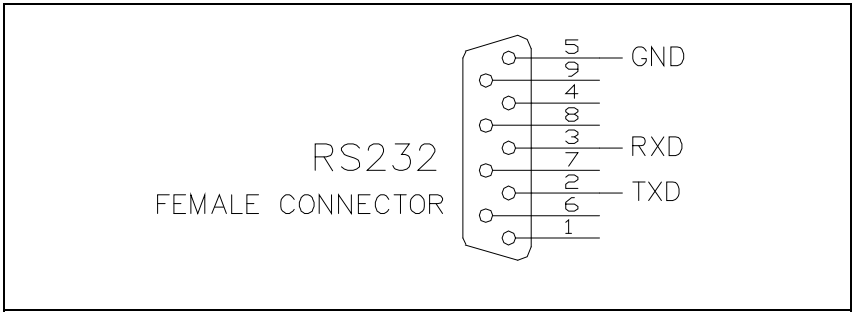


Figure 2 Communication RS 232 serial port connections

Transmission Channel Characteristics

levels:	RS 232/RS 422
baud rate:	9600/4800
	programmable by a jumper on the board
character length:	8 bits
parity:	none
stop bit:	1 bit
protocoll:	master (PC) / slave (converter)

In this case the value to be assigned to the ADDRESS field must be 80 hex (for RS 232).

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 (for RS 232 and RS 422 only)
<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

When a slave device is addressed by the master:

1) 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	33
STX	ADDR	ACK	ETX	CRC	

Command : START
Source : PC
Destination : Inverter

02	80	30	30	30	31	30	03	42	32
STX	ADDR	WINDOW			WR	OFF	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	OFF	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	44
STX	ADDR	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	34	32	03	38	34
STX	ADD	WINDOW			RD	000042						ETX	CRC	

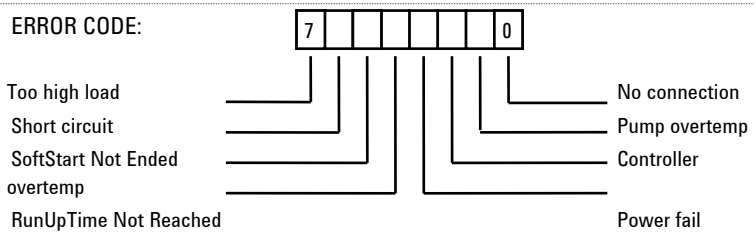
Command : ERR-CODE
Source : PC
Destination : Inverter

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	

Table 4 Serial Communication Windows

WIN	TYPE	R	W	Description
000	L	X	X	START/STOP (1= START ; 0= STOP)
008	L	X	X	REMOTE/SERIAL Configuration (1= Remote ; 0= Serial)
100	L	X	X	SOFT START YES/NO (1= YES ; 0= NO) Default= 0
107	L	X	X	SOFT START YES/NO (1= YES ; 0= NO) Default= 0
108	N	X	X	BAUD RATE (3-4) [4800-9600] Default= 4
109	L		X	PUMP LIFE RESET [Write "1" to Reset]
120	N	X	X	SET ROTATIONAL FREQUENCY [Hz] 150 Hz < = F_imp < = FMAX
121	N	X	X	MAX SETTABLE ROTATIONAL FREQUENCY [Hz] F<=F_MAX_ABS
130	N	X		RAMP CURRENT [mA]
200	N	X		CURRENT [mA]
201	N	X		VOLTAGE[V]
202	N	X		POWER [W]
203	N	X		DRIVING FREQUENCY [Hz]
204	N	X		PUMP TEMPERATURE [°C]
205	N	X		STATUS [0=stop; 1=interlock; 2=ramp; 3=regulation; 4=brake; 5=normal; 6=failure]
206	N	X		ERROR CODE: 
211	N	X		PUMP SENSOR TEMPERATURE READING [208= 25°C - 128= 60°C]
216	N	X		AMBIENT SENSOR TEMPERATURE READING
300	N	X		CYCLE TIME [min]
301	N	X		CYCLE NUMBER
302	N	X		PUMP LIFE [h]

WIN	TYPE	R	W	Description
319	A	X		Controller Model
320	A	X		Base Pump Model Number (8 characters)
321	A	X		Modified Standard Model Number (4 characters)
323	A	X		Controller Serial Number (5 characters)
325	A	X		Electrical Modification Level (10 characters)
400	A	X		CRC PROGRAM LISTING [QE7xxxx]
401	A	X		CRC BOOTLOADER [BL1xxxx]
402	A	X		CRC PARAMETER LISTING [PA7xxxx]
404	A	X		CRC FILE PARAMETER STRUCTURE
406	A	X		PROGRAM LISTING CODE & REVISION
407	A	X		PARAMETER LISTING CODE & REVISION
500	L		X	MONITOR MODE

WIN = Window
R = Read
W = Write
L = Logical
N = Numeric
A = Alphanumeric

Operation

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.

The controller operates completely automatically after the remote start command is given.

Switching on/off the Pump

To switch on the pump it is necessary to short circuit pin 1 and pins 5-6 (ground) of the 9 pin “D” type connector.

To switch off the pump it is necessary to remove the short circuit between pins 1 and 5-6.

Analog output: 0 to 10 Vdc proportional to speed (0 to 10 V = 0 to 100% speed).
This output is active also during the pump “slow down” phase after a Stop command.

Low Speed Activation/Deactivation

To activate the Low Speed status it is necessary to connect pin 9 of the 9-pin connector to pin 5-6 (ground) of the 9-pin “D” type connector.

To deactivate the Low Speed status it is necessary to disconnect pin 9 from pin 15 (ground) of the same connector.

The low speed frequency is equal to 830 Hz.

Maintenance

Replacement controllers are available on an advance exchange basis through Agilent. If necessary, information is provided to aid the operator in determining malfunctions and corrective steps to be taken.

WARNING! **Voltages developed in the unit are dangerous and may be fatal. Service must be performed by authorized personnel only.**

Error Messages

For a certain type of failure, the controller will self-diagnose the error and the following messages will be displayed. The controller signals the error occurred by means of a diagnostic LED located on the box (FAULT), and on the RS 232 port. The LED blinks in a coded mode: it flashes a number of time equal to the error code (see the following table) and then stays off, and so on.

“Status” LED (on the box)

OFF	in STOP
Blinking	in STARTING
ON	in NORMAL

Table 5 Error Code Table

LED BLINKING NUMBER	DESCRIPTION
0	No error
1	Output overcurrent
2	Not connected pump
3	Pump overtemperature
4	Controller overtemperature
5	Run-up overtime
6	Soft start overtime
7	Too High Load
8	Power Failure

PCB Jumpers

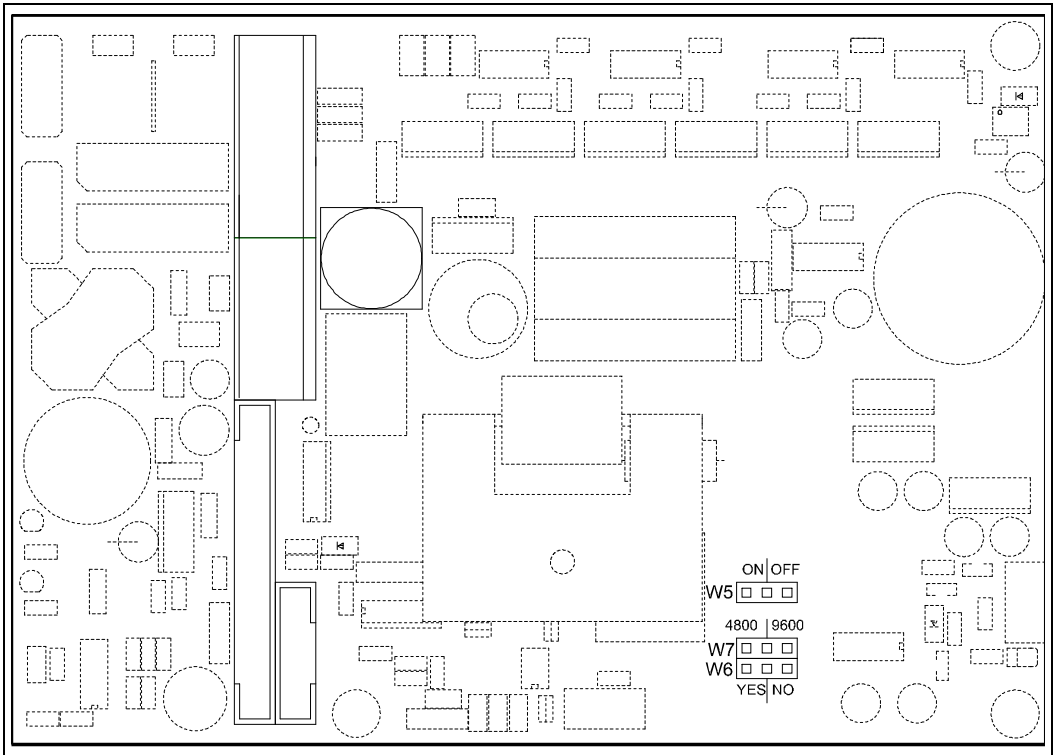


Figure 3 PCB Jumpers

Agilent Technologies

Vacuum Products Division

Dear Customer,

Thank you for purchasing an Agilent vacuum product. At Agilent Vacuum Products Division 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 products. 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.

Giampaolo LEVI

Vice President and General Manager
Agilent Vacuum Products Division

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

CUSTOMER REQUEST FOR CORRECTIVE / PREVENTIVE / IMPROVEMENT ACTION

TO: AGILENT VACUUM PRODUCTS DIVISION TORINO – QUALITY ASSURANCE

FAX N°: XXXX-011-9979350

ADDRESS: AGILENT TECHNOLOGIES ITALIA S.p.A. – Vacuum Products Division –

Via F.lli Varian, 54 – 10040 Leinì (TO) – Italy

E-MAIL: vpd-qualityassurance_pdl-ext@agilent.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 AGILENT VPD) LOG N° _____

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

Agilent Technologies

Agilent Technologies

Vacuum Products Division
Instructions for returning products

Dear Customer:

Please follow these instructions whenever one of our products needs to be returned.

1) Complete the attached Request for Return form and send it to Agilent Technologies (see below), taking particular care to identify all products that have pumped or been exposed to any toxic or hazardous materials.

2) After evaluating the information, Agilent Technologies will provide you with a Return Authorization (RA) number via email or fax, as requested.
Note: Depending on the type of return, a Purchase Order may be required at the time the Request for Return is submitted. We will quote any necessary services (evaluation, repair, special cleaning, eg).

3) **Important steps for the shipment of returning product:**
   - Remove all accessories from the core product (e.g. inlet screens, vent valves).
   - Prior to shipment, drain any oils or other liquids, purge or flush all gasses, and wipe off any excess residue.
   - If ordering an Advance Exchange product, **please use the packaging from the Advance Exchange to return the defective product.**
   - Seal the product in a plastic bag, and package product carefully to avoid damage in transit. You are responsible for loss or damage in transit.
   - Agilent Technologies is not responsible for returning customer provided packaging or containers.
   - **Clearly label package with RA number.** Using the shipping label provided will ensure the proper address and RA number are on the package. Packages shipped to Agilent without a RA clearly written on the outside cannot be accepted and will be returned.

4) Return only products for which the RA was issued.

5) **Product being returned under a RA must be received within 15 business days.**

6) **Ship to the location specified on the printable label, which will be sent, along with the RA number, as soon as we have received all of the required information.** Customer is responsible for freight charges on returning product.

7) Return shipments must comply with all applicable **Shipping Regulations** (IATA, DOT, etc.) and carrier requirements.

RETURN THE COMPLETED **REQUEST FOR RETURN** FORM TO YOUR NEAREST LOCATION:

EUROPE:	**NORTH AMERICA:**	**PACIFIC RIM:**
Fax: 00 39 011 9979 330		
Fax Free: 00 800 345 345 00	Fax: 1 781 860 9252	please visit our website for individual
Toll Free: 00 800 234 234 00	Toll Free: 800 882 7426, Option 3	office information
vpt-customercare@agilent.com	vpl-ra@agilent.com	http://www.agilent.com

Agilent Technologies

Vacuum Products Division
Request for Return Form
(Health and Safety Certification)

Please read important policy information on Page 3 that applies to all returns.

1) CUSTOMER INFORMATION

Company Name:	**Contact Name:**
Tel: **Email:**	**Fax:**
Customer Ship To:	**Customer Bill To:**
Europe only: **VAT reg. Number:**	USA/Canada only: ☐ **Taxable** ☐ **Non-taxable**

2) PRODUCT IDENTIFICATION

Product Description	Agilent P/N	Agilent S/N	Original Purchasing Reference

3) TYPE OF RETURN (**Choose one from each row** and supply Purchase Order if requesting a billable service)

3A. ☐ Non-Billable ☐ Billable ➡ New PO # (hard copy must be submitted with this form):

3B. ☐ Exchange ☐ Repair ☐ Upgrade ☐ Consignment/Demo ☐ Calibration ☐ Evaluation ☐ Return for Credit

4) HEALTH and SAFETY CERTIFICATION

AGILENT TECHNOLOGIES CANNOT ACCEPT ANY PRODUCTS CONTAMINATED WITH BIOLOGICAL OR EXPLOSIVE HAZARDS, RADIOACTIVE MATERIAL, OR MERCURY AT ITS FACILITY.
Call Agilent Technologies to discuss alternatives if this requirement presents a problem.

The equipment listed above (check one):

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

☐ **HAS** pumped or been exposed to the following toxic or hazardous materials. If this box is checked, the following information must also be filled out. Check boxes for all materials to which product(s) pumped or was exposed:

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

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

_____

NOTE: If a product is received at Agilent 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 Agilent employees as well as to any third party occurring as a result of exposure to toxic or hazardous materials present in the product.

Print Name: **Authorized Signature:** ..... **Date:**

5) FAILURE INFORMATION:

Failure Mode (REQUIRED FIELD. See next page for suggestions of failure terms):
Detailed Description of Malfunction: (Please provide the error message)
Application (system and model):

I understand and agree to the terms of Section 6, Page 3/3.
Print Name: **Authorized Signature:** ..... **Date:**

Agilent Technologies

Vacuum Products Division
Request for Return Form
(Health and Safety Certification)

Please use these Failure Mode to describe the concern about the product on Page 2.

TURBO PUMPS and TURBO CONTROLLERS

APPARENT DEFECT/MALFUNCTION		POSITION	PARAMETERS	
- Does not start	- Noise	- Vertical	Power:	Rotational Speed:
- Does not spin freely	- Vibrations	-Horizontal	Current:	Inlet Pressure:
- Does not reach full speed	-Leak	-Upside-down	Temp 1:	Foreline Pressure:
- Mechanical Contact	-Overtemperature	-Other:	Temp 2:	Purge flow:
- Cooling defective	-Clogging	.....	OPERATING TIME:	

ION PUMPS/CONTROLLERS

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

VALVES/COMPONENTS

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

LEAK DETECTORS

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

INSTRUMENTS

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

SCROLL AND ROTARY VANE PUMPS

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

DIFFUSION PUMPS

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

Section 6) *ADDITIONAL TERMS*

Please read the terms and conditions below as they apply to all returns and are in addition to the Agilent Technologies Vacuum Product Division – Products and Services Terms of Sale.

- Customer is responsible for the freight charges for the returning product. Return shipments must comply with all applicable **Shipping Regulations** (IATA, DOT, etc.) and carrier requirements.
- Customers receiving an Advance Exchange product agree to return the defective, rebuildable part to Agilent Technologies **within 15 business days**. Failure to do so, or returning a non-rebuildable part (crashed), will result in an invoice for the non-returned/non-rebuildable part.
- Returns for credit toward the purchase of new or refurbished Products are subject to prior Agilent approval and may incur a restocking fee. Please reference the original purchase order number.
- Units returned for evaluation will be evaluated, and a quote for repair will be issued. If you choose to have the unit repaired, the cost of the evaluation will be deducted from the final repair pricing. A Purchase Order for the final repair price should be issued within 3 weeks of quotation date. Units without a Purchase Order for repair will be returned to the customer, and the evaluation fee will be invoiced.
- A Special Cleaning fee will apply to all exposed products per Section 4 of this document.
- If requesting a calibration service, units must be functionally capable of being calibrated.

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