



VARIAN 
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CE

CT-100 Active Rough Vacuum Gauge

INSTRUCTION MANUAL

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Revision C
January 2004

CT-100 Active Rough Vacuum Gauge



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Apiezon[®] L grease is a registered trademark of M&I Materials Ltd.

Warranty

Products manufactured by Seller are warranted against defects in materials and workmanship for twelve (12) months from date of shipment thereof to Customer, and Seller's liability under valid warranty claims is limited, at the option of Seller, to repair, to replace, or refund of an equitable portion of the purchase price of the Product. Items expendable in normal use are not covered by this warranty. All warranty replacement or repair of parts shall be limited to equipment malfunctions which, in the sole opinion of Seller, are due or traceable to defects in original materials or workmanship. All obligations of Seller under this warranty shall cease in the event of abuse, accident, alteration, misuse, or neglect of the equipment. In-warranty repaired or replaced parts are warranted only for the remaining unexpired portion of the original warranty period applicable to the repaired or replaced parts. After expiration of the applicable warranty period, Customer shall be charged at the then current prices for parts, labor, and transportation.

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If it is found that Seller's Product has been returned without cause and is still serviceable, Customer will be notified and the Product returned at Customer's expense; in addition, a charge for testing and examination may be made on Products so returned.

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Preface

EMC Warnings

EN 55022 Class A Warning

This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

FCC

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesirable operation.



The equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generated, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is also likely to cause harmful radio communications interference in which case the user will be required to correct the interference at his own expense.

Installation Requirements

To maintain compliance with both the FCC Part 15 rules and the European Union's EMI directives, the user must use a shielded cable constructed of a braided shield and metal or metalized plastic backshells directly connected to the cable shield at the 15 pos D-Sub connector of the Eyesys Mini-BA. The shield must be connected to ground at the user's equipment. Failure to install the equipment in this way may result in the unit no longer meeting the requirements for radiated emissions and susceptibility.

Hazard and Safety Information

This manual uses the following standard safety protocols:

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.

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 Vacuum Technologies. All warning and cautions should be read carefully and strictly observed. Consult local, state, and national agencies regarding specific requirements and regulations. Address any safety, operation, and/or maintenance questions to your nearest Vacuum Technologies office.

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Equipment, General

WARNING



1. *Equipment tightness is guaranteed for normal operating conditions when the equipment leaves the factory. It is the user's responsibility to maintain the level of tightness particularly when pumping dangerous products.*

2. *This product is not intrinsically safe and can initiate and sustain a fire if used with combustible gas mixtures containing hydrogen, gasoline, ethanol or similar compounds.*

CAUTION



The performance and operating safety of this equipment can only be guaranteed if it is operated according to normal conditions of use.

WARNING



Disconnect power from the CT-100 before performing any maintenance procedure that requires physically disconnecting or opening any part of the system.

Vacuum Equipment and Cleanliness

Cleanliness is vital when servicing any vacuum equipment. The substances used for cleaning can lead to hazardous conditions or have adverse effects on the equipment.

WARNING



Explosion and Fire from Acetone and Alcohol: This device may be cleaned with acetone and alcohol. When combined with air, oxygen, and other oxides, alcohol and most other solvents are very flammable and explosive. Never permit any trace of these cleaners to remain in or on the gauge. Always remove all traces of alcohol and acetone and other cleaners with clean, dry, oil-free compressed air.

CAUTION



Do not use silicone oil or silicone grease.

Use powder-free butyl or polycarbonate gloves to prevent skin oils from getting on vacuum surfaces.

Do not clean any aluminum parts with Alconox[®]. Alconox is not compatible with aluminum and will cause damage.

NOTE



Normally, it is unnecessary to use vacuum grease. However, if it must be used, avoid silicone types, and use it sparingly. Apiezon[®] L grease is recommended (Technologies Part Number 695400004).

Vacuum Technologies Services

Please see our catalog, or contact us to learn of the services that are available to assist in your vacuum measurement and leak detection efforts.

Contacting Vacuum Technologies

In the United States, you can contact Vacuum Technologies Customer Service at 1-800-8VARIAN.

Internet users:

- Send email to Customer Service & Technical Support at vpl.customer.support@varianinc.com
- Visit our web site at www.varianinc.com/vacuum
- Order on line at www.evarian.com

See the back cover of this manual for a listing of our sales and service offices.

Declaration of Conformity
Konformitätserklärung
Déclaration de Conformité
Declaración de Conformidad
Verklaring de Overeenstemming
Dichiarazione di Conformità



We
Wir
Nous
Nosotros
Wij
Noi

Varian Vacuum Technologies
121 Hartwell Avenue
Lexington, MA, 02421-3133 USA

declare under our sole responsibility that the product,
erklären, in alleniniger Verantwortung, daß dieses Produkt,
déclarons sous notre seule responsabilité que le produit,
declaramos, bajo nuestra sola responsabilidad, que el producto,
verklaren onder onze verantwoordelijkheid, dat het product,
dichiariamo sotto nostra unica responsabilità, che il prodotto,

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to which this declaration relates is in conformity with the following standard(s) or other normative documents.
auf das sich diese Erklärung bezieht, mit der/den flogenden Norm(en) oder Richtlinie(n) übereinstimmt.
auquel se réfère cette déclaration est conforme à la (auz) norme(s) ou au(x) document(s) normatif(s).
al que se refiere esta declaración es conforme a la(s) norma(s) u otro(s) documento(s) normativo(s).
waamaar deze verklaring verwijst, aan de volende norm(en) of richtlijn(en) beantwoordt.
a cui se riferisce questa dichiarazione è conforme alla/e sequente/I norma/o documento/I normativo/i.

Low Voltage Directive

EN61010-1

1993 Safety requirements for electrical equipment for measurement, control, and laboratory use, incorporating Amendments Nos. 1 and 2.

EMC Emissions and Immunity

EN 61326

1997 Measurement, control and laboratory equipment, EMC requirements – Industrial use.

EMC Emissions

FCC 47 CFR part 15

Class A emissions requirements (USA).

EN 55011

1998 Group 1 Class A ISM emissions requirements (EU).

A handwritten signature in cursive script that reads "Frederick C. Campbell".

Frederick C. Campbell
Operations Manager
Varian Vacuum Technologies
Lexington, Massachusetts, USA

October 2002



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Introduction

The CT-100 Active Rough Vacuum Gauge provides pressure measurements over a range of 1×10^{-4} Torr (1.33×10^{-4} mbar, 1.33×10^{-2} Pa) to atmosphere. The 0.2 second response time of the CT-100 and its excellent accuracy and precision allows its use in place of Pirani gauges.

The CT-100 provides a stable analog voltage output as an indication of the test pressure; the unit can be calibrated in a selection of vacuum ranges. Two potentiometer-variable setpoints provide electrical alarms at selected pressures within the calibrated range of the device. Alarm indications are via the open collector grounding of two output transistors and by the illumination of two LEDs.

An internal power supply provides stable operating voltages from a wide range of external DC power sources.

The gauge is contained in a plastic housing mounted by a 1/8" NPT vacuum fitting. Electrical connections are on a single 9-pin D-subminiature connector.

The output pressure signal is a convenient 1.000 VDC to 9 VDC at 100 Ω internal impedance that can be used with strip chart recorders or other analog voltage data acquisition systems.

Specifications

Measurement, electrical and mechanical specifications for the CT-100 are given in Table 1.

Table 1 Specifications

Item	Description
Pressure ranges	
Calibration at vacuum	1×10^{-4} to 100 Torr, sensitive to ATM 1.33×10^{-4} to 133 mbar, sensitive to ATM 1.33×10^{-2} to $133 \times 10^{+4}$ Pa, sensitive to ATM
Calibration at atmospheric pressure	20×10^{-2} Torr to ATM 2.6×10^{-2} to 1000 mbar 2.6 to 10^{+5} Pa
Measurement response time	0.2 seconds
Operating temperature	UL recognized: From 0 °C to 40 °C; maximum relative humidity 80% for temperatures up to 31 °C decreasing linearly to 50% relative humidity at 40 °C
Storage temperature	-15 °C to 85 °C
Mounting orientation	Vacuum port pointing down for best results above 1 Torr (1.33 mbar, 133 Pa)
Weight with NPT fitting	560 grams (0.25 lb)

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Table 1 Specifications (Continued)

Item	Description
Interface	
Setpoints	Two user defined pressure setpoints for process steps, alarms, high vacuum gauge trigger, or other pressure-induced events
Setpoint alarm output	Dual, non isolated, open collector outputs 0.3 VDC @ 100 mA (ON)
Setpoint voltage level	0 VDC to 12 VDC referred to analog output 100 kΩ output impedance
Adjustments	
Analog voltage output	Proportional to pressure Non-linear, 1 VDC to 9 VDC, nominal 100 Ω output impedance
Power supply	UL recognition for 24 VDC ±10% @ 500 mA max (18 VDC to 30 VDC @ 125 mA, typical operating)
Fault	<0.5 VDC or >9 VDC
Displays	
Setpoint indicators	Two LEDs indicating that the measured pressure is lower than the respective setpoint
Vacuum Indicator	Green LED indicates <100 mTorr (0.133 mbar, 13.3 Pa) vacuum is achieved
Construction	
Materials exposed to vacuum	Nickel plated mild steel, nickel alloy
Casing	Flame retardant ABS (Acrylonitrile-butadiene-styrene)
Sensor element	Platinel
Sensor internal volume	5.4 ml
Connections	
Electrical	9-pin D-subminiature
Vacuum	1/8" NPT vacuum fitting
Installation	
Indoor use	Installation Category II
Pollution category	Category 2
Altitude	2000 m

The CT-100 is compatible with a wide range of Vacuum Technologies pumps as listed in Table 7 on page 24.

Setup and Calibration

Factory Calibration

The CT-100 is calibrated at the factory at high vacuum of 10^{-5} Torr (1.33×10^{-5} mbar, 1.33×10^{-3} Pa). You will achieve the highest measurement accuracy by recalibrating the gauge after installation of the vacuum system using the procedure in “Calibrating the Gauge” on page 9.

Setup Procedures

There are four procedures involved in applying the CT-100 to a vacuum system. This ease of use coupled with the simplicity of fault repair makes the CT-100 very desirable in situations where many gauges are employed and in harsh environments that can lead to stress on the gauge and subsequent expectation of short life.

The setup procedures are:

1. Mount the gauge with its NPT fitting facing downward. A range of fitting adaptors is available from Vacuum Technologies as listed in Table 2 on page 5.

CAUTION



Do not tighten the fitting by twisting the plastic case as this will result in damage to the gauge. Use the wrench specified in “Tools and Equipment” on page 4 below.

2. Plug the single electrical cable into the D-connector and appropriately connect the free-end wires according to information in Table 3 on page 6.
3. Perform a one-point calibration of the non-linear sensor as described in “Calibrating the Gauge” on page 9.

Calibration must be done at vacuum below 1×10^{-4} Torr (1.33×10^{-4} mbar, 1.33×10^{-2} Pa) or at atmosphere, depending on the expected range of the gauge use. Calibration at intermediate pressures may also be performed with the use of a calibrated pressure reference.

NOTE



Record the pressure at which you performed the calibration.

4. Adjust the two setpoint potentiometers to the desired trigger levels as described in “Setting the Alarms” on page 13. If you do not want either alarm to go off, turn the potentiometers fully clockwise to maximum vacuum, a level that may not be expected for this system.

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Tools and Equipment

Have the following items available for setup and calibration.

- ❑ 7/16" wrench for the 1/8" NPT fitting
- ❑ Digital voltmeter
- ❑ 24 VDC power supply, 125 mA capacity
- ❑ Vacuum pump able to reach 1×10^{-5} Torr, (1.33×10^{-3} mbar, 1.33×10^{-1} Pa) with its necessary fittings
- ❑ Plumber's sealing tape or other suitable thread sealant

Vacuum System Configuration

The engineering drawing of the gauge shown in Figure 1 points out the locations of user items on the CT-100. All adjustment locations are readily accessible when the unit is mounted vacuum port downward in the vacuum system.

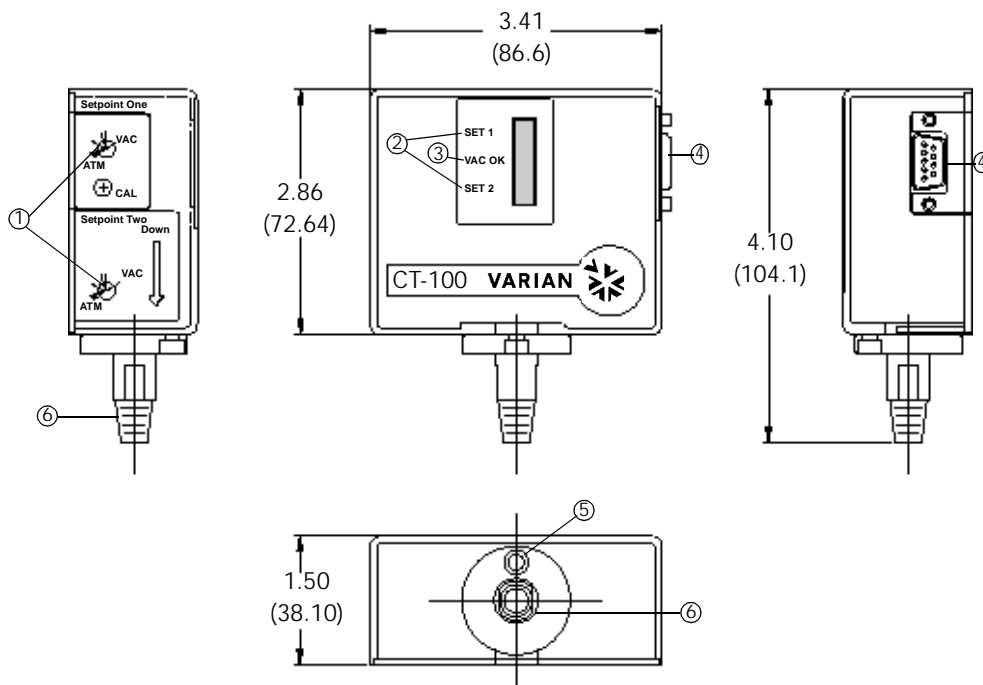


Figure 1 Dimensions, inches (mm), and Important Items

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Important items shown in the figure are:

- ① Potentiometers — Setpoints 1 and 2
- ② Setpoint alarm LEDs
These LEDs are OFF until the vacuum reaches the setpoint level. Thereafter, they remain RED as long as the pressure stays below the setpoint.
- ③ **VACuum OK** indicator
This LED is OFF at atmospheric pressure and turns GREEN when the vacuum is below 100 milliTorr (0.133 mbar, 13.3 Pa).
- ④ 9-pin D-subminiature connector for interface cable to the electrical system.
- ⑤ Allen screw access for fixing the sensor orientation after replacement.
- ⑥ 1/8" NPT vacuum fitting

Vacuum Connections

Vacuum fitting may be purchased from Vacuum Technologies to mate your system with the 1/8" NPT fitting integral to the CT-100. The available stainless steel and aluminum fittings are listed in Table 2. Be sure the appropriate fitting for the vacuum system to be measured is installed on your CT-100.

Table 2 Vacuum Fittings

Fitting Size	Vacuum Technologies Part Number
304 Stainless Steel	
KF16	KAFP160125S
KF25	KAFP250125S
Aluminum	
KF16	KAFP160125A
KF25	KAFP250125A

NOTE



Mount the gauge with the vacuum port facing downward for optimum measurement accuracy.

Vacuum Sealing

The CT-100 must be securely connected to the vacuum system to be tested. Seal all threaded joints using plumber's tape or an appropriate sealant. Tighten the thread securely.

Electrical Connections

All signals and voltages are handled through a 9-pin D-subminiature connector mounted on the side of the CT-100 as shown in Figure 1 on page 4.

The electrical pinouts for this connector are given in Table 3. The connector pin layout is shown in Figure 2.

Table 3 D-subminiature Connector Pinouts

Pin No.	Description
1.	Relay #2 N.O.
2.	Relay #1 N.O.
3.	Power Input (+24 VDC)
4.	Power Ground
5.	Analog Output
6.	Relay Common
7.	Setpoint #2 Output
8.	Signal Ground
9.	Setpoint #1 Output
Shell	Chassis Ground in the gauge. Connect to the Power Supply <i>at the Power Supply</i>

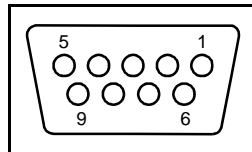


Figure 2 9-Pin D-subminiature Connector

Connecting to the Gauge

The CT-100 generates five signal levels that are externally measured or sensed. These signals, with their pin location on the D-subminiature connector, are given in Table 3.

The voltage on pin 5 represents the pressure in the test object. The equivalent circuit for this output is shown in Figure 3.

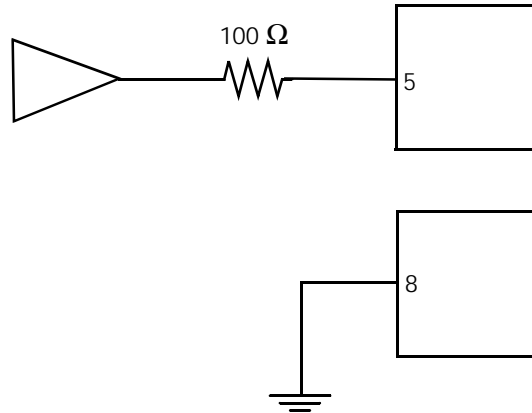


Figure 3 Pressure Output Equivalent Circuit

The voltages on pins 7 and 9 represent the setpoint alarm pressures. These voltages are taken from the wipers of the screwdriver-adjust potentiometers respectively labelled Setpoint 2 and Setpoint 1 in Figure 1 on page 4. The circuit for these outputs is shown in Figure 4. The sensing circuit loaded on this output should have an impedance of at least 10 Meg Ω

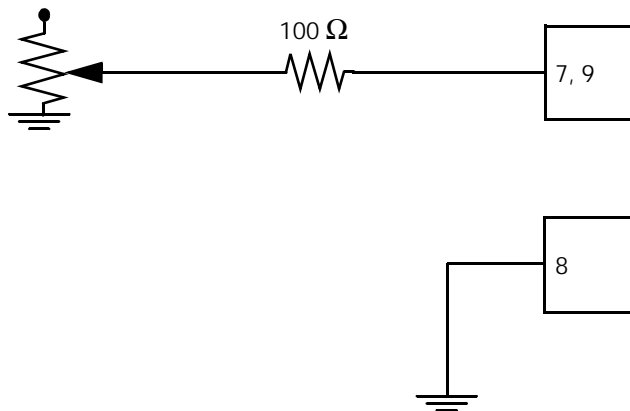


Figure 4 Setpoint Level Equivalent Circuit

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The voltage on pins 1 and 2 are the switched collectors indicative of a tripped setpoint alarm. The equivalent circuit for these outputs is shown in Figure 5. The collector is clamped to ground when the setpoint level is reached. This circuit can sink up to 100 mA from a supply of up to 30 VDC.

CAUTION



Since the usual driven element is a relay coil, a snubber diode is required for protection from inductive flyback as is shown below and in Figure 12 on page 17.

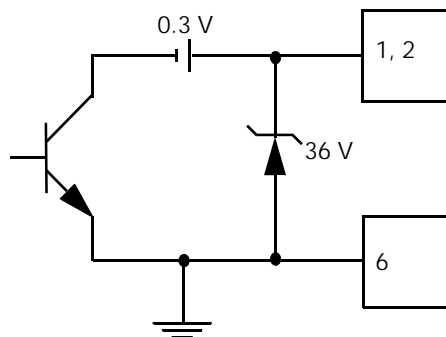


Figure 5 Setpoint Output Driver Equivalent Circuit

The CT-100 appears as shown in Figure 6 when mounted in a vacuum system.

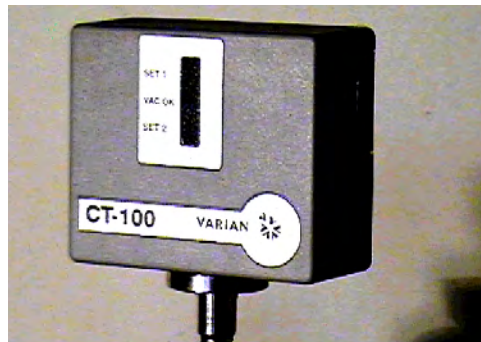


Figure 6 Installed CT-100

NOTE



Mount the gauge with the vacuum port facing downward for optimum measurement accuracy.

Calibrating the Gauge

Perform a recalibration every few months or more often as needed (see Table 6 on page 18) based on the temperature and the process chemistry in which the gauge is used. Your Vacuum Technologies Customer Support Center can provide advice on establishing a routine calibration schedule for your applications. See the rear cover of this manual for a list of Center locations.

The CT-100 pressure vs. voltage calibration curves for air and argon are given in Figure 7. The data on which to base a calibration are given in Table 4 on page 10. The calibration procedure for any gas *without a reference gauge* is based on establishing a datum at either:

- ❑ The ultimate vacuum for the CT-100 at 1×10^{-5} Torr (1.33×10^{-5} mbar, 1.33×10^{-3} Pa) where the gauge output voltage is set to *1.000 VDC for any gas, or*
- ❑ At atmospheric pressure of 760 Torr (1000 mbar, 10,000 Pa) where the gauge voltage is set to:
 - ❑ *8.255 VDC in air/N₂, or*
 - ❑ *6.783 VDC in argon.*

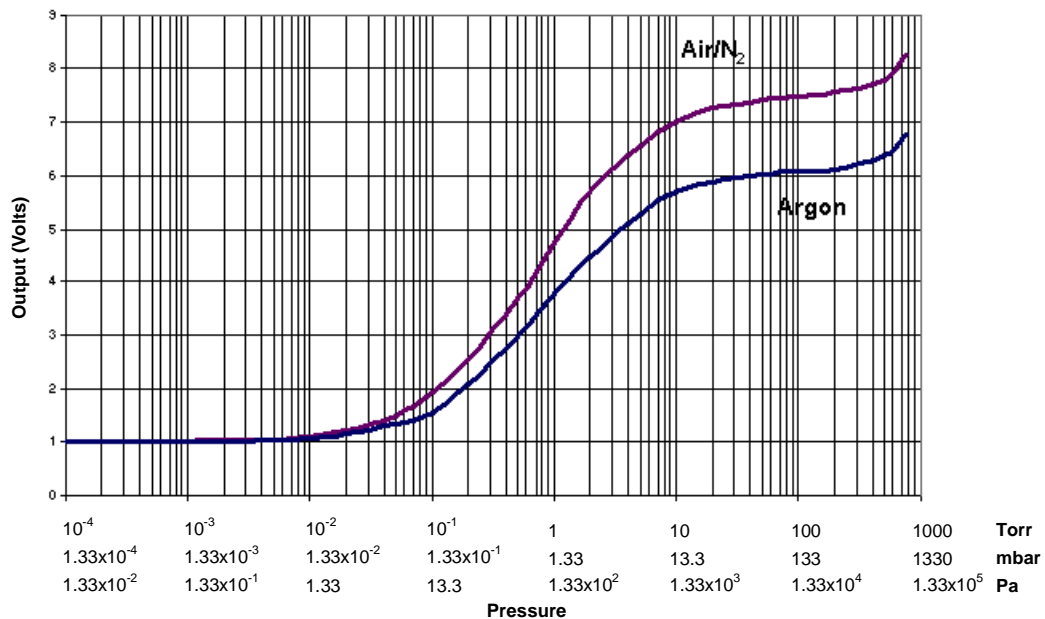


Figure 7 Air/N₂ and Argon Calibration Curves

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Table 4 Air/N₂ and Argon Calibration Data

Pressure (Torr)	Pressure (mbar)	Pressure (Pa)	V _{out} (Air/N ₂)	V _{out} (Argon)
1.00E-04	1.33E-04	1.33E-02	1.002	1.002
2.00E-04	2.66E-04	2.66E-02	1.004	1.003
5.00E-04	6.65E-04	6.65E-02	1.007	1.005
1.00E-03	1.33E-03	1.33E-01	1.013	1.008
2.00E-03	2.66E-03	2.66E-01	1.025	1.015
5.00E-03	6.65E-03	6.65E-01	1.055	1.036
1.00E-02	1.33E-02	1.33E+00	1.111	1.069
2.00E-02	2.66E-02	2.66E+00	1.216	1.136
5.00E-02	6.65E-02	6.65E+00	1.501	1.330
1.00E-01	1.33E-01	1.33E+01	1.940	1.562
2.00E-01	2.66E-01	2.66E+01	2.540	2.085
5.00E-01	6.65E-01	6.65E+01	3.678	2.977
1.00E+00	1.33E+00	1.33E+02	4.737	3.787
2.00E+00	2.66E+00	2.66E+02	5.703	4.312
5.00E+00	6.65E+00	6.65E+02	6.547	5.288
1.00E+01	1.33E+01	1.33E+03	6.999	5.598
2.00E+01	2.66E+01	2.66E+03	7.241	5.892
5.00E+01	6.65E+01	6.65E+03	7.405	6.017
1.00E+02	1.33E+02	1.33E+04	7.463	6.065
2.00E+02	2.66E+02	2.66E+04	7.548	6.097
5.00E+02	6.65E+02	6.65E+04	7.762	6.347
7.60E+02	1.01E+03	1.01E+05	8.255	6.783

To calibrate the CT-100:

1. Connect the gauge to the vacuum system to be measured.
 If you want to establish the datum at atmospheric pressure, the system does not have to be pumped down.
2. Connect the cable to a power supply.
3. Connect a voltmeter to gauge ground pin # 4 and to gauge output pin # 5 on the cable from the D-connector.

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4. Plug the cable into the gauge and turn the power supply ON.
5. Allow the gauge to warm up for 1/2-hour.
 - ❑ To calibrate at atmosphere, go to step 6.
 - ❑ To calibrate at vacuum, go to step 7.
6. Adjust the **CAL** screwdriver potentiometer as shown in Figure 8 until the voltmeter reads 8.255 VDC.

If calibrating in an argon atmosphere, adjust the output to 6.783 VDC.

The gauge is now calibrated with maximum accuracy obtained near atmospheric levels.

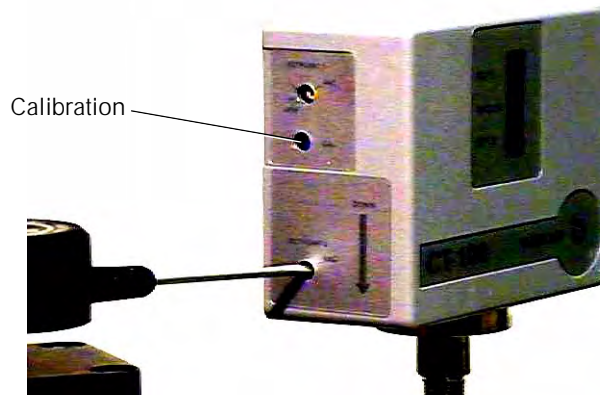


Figure 8 Adjusting the Calibration Potentiometer

To calibrate the gauge for optimum accuracy at high vacuum levels:

1. Connect the gauge to a pump and precision gauge able to achieve and measure 1×10^{-5} Torr (1.33×10^{-5} mbar, 1.33×10^{-3} Pa) or lower.
2. Adjust the **CAL** screwdriver potentiometer as shown in Figure 8 until the voltmeter reads 1.000 volts.

Note in Table 4 that the output voltage rises by 2 millivolts at the lowest accurately measurable level for the CT-100, 1×10^{-4} Torr (1.33×10^{-4} mbar, 1.33×10^{-2} Pa).

The gauge is now calibrated for measurements from 10^{-4} to 100 Torr (1.33×10^{-4} to 133 mbar, 1.33×10^{-2} to 1.33×10^4 Pa).

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Calibration at Intermediate Pressures

The CT-100 can be calibrated at intermediate pressures to attain the best accuracy near that level, or to compensate for use at high altitude.

To calibrate the gauge at intermediate pressures:

1. Determine the pressure at which you want to calibrate the gauge.

If the gauge is being operated at high altitude, determine the local air pressure.

2. Refer to the chart in Figure 7 on page 9 or to Table 4 on page 10 and determine the output voltage corresponding to that pressure.

A linear interpolation between points in the table will provide sufficient accuracy.

For example, at a calibration pressure of 20 milli Torr (0.266 mbar, 26.6 Pa), the output voltage should be adjusted to 1.216 VDC as shown in Table 4.

3. Use a calibrated reference gauge to verify that the pressure in the system is at the desired value.
4. Adjust the **CAL** potentiometer until the output voltage reads the value just determined.

Setting the Alarms

The two setpoints are screwdriver adjusted as shown in Figure 9.

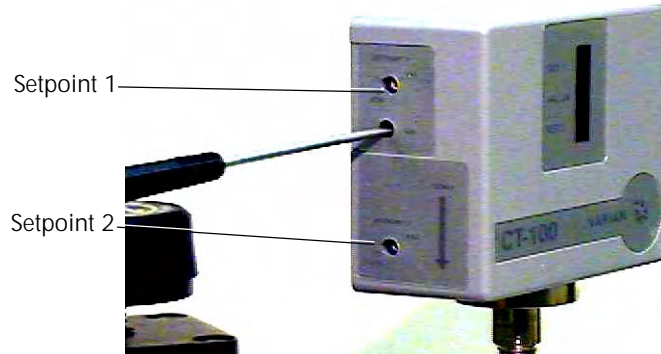


Figure 9 Screwdriver Adjustment of the Setpoints

The output voltage of 1 VDC to 9 VDC covers the measurement range from vacuum to atmospheric. The setpoints can be extended beyond this range to the limits of 0 to 12 volts for alarm settings beyond the accurate range of the gauge.

Examples:

- ❑ If the setpoint is greater than the reading for ATM, the output and the LED will always be active whenever power is applied to the gauge.
- ❑ If the setpoint is lower than the **VAC** reading, the setpoint can indicate a sensor failure.

When a setpoint is activated, the corresponding open collector, on pin 1 for setpoint 2 and on pin 2 for setpoint 1, becomes active and can sink current to the common ground. This connection may be used to drive a relay coil (see Figure 12 on page 17) or other indicator that shows the trigger setpoint has been reached.

There are two ways to adjust the setpoints:

- ❑ Use a voltmeter to measure the voltage equivalent of the pressure at which the alarm is to be set. This provides the most accurate way to establish a setpoint.
- ❑ Rotate the potentiometer screw by referring to the line markings on the front panel. These markings provide approximate pressure settings throughout the range of measurable vacuum.

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Voltmeter adjustment of a setpoint:

1. Connect power to a CT-100 gauge that has been calibrated. The voltage to be measured is from 0 up to 12 VDC. If necessary, set the voltmeter scale to measure this range.
2. Attach the voltmeter ground to pin 8 on the D-connector cable.
3. Attach the voltmeter probe to pin 9 to measure setpoint #1 and to pin 7 for setpoint #2 as determined from Table 3 on page 6. At this point you are reading the voltage on the wiper of the selected potentiometer.
4. Refer to the Table 4 on page 10 or to Figure 7 on page 9 for the gas you wish to measure.

This data is given in Torr, mbar, and Pascals on the pressure X-axis.

5. Locate the pressure for the setpoint on the X-axis of the chart and read off the voltage from the Y-axis, or find a specific pressure in the table and its associated voltage. Use a linear interpolation between the nearest data points for intermediate values.
6. Adjust the screwdriver potentiometer for the appropriate setpoint until the voltmeter reads the value indicated on the curve or the table.

You can calibrate to three decimal places, ± 1 millivolt.



If you are measuring a different gas, the setpoints must be readjusted.

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Setpoint Adjustment from Panel Markings:

Each setpoint can be brought to an approximate pressure level by rotating the screwdriver adjustment according to the markings on the side panel surrounding the potentiometer. These markings are placed approximately at each decade of vacuum (refer to Figure 10 and Table 5).

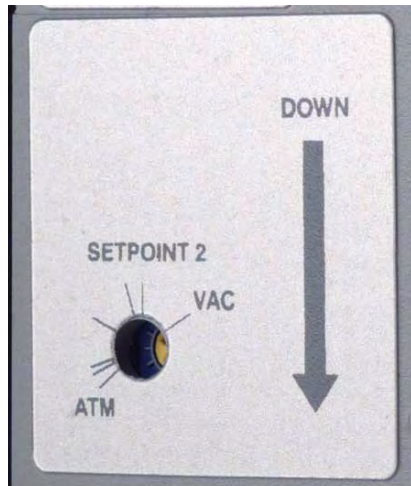


Figure 10 Potentiometer Pressure Markings on the Side Panel

Table 5 Marking Pressures

Marking Clockwise	Torr	mbar	Pascal
ATM	760	1000	10^{+5}
1	100	133	$1.33 \times 10^{+4}$
2	10	13.3	$1.33 \times 10^{+3}$
3	1	1.33	133
4	100 mT	1.33×10^{-1}	13.3
5	10 mT	1.33×10^{-2}	1.33
VAC	1 mT	1.33×10^{-3}	1.33×10^{-1}

Cleaning

Exterior

The exterior of the CT-100 may be kept clean using a cloth slightly dampened with water.

Interior

Remove all power from the CT-100 before opening the cover to clean its internal parts. To remove the cover, follow the procedure given in "Changing the Vacuum Sensor" on page 21. The only internal part that may require cleaning is the vacuum port and the sensor mounted inside the port. Use alcohol or acetone for cleaning.

WARNING



Explosion and Fire from Acetone and Alcohol: This device may be cleaned with acetone and alcohol. When combined with air, oxygen, and other oxides, alcohol and most other solvents are very flammable and explosive. Never permit any trace of these cleaners to remain in or on the gauge. Always remove all traces of alcohol and acetone and other cleaners with clean, dry, oil-free compressed air.

Gauge Applications

The CT-100 setpoint trigger can be used to enable or disable the sensor filament in an associated Eyesys precision vacuum gauge. The connections to achieve this are shown in Figure 11.

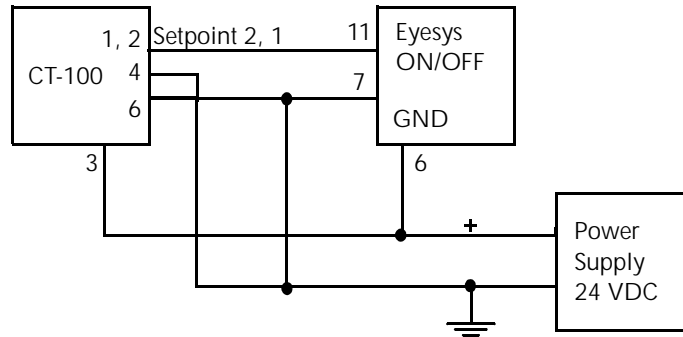


Figure 11 Setpoint Output to the Eyesys Mini-BA

CAUTION



When using the CT-100 setpoint trigger output to drive an external relay, a diode must be placed across the coil to avoid the flyback voltage from damaging the output collector. This circuit is shown in Figure 12.

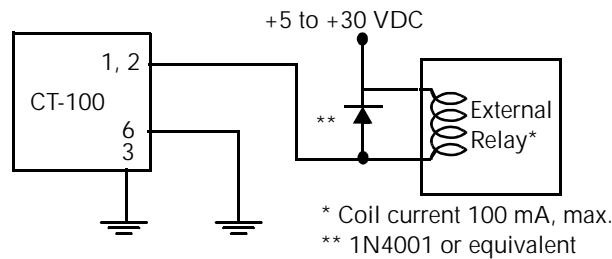


Figure 12 Setpoint Output Driving a Relay Coil

Troubleshooting

Qualified Service

The only user-serviceable procedure in the CT-100 is the replacement of the vacuum sensor as discussed in “Changing the Vacuum Sensor” on page 21. All other service or repair must be done only by Vacuum Technologies qualified service staff. Refer to “Contacting Vacuum Technologies” on page xiv. Table 6 contains a list of failure symptoms for the CT-100, the possible causes for the failure, and the corrective actions that you can take.



The vacuum sensor is the only replaceable part in the CT-100. No other replacements or repairs are authorized for customer action. If you replace any part other than the sensor, you will void the warranty and negate the certification to industrial standards.

Table 6 Troubleshooting

Symptom	Possible Causes	Corrective Action	See...
Green LED does not light at HI vacuum	Power not applied	Apply power correctly.	Table 3 on page 6
	Power polarity reversed		
	Sensor failure	Replace sensor.	Section “Changing the Vacuum Sensor” on page 21
Setpoint LEDs do not light	Power not applied	Apply power correctly.	
	Power polarity reversed		
	Sensor failure	Replace sensor.	Section “Changing the Vacuum Sensor” on page 21
	Setpoint level set too high	Readjust setpoint level.	“Setting the Alarms” on page 13
Analog output near 0 volts at any pressure	Power not applied	Apply power.	
	Power polarity reversed	Apply power correctly.	
	Sensor failure	Replace the sensor.	Section “Changing the Vacuum Sensor” on page 21
	CAL adjustment incorrect	Recalibrate.	“Calibrating the Gauge” on page 9
	Printed circuit board failure	Call the Customer Support Center.	

CT-100 Active Rough Vacuum Gauge

Table 6 Troubleshooting (Continued)

Symptom	Possible Causes	Corrective Action	See...
Analog output above 9 volts at any pressure	Supply voltage greater than 30 VDC	Reduce the supply voltage.	
	Sensor contaminated	Clean the sensor.	“Cleaning” on page 16
	Sensor failure	Replace the sensor.	Section “Changing the Vacuum Sensor” on page 21
Draws excessive power. Supply current > 125 mA	Printed circuit board failure	Call the Customer Support Center.	
Does not track calibration curve	CAL adjustment incorrect	Recalibrate.	“Calibrating the Gauge” on page 9
	Gas other than air or argon	Calibrate with the actual gas used.	
	Contaminated sensor	Clean or replace the sensor.	Section “Changing the Vacuum Sensor” on page 21
	Leak at pipe thread fitting	Reattach the CT-100 with new thread sealant using the proper torque.	“Vacuum Sealing” on page 5
Analog output unstable	Power supply voltage too high	Lower the voltage to under 30 VDC.	Section “Changing the Vacuum Sensor” on page 21
	Sensor failure	Replace the sensor.	Section “Changing the Vacuum Sensor” on page 21
	Cable shield and power return tied together at gauge	Tie the cable shield and power return together at the power supply, only.	
	Use of unshielded cable	Use a shielded cable grounded at the power supply.	
	RFI or EMI are above the limits of EN61326	Reduce the RFI and EMI to below levels of EN61326 or add additional shielding.	
	Pressure in chamber fluctuates	No action required. Gauge responds to pressure changes of 0.2 seconds.	

CT-100 Active Rough Vacuum Gauge

Table 6 Troubleshooting (Continued)

Symptom	Possible Causes	Corrective Action	See...
Unable to calibrate	Incorrect pressure level	Replace the sensor.	Section "Changing the Vacuum Sensor" on page 21
	Sensor failure		
	Printed circuit board failure	Call the Customer Support Center.	
Setpoint potentiometer markings not accurate	Markings are approximate	Use setpoint level outputs to obtain an accurate setting.	"Setting the Alarms" on page 13
Setpoint outputs stay at 0 volts	No pull-up resistor	Connect a pull-up resistor.	Figure 5 on page 8
	Printed circuit board failure	Call the Customer Support Center.	

Changing the Vacuum Sensor

The thermal pressure vacuum sensor is mounted inside the plastic housing and is accessible for changing by opening the housing. Perform this work at an ESD controlled workstation.

Tools required:

- ❑ Phillips head screwdriver, small
- ❑ Allen (hex) wrench, 1/8"

To replace the sensor:

1. Disconnect the D-connector plug from the CT-100.
2. Remove the CT-100 from the vacuum system.
3. Remove three screws holding the cover to the gauge body and lift the cover off.

The screw at the position shown in Figure 13 is longer than the other two screws and must be returned to the same place when reassembling the cover.

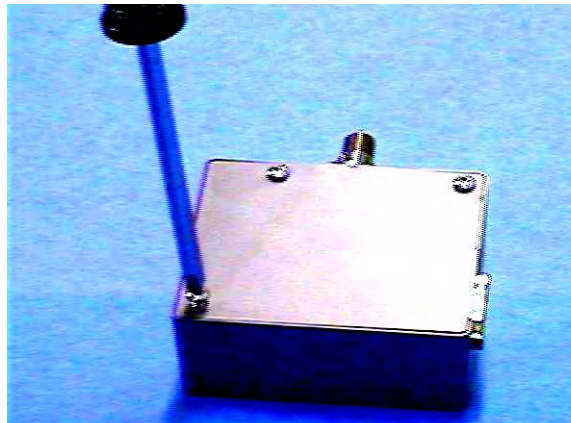


Figure 13 Location of the Long Screw

4. Locate the Allen (hex) screw at the top, outer end of the sensor body. Use a 1/8" hex wrench and remove the screw as shown in Figure 14.



Figure 14 Location of Allen (hex) Screw

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5. Locate and unplug the red plastic connector that attaches the cable from the sensor to the circuit board, as shown in Figure 15.

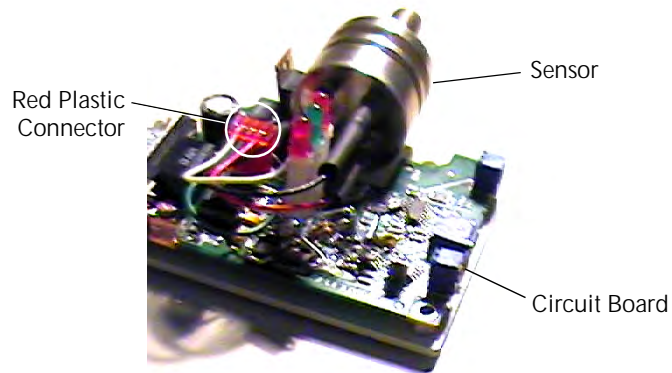


Figure 15 Red Connector and Sensor

6. Lift the sensor and its attached cable out of the gray plastic cradle.
7. Put the new sensor into the cradle. Be sure to locate the tube and wires as shown in Figure 16.

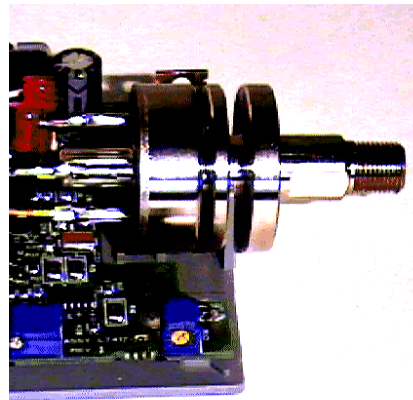


Figure 16 Sensor in its Cradle

CT-100 Active Rough Vacuum Gauge

8. Rotate the sensor so the Allen screw anchor hole is at the top of the assembly and is visible through the hole in the cover as shown in Figure 17.



Figure 17 Positioning the Sensor

9. Insert and finger tighten the Allen screw.
10. Reattach the red connector. The connector is polarized to be inserted in only a specific orientation and with full alignment of plug and socket.

CAUTION



Sensor failure may take place if the connector and plug are not aligned and if any pins are not firmly engaged.

11. Replace the gauge cover and fully tighten the Allen screw.
12. Locate the longer of the cover screws and insert it in the lower left position as shown in Figure 15 on page 22 with the vacuum port facing upward.
13. Replace the remaining two screws and replace the gauge in the vacuum system.
14. Calibrate the gauge using the procedure in "Calibrating the Gauge" on page 9.

Compatible Vacuum Pumps

Table 7 Compatible Vacuum Pumps

Product
Vacuum Pumps
SH-100 Dry Scroll
TriScroll Series - TS-300, 320, 600, 620
Rotary Vane
Turbo Molecular
Ion
Diffusion
Vacuum Gauges
High Vacuum Gauge - Mini BA (Digital)
High Vacuum Gauge - Mini IMG (Analog)

Accessories and Replacement Parts

Table 8 Accessories and Replacement Parts

Item	Part Number
Interface Cable with 9 -pin, D-subminiature male connector	R0907xyz xyz = length in feet
Power Supply/Breakout Box [24 VDC power and signal test points]	670077101
Vacuum Sensor 1/8" NPT	L7426601
RJ45 Adapter for Edwards ATC and APG	L7439301
Mating DSUB Connector Kit	L7440301
Vacuum Fittings: 304 Stainless Steel	
KF16	KAFP160125S
KF25	KAFP250125S
Vacuum Fittings: Aluminum	
KF16	KAFP160125A
KF25	KAFP250125A

- Return authorization numbers (RA#) **will not** be issued for any product until this Certificate is completed and returned to a Varian, Inc. Customer Service Representative.
- Pack goods appropriately and drain all oil from rotary vane and diffusion pumps (for exchanges please use the packing material from the replacement unit), making sure shipment documentation and package label clearly shows assigned Return Authorization Number (RA#) VVT cannot accept any return without such reference.
- Return product(s) to the nearest location:

North and South America

Varian, Inc.
Vacuum Technologies
121 Hartwell Ave.
Lexington, MA 02421
Fax: (781) 860-9252

Europe and Middle East

Varian S.p.A.
Via F.lli Varian, 54
10040 Leini (TO) – ITALY
Fax: (39) 011 997 9350

Asia and ROW

Varian Vacuum Technologies
Local Office

For a complete list of phone/fax numbers see www.varianinc.com/vacuum

- If a product is received at Varian, Inc. in a contaminated condition, **the customer is held responsible** for all costs incurred to ensure the safe handling of the product, and **is liable** for any harm or injury to Varian, Inc. employees occurring as a result of exposure to toxic or hazardous materials present in the product.

<i>CUSTOMER INFORMATION</i>		
Company name:		
Contact person: Name:	Tel:.....	
Fax:	E-mail:	
Ship method:	Shipping Collect #:	P.O.#:
Europe only: VAT Reg Number:	USA only: <input type="checkbox"/> Taxable <input type="checkbox"/> Non-taxable	
Customer ship to:	Customer bill to:	
.....	
.....	

PRODUCT IDENTIFICATION

Product Description	Varian, Inc. Part Number	Varian, Inc. Serial Number

TYPE OF RETURN (check appropriate box)

<input type="checkbox"/> Paid Exchange	<input type="checkbox"/> Paid Repair	<input type="checkbox"/> Warranty Exchange	<input type="checkbox"/> Warranty Repair	<input type="checkbox"/> Loaner Return
<input type="checkbox"/> Credit	<input type="checkbox"/> Shipping Error	<input type="checkbox"/> Evaluation Return	<input type="checkbox"/> Calibration	<input type="checkbox"/> Other

HEALTH and SAFETY CERTIFICATION

VACUUM TECHNOLOGIES CANNOT ACCEPT ANY BIOLOGICAL HAZARDS, RADIOACTIVE MATERIAL, ORGANIC METALS, OR MERCURY AT ITS FACILITY. CHECK ONE OF THE FOLLOWING:		
<input type="checkbox"/> I confirm that the above product(s) has (have) NOT pumped or been exposed to any toxic or dangerous materials in a quantity harmful for human contact.		
<input type="checkbox"/> I declare that the above product(s) has (have) pumped or been exposed to the following toxic or dangerous materials in a quantity harmful for human contact (<u>Must be filled in</u>):		
Print Name.....	Signature	Date

PLEASE FILL IN THE FAILURE REPORT SECTION ON THE NEXT PAGE

Do not write below this line

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



FAILURE REPORT

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

TURBO PUMPS AND TURBOCONTROLLERS

Claimed Defect	Position	Parameters
<input type="checkbox"/> Does not start <input type="checkbox"/> Does not spin freely <input type="checkbox"/> Does not reach full speed <input type="checkbox"/> Mechanical Contact <input type="checkbox"/> Cooling defective	<input type="checkbox"/> Noise <input type="checkbox"/> Vibrations <input type="checkbox"/> Leak <input type="checkbox"/> Overtemperature <input type="checkbox"/> Clogging	<input type="checkbox"/> Vertical <input type="checkbox"/> Horizontal <input type="checkbox"/> Upside-down <input type="checkbox"/> Other
		Power: Rotational Speed: Current: Inlet Pressure: Temp 1: Foreline Pressure: Temp 2: Purge flow: Operation Time:
Describe Failure:		
Turbocontroller Error Message:		

ION PUMPS/CONTROLLERS

<input type="checkbox"/> Bad feedthrough <input type="checkbox"/> Vacuum leak <input type="checkbox"/> Error code on display	<input type="checkbox"/> Poor vacuum <input type="checkbox"/> High voltage problem <input type="checkbox"/> Other
Describe failure:	
Customer application:	

VALVES/COMPONENTS

<input type="checkbox"/> Main seal leak <input type="checkbox"/> Solenoid failure <input type="checkbox"/> Damaged sealing area	<input type="checkbox"/> Bellows leak <input type="checkbox"/> Damaged flange <input type="checkbox"/> Other
Describe failure:	
Customer application:	

LEAK DETECTORS

<input type="checkbox"/> Cannot calibrate <input type="checkbox"/> Vacuum system unstable <input type="checkbox"/> Failed to start	<input type="checkbox"/> No zero/high background <input type="checkbox"/> Cannot reach test mode <input type="checkbox"/> Other
Describe failure:	
Customer application:	

INSTRUMENTS

<input type="checkbox"/> Gauge tube not working <input type="checkbox"/> Communication failure <input type="checkbox"/> Error code on display	<input type="checkbox"/> Display problem <input type="checkbox"/> Degas not working <input type="checkbox"/> Other
Describe failure:	
Customer application:	

ALL OTHER VARIAN, INC.

<input type="checkbox"/> Pump doesn't start <input type="checkbox"/> Doesn't reach vacuum <input type="checkbox"/> Pump seized	<input type="checkbox"/> Noisy pump (describe) <input type="checkbox"/> Overtemperature <input type="checkbox"/> Other
Describe failure:	
Customer application:	

DIFFUSION PUMPS

<input type="checkbox"/> Heater failure <input type="checkbox"/> Doesn't reach vacuum <input type="checkbox"/> Vacuum leak	<input type="checkbox"/> Electrical problem <input type="checkbox"/> Cooling coil damage <input type="checkbox"/> Other
Describe failure:	
Customer application:	

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