VARIAN

vacuum technologies

SQ405 Controller

MANUALE DI ISTRUZIONI

BEDIENUNGSHANDBUCH

NOTICE DE MODE D'EMPLOI

INSTRUCTION MANUAL

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   LOG N° _____
(by VARIAN VTT)

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

VARIAN

VARIAN ✳ *Request for Return* ISO 9001 REGISTERED

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

		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		....	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.

GENERAL INFORMATION

This equipment is destined for use by professionals. The user should read this instruction manual and any other additional information supplied by Varian before operating the equipment. Varian will not be held responsible for any events occurring due to non-compliance, even partial, with these instructions, improper use by untrained persons, non-authorised interference with the equipment or any action contrary to that provided for by specific national standards. The SQ405 is a high voltage feeder used to feed the ionic pumps.

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

INSTALLATION

⚠️

WARNING!

The controller is equipped with a 3-wire power cord. Use this power cord in conjunction with a properly grounded power socket to avoid electrical shock.
High voltage developed in the controller can cause severe injury or death. Before servicing the unit, disconnect the input power cable.

NOTE

The controller must be installed inside 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 0 °C to +45 °C
- relative humidity: 0 - 95%
  (without condensation)

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

The following paragraph describes the fundamental operating procedures.

Make all vacuum manifold and electrical connections and refer to the pump instruction manual prior to operating the controller.

Power Failure
In the event of a power failure (momentary or long period) the controller is switched off. When power is restored, the controller will automatically restart.

☞ WARNING

High voltage in the controller can cause severe injury or death. Before servicing, turn power off and remove the power cable.

3

Technical Specifications

Mains Supply:	
Voltage	200Vac ±10% Single phase
Frequency	50 Hz
Power	800 VA max
Outputs:	
Voltage	7000 V max
Current	100 mA nominal – 200mA short circuit
Power	200 W max
Operating Temperature	From 0 to +40 °C
Storage Temperature	From -20 to+70 °C
Mains fuses	2 x T 6.3A

Connectors Description

The C.U. has connectors for the following functions:

- **Mains connection:** Plug IEC type with integrated fuses for 200V 50Hz supply

- **Connections to the Pump:** J1, Fisher D105A049 type connector

Connectorl/O: J2, Delta type 25 pin female:

N.Pin	Description	Type
14	Output +24Vcc	Supply voltage
1	Input HV ON/OFF positive	Optically Insulated Input
2	Input HV ON/OFF negative	
15	GND	Supply voltage
5	FAULT n.o. output	
18	FAULT n.o. output	
6	HV ON n.o. output	
19	HV ON n.o. output	RELAY output
7	PROTECT/START n.o. output	
20	PROTECT/START n.o. output	
8	LOCAL/REMOTE n.o. output	
21	LOCAL/REMOTE n.o. output	
3	CURRENT analog output positive	
16	CURRENT analog output GND	Logarithmic analog output
4	PRESSURE analog output positive	
17	PRESSURE analog output GND	
9	RESERVED	Analog Output

復電後
ON信号であれば
ONとなった

+4.5Vで ON.
0Vで OFF

4.5VU上

4

- **Serial Connector: J3, Delta type 9 pin female for RS422**

Pin	Description	Type
6	TX-A (+)	RS 422 output
8	TX-B (-)	
4	RX-A (+)	RS 422 input
7	RX-B (-)	
5	GND	Supply
9	RESERVED	Input

The Front Panel has a 16 x 2 alphanumeric display and a 4 keys keyboard:

Tasto	Descrizione
H.V. ON/OFF	Pump supply ON/OFF
MODE	Working mode configuration
MEASURE	Selection of the displayed measurement
CHANGE	Current parameter value change

Display messages related to the pump working condition:

When the C.U. is switched on, the display shows:

			A	U	T	O	T	E	S	T				
						O	K							

Main page: if in Local mode

P	U	M	P		R	E	A	D	Y		F	O	R	
L	O	C	A	L		S	T	A	R	T				

If in Remote mode

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

From this page it is possible to Start the pump or to go to the C.U. configuration.

*Configuration: In this condition it is possible to change the operating mode.
The configuration is just possible with the HV off. To enter in the Configuration, press the Mode push button*

```
| L | O | C | A | L | / | R | E | M | O | T | E |   |   |   |
| S | E | L | E | C | T | I | O | N | : |   | X | X | X |   |
```

Where XXX can be LOC, REM or SERIAL.
The corresponding output on the rear panel connector will be: open contact for LOC or SERIAL and closed contact for REM.

The CHANGE push button allows to change the present selection.
To confirm the selection and proceed to the following page, press the MODE push button.

```
| P | R | O | T | E | C | T | / | S | T | A | R | T |   |   |   |
| S | E | L | E | C | T | I | O | N | : |   | X | X | X | X | X |
```

Where XXXXX can be PROT or START. The selection is done by means of the CHANGE button.
The corresponding output on the I/O rear panel connector will be: open contact for PROT and closed contact for START.

Press the MODE push button again to go to the Serial communication Baude Rate selection.

```
| S | E | R | I | A | L |   | B | A | U | D |   | R | A | T | E |
|   |   | X | X | X | X |   | B | A | U | D |   |   |   |   |   |
```

XXXX can be 9600, 4800, 1200 or 600 selectable by means of the CHANGE button.
Press the MODE button again to go to the SERIAL address selection page.

```
| S | E | R | I | A | L |   | A | D | D | R | E | S | S | : |
|   |   |   |   |   |   | X | X |   |   |   |   |   |   |   |
```

XX is the address from 1 to 32 that can be modified by means of the CHANGE button.
To pass from the tens to the units press the MODE button.

Press the MODE button again to go back to the main menu.

Pump in Start: In the following pages the operating mode and the analog values are displayed.

The pump is switched on by pressing the HV ON/OFF push button in Local mode or through the HV ON/OFF input in REMOTE mode.

If the HV cable is disconnected from the pump, the Error (Fault) condition "Cable Interlock" will be generated.

When the HV cable is connected, the display shows:

H	V		O	N				P	R	O	T	E	C	T
1	.	3	E	-	7		P	a				X	X	X

Where the Protect indication is shown only if the Protect mode has been selected.

The HV ON output on the Remote I/O connector will be: open contact with HV OFF and closed contact with HV ON.

The MEASURE push button allows to change the page on the display.

H	V		O	N				P	R	O	T	E	C	T
1	.	3	E	-	6		A					X	X	X

Error Condition:

If an Error condition is detected, the FAULT contact on the I/O connector will close .

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

This message is displayed when the HV Cable is disconnected

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

This message appears if the measured pump current is continuously higher than 100 mA for a time of 500 msec or longer.with the Protect mode selected

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

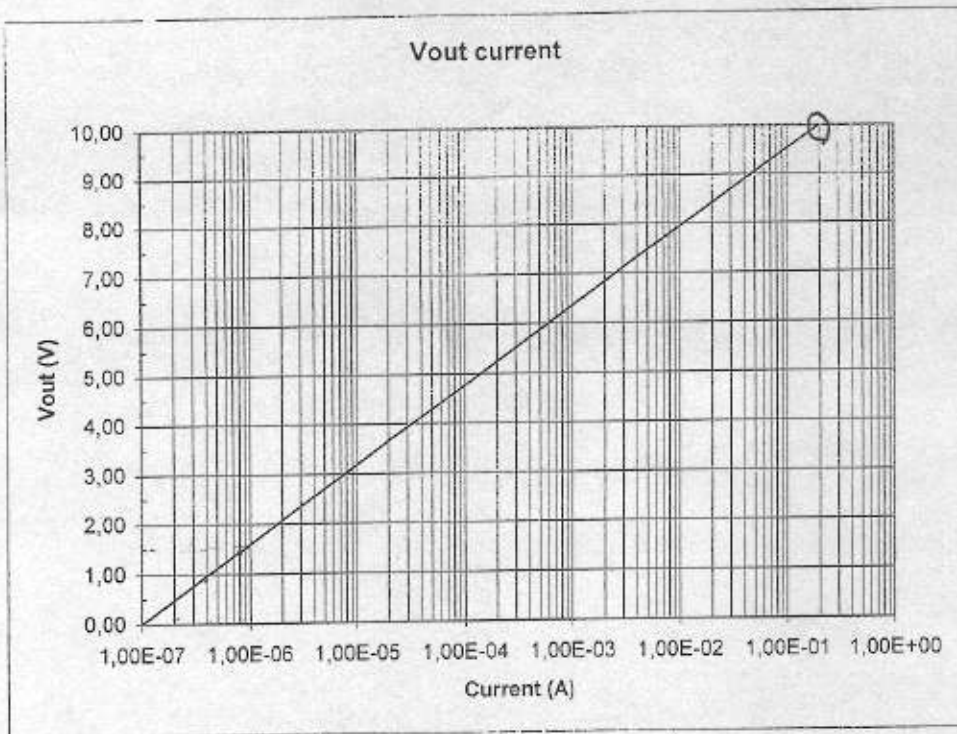This message appears if the temperature inside the controller is higher than set threshold.

Pressure indication

The Pressure indication is calculated from the Current value according to the following relationship
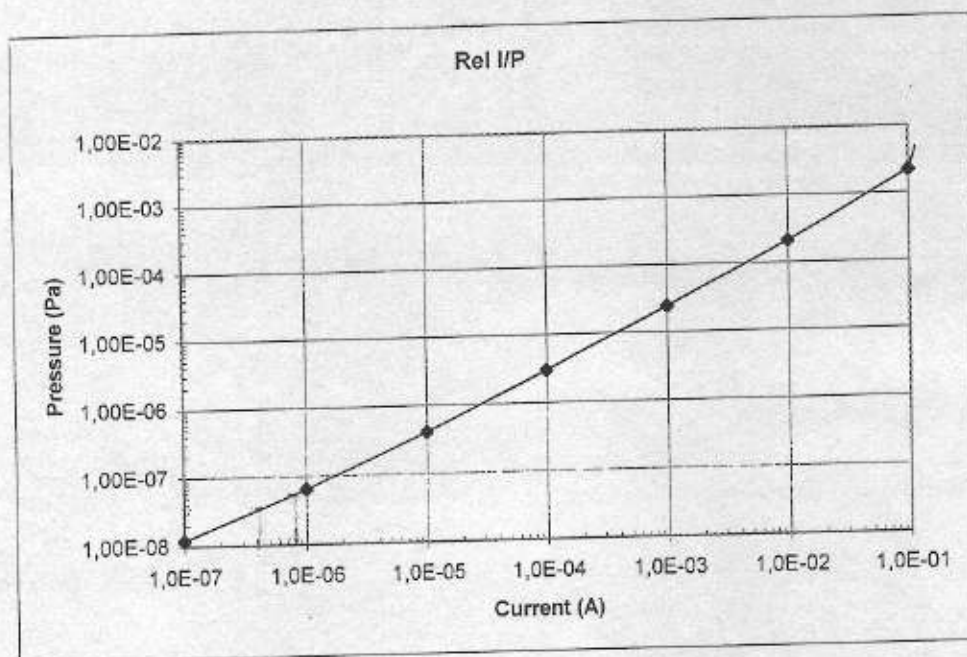
Analog Outputs:

The following graphs give the relationship between the Current and the Pressure versus the Recorder Outputs values.

Vout current

$$10V = 2 \times 10^{-1} A$$
$$0V = 1 \times 10^{-7} A$$
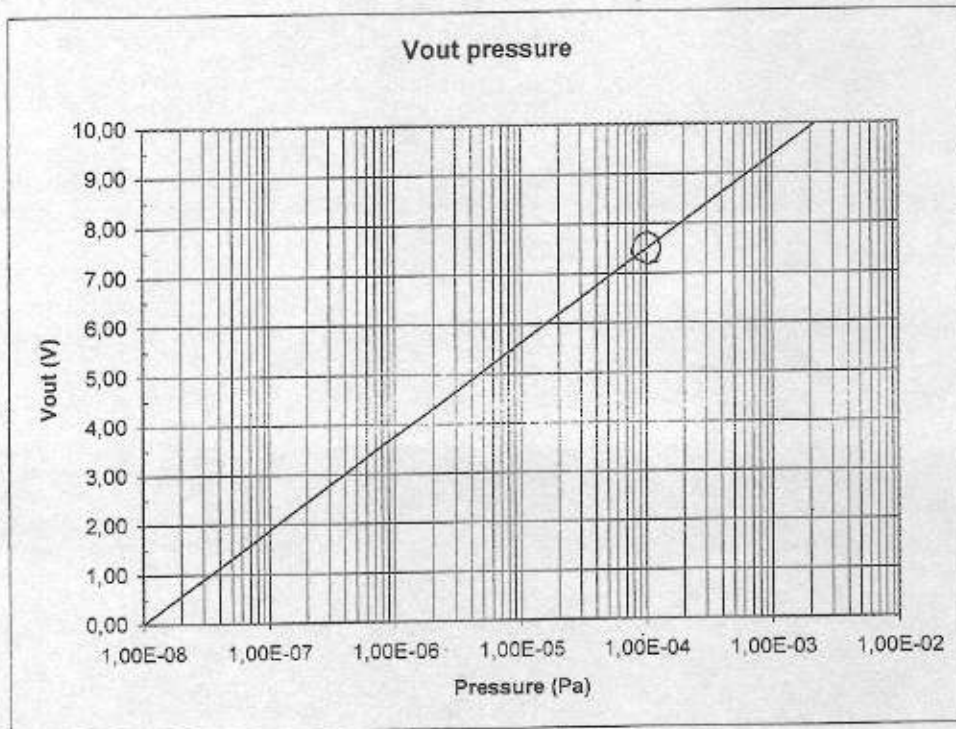
$$v = A \log I + B$$
$$10 = A(-1 + \log_{10} 2^{0,301}) + B$$
$$0 = A - 7A + B$$
$$10 = 6.3 A$$
$$A = \frac{10}{6.3} = 1.59$$
$$B = 7A = 11.1$$
$$I = 10^{\frac{V-11.1}{1.59}}$$

Vout pressure

$$7.5V = 1 \times 10^{-4} Pa$$
$$0V = 1 \times 10^{-8} Pa$$

$$A \times \log_{10} P + B = V$$

$$-8A + B = 0$$

$$-4A + B = 7.5$$

$$4A = 7.5$$
$$A = +\frac{7.5}{4}$$

$$B = +15$$

$$\log_{10} P = \frac{V-B}{A}$$
$$= \frac{V-15}{7.5/4}$$
$$= \frac{8(V-15)}{15}$$
$$= \frac{8}{15}V - 8$$

$$\boxed{P = 10^{\left(\frac{8}{15}V - 8\right)}}$$

$$V = \frac{15}{8} \log_{10} P + 15$$

9

Serial Communication Description:

Communication Format

- **8 Data bits**
- No Parity
- 1 Stop bit
- Baud Rate: 600/1200/2400/4800/9600 baud, programmable
-

Communication Protocol

- Master/Slave type (Computer = Host, Controller = Slave)
- Max. number of periferal units = 32

The communication takes place according to the following scheme:

Host ◄——► Controller
Message ◄——► Answer

Message Format

<ADR> + <LDAT> + <COM> + <CHAN> + <DATA> + <CRC>

Where:

- <ADR>: 0x80 + Periferal unit address (from 0x1 to 0x20)

- <LDAT>: COM, CHAN and DATA fields length (coded in decimal on 2 characters) (00 to 99)

- <COM>: Capital or non capital letter identifying the command (see the "Command Table") followed by the SubCommand (always 0x30 equivalent to the 0n character)

- <CHAN>: Channel number (it is always 0x30, equivalent to 0, for this type of controller)

- <DATA>: String of length and content that depend from the command.
  If the command is a request of reading of a data, this field will contain the "?" (0x3f hexadecimal) character.
  If the command is a data setting command, or if the message is the answer from the controller to a reading command, this field will contain a data string like shown in the following table

Data Type	Valid Character
Logical	0
	1
Numerical	5 character string completed with "0" characters
Exponential	String with the following format x.xEsxx

- <CRC>: XOR of all the characters of the message, excluding the CRC itself and with the MSB set to 0

The answer structure from the addressed Slave unit, will depend on the received command message:

- No characters if the message has a wrong CRC or a wrong Slave address.
- ACK (0x6 hexadecimal) to confirm the setting of the parameter associated to the command sent by Master, if the command is a writing command
- A message with the same structure as the message desribed above, but with the <DATA> field that contains the Parameter requested by the Master and with the <ADR> with the MSB set to 0 when the command is a reading command.
- If the message is wrong, the answer will contain the error code identified by the "!" character followed by the "Error Code" coded in decimal on a single character:

- **2: Not existing command**
- **4: Not a reading command**
- **5: Data not valid**
- **6: Out of range value**

Command Table

Following is the command table with the description of the allowed operations and the associated data type:

Command	Channel	Description	Type	Read/Write	Data
L0	0	*LOC/REM Configuration*	*Numerical*	R/W	'0':Loc '1':Rem '2':Serial
R0	0	PROTECT/START Configuration	Logical	R/W	'0':Protect '1':Start
A0	0	Address	Numerical	R/W	01 – 32
O0	0	HV On/Off	Logical	R/W	'0':Off '1':On
B0	0	Baud Rate	Numerical	R/W	'0': 600baud, '1': 1200baud, '2': 2400baud, '3': 4800baud, '4': 9600baud
I0	0	Current Measurment	Esponential	R	'x.xE-x'
P0	0	Pressure Measurment	Esponential	R	'x.xE-x'
S0	0	Status	Numerical	R	'0':Stop '1':Start '2':Fault
E0	0	Error Code	Numerical	R	'0':No err '1':Overcurrent '2':Overtemp *'3': interlock*
f0	0	Crc memory	Numerical	R	Flash memory Crc16

Data type:
- Logical: 1 character data field (0/1)
- Exponential: Numerical data field (x.xEsxx)
- Numerical: Numerical data field (xxxxx)

Serial communication examples:

HV ON command by Serial line with controller in Serial mode
⟨ADR⟩⟨L DAT⟩⟨COM⟩⟨CHAN⟩⟨DATA⟩⟨CRC⟩
0x81 0x30 0x34 0x4F 0x30 0x30 0x31 0x7B
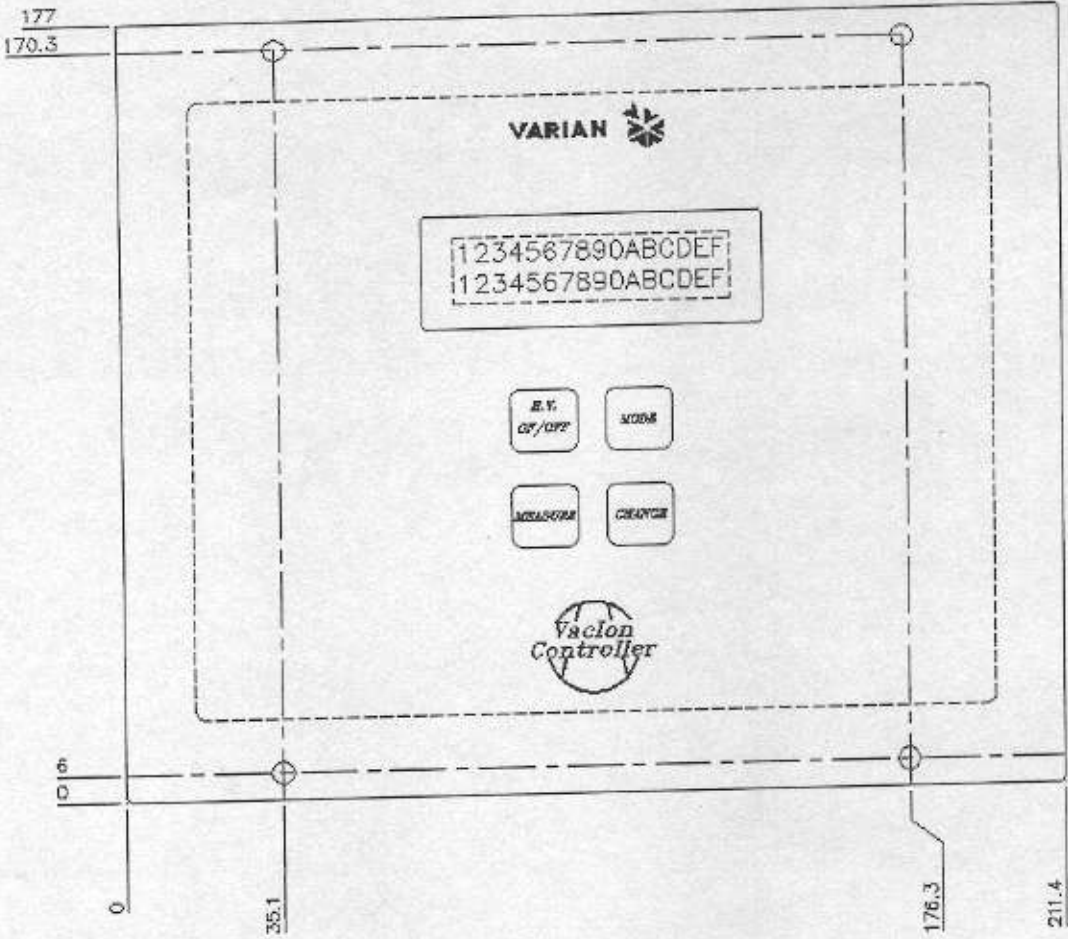
Answer from the control unit:

0x06

Pressure reading request:

0x81 0x30 0x34 0x50 0x30 0x30 0x3F 0x6A

Answer from the control unit:

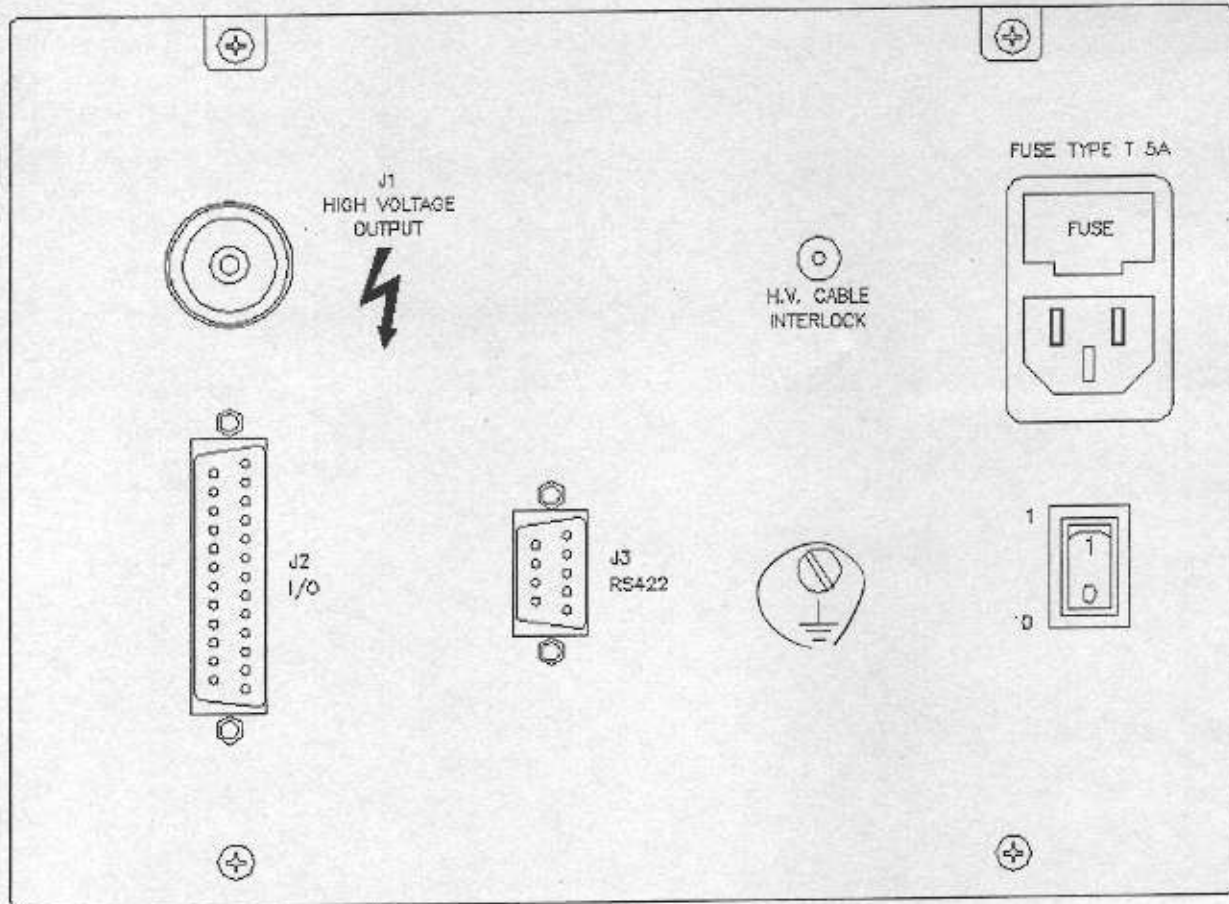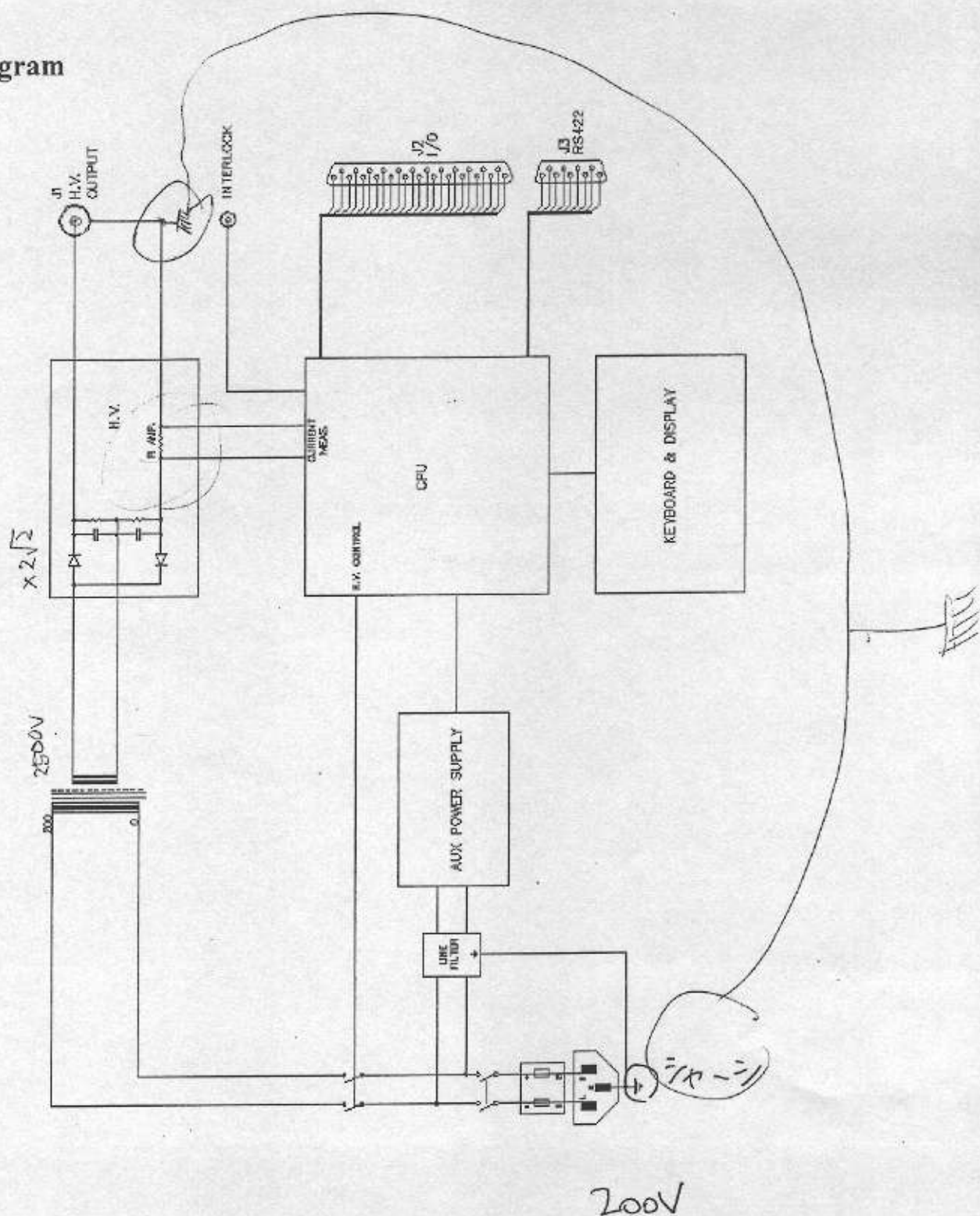0x01 0x31 0x30 0x50 0x30 0x30 0x34 0x2E 0x31 0x45 0x2D 0x30 0x35 0x16

Front Panel

Rear panel

Block Diagram

Interconnections schematic:

FEMALE CONNECTOR

J2
I/O

OUT LOCAL/REMOTE (RELAY CONTACT N.O.)
OUT LOCAL/REMOTE (RELAY CONTACT N.O.)
OUT PROTECT/START (RELAY CONTACT N.O.)
OUT PROTECT/START (RELAY CONTACT N.O.)
OUT HV ON (RELAY CONTACT N.O.)
OUT HV ON (RELAY CONTACT N.O.)
OUT FAULT (RELAY CONTACT N.O.)
OUT FAULT (RELAY CONTACT N.O.)
PRESSURE (GND ANALOG OUT)
PRESSURE (+ ANALOG OUT)
CURRENT (GND ANALOG OUT)
CURRENT (+ ANALOG OUT)
GND
- HV ON/OFF (INPUT)
+ 24VDC 30mA
+ HV ON/OFF (INPUT)

CURRENT LOGARITHMIC OUTPUT : 0V=100mA ; 6V=100mA
PRESSURE LOGARITHMIC OUTPUT :
RELAY CONTACT : 24V 100mA

ANALOG OUTPUTS CONFIGURATION

ANALOG OUTPUT

OUTPUTS CONFIGURATION

OUTPUT

INPUT CONFIGURATION

INPUT

FEMALE CONNECTOR

J3
RS422

GND
Tx-A - (INPUT RS422)
Tx-B - (OUTPUT RS422)
Tx-B + (INPUT RS422)
TX-A + (OUTPUT RS422)