



**OPERATION MANUAL  
SERIAL COMMUNICATION**

**POWER SUPPLY  
FOR MOLECULAR PUMP  
TC163H/TC203/TC223/TC353/TC523H/TC1104  
TC443S/TC553/TC1003/TC1103/TC1503H/TC1813/TC3213**



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***VIEW OUR INVENTORY***

**Before using the pump and the power supply, read carefully and understand thoroughly the cautions in this manual.  
Save this manual for future use and reference.**

**OSAKA VACUUM, LTD.**

## Definitions and symbols

In this manual, "Caution" and "Warning" are defined as follows:

**⚠ Warning : To prevent an accident resulting in injury or death  
If you don't follow it, it will cause an accident resulting in injury or death.**

**⚠ Caution : To prevent damage to the pump or power supply  
If you don't follow it, it will cause damage to the pump (or power supply)  
or injury.**

**⚠ Warning**

**Important description for preventing an accident resulting in injury or death when you use the pump and power supply.**

**⚠ Caution**

**Important description for safe operation of pump and the power supply.**

**⚠ Caution**

**Before using the pump and power supply, be sure to read this manual for safe operation of the pump and power supply. Operations not following the procedures in this manual may cause a failure or accident resulting in injury etc.**

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## 1. Preface

The power supply has a serial interface in conformity with RS232C. It operates the power supply and monitors operational information through the upper host computer. In all operation modes, all commands are effective except START and STOP.

### 1) Operations

Start/stop the pump

### 2) Monitor of operational information

Status (Standby / Acceleration / Normal / Brake / Reacceleration /Failure)

Details of failure

Total operational time of the power supply

Output frequency(Rotating speed)

## 2. Operation mode

To operate on serial communication mode, it is necessary to select the operation mode "SERIAL". How to select the operation mode "SERIAL" is shown in Table1 and Figure1.

	Operation	Explanation	Display
1	Press the function buttons F1 and F3 (press the F3 button before F1 button.) simultaneously over 5 seconds when "Standby" is indicated on display.	Select MAINTENANCE MODE	Maintenance Mode (F1:Next F2:In)
2	Press the F2 button	Enter into MAINTENANCE MODE	No Load Test OFF
3	Press the F1 button four times	Select Operation mode	Operation Time Reset OFF / Protection Signal ON / Fan Alarm OFF / Operation Mode Select LOCAL
4	Press the F2 button twice	Select SERIAL	Operation Mode Select REMOTE / Operation Mode Select SERIAL
5	Press the F3 button	<b>Enter into SERIAL mode</b>	CRC OFF
6	Press the F1 button	Return to initial display	Maintenance Mode (F1:Next F2:In)
7	Press the F1 button	Return to initial display	Standby <b>S</b> 0 rpm 12345h

Table1. How to select the operation mode "SERIAL"

In all operation modes, all commands are effective except START(SDR1) and STOP(SDR0).

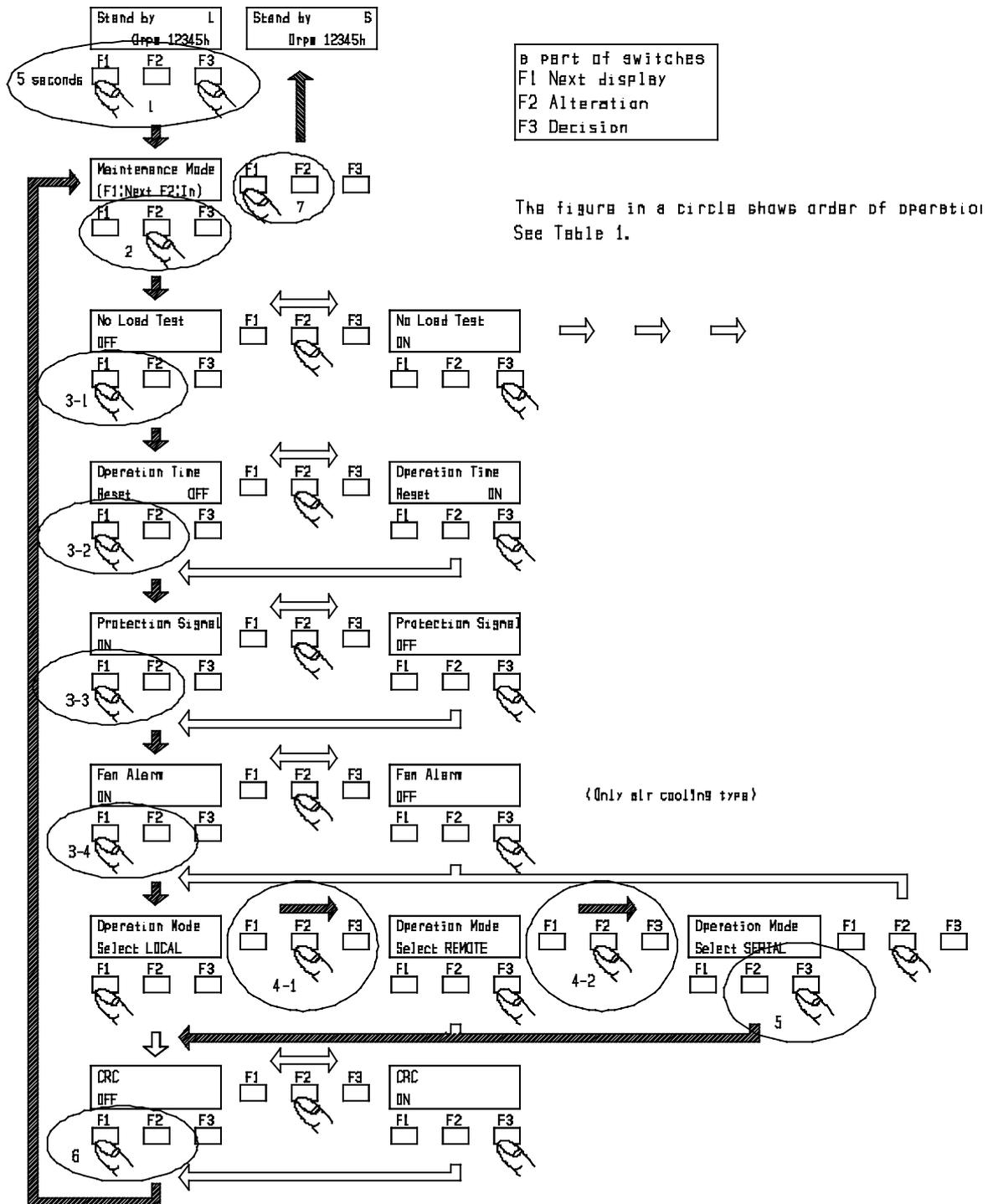


Figure 1. How to select the operation mode "SERIAL"

### 3. Interface specifications

#### 3-1. Transmission specifications

Item	Specification
Method of communication	RS232C
Transmission speed	2400/4800/ <u>9600</u> /19200(bps)
Parity bit	<u>none</u> /odd/even
Start bit	1
Length of data bit	7/ <u>8</u>
Length of stop bit	<u>1</u> /2
Protocol	Refer to section 5, " Protocol specifications "
Control of flow	Hard wear(RS/CS)

**Note.1)** "  "(under bar) is an initial value.

#### 3-2. Connector specifications

Connector ("SERIAL" on the rear panel)    D-Sub 9 pin male  
(Daiichi dennshi 17JE-23090-02(D1))

##### Pin layout

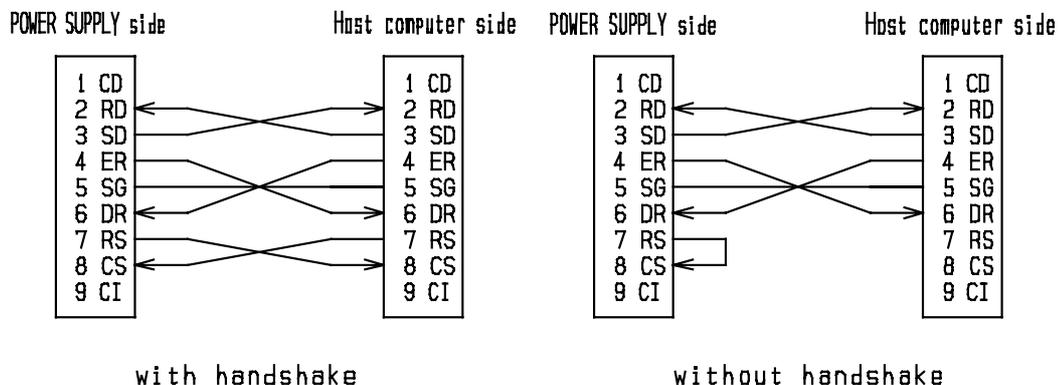
Pin No.	Signal name(JIS)	Status of signal	Input/Output
1	-	Not connected to inside	-
2	RD	Receive data	Input
3	SD	Send data	Output
4	ER	Data terminal ready	Output
5	SG	Signal ground	-
6	-	Not connected to inside	-
7	RS	Request to send	Output
8	CS	Permit to send	Input
9	-	Not connected to inside	-

#### 3-3. Cable specifications

The connection between the power supply and host computer is as follows. Make the cable length as short as possible.

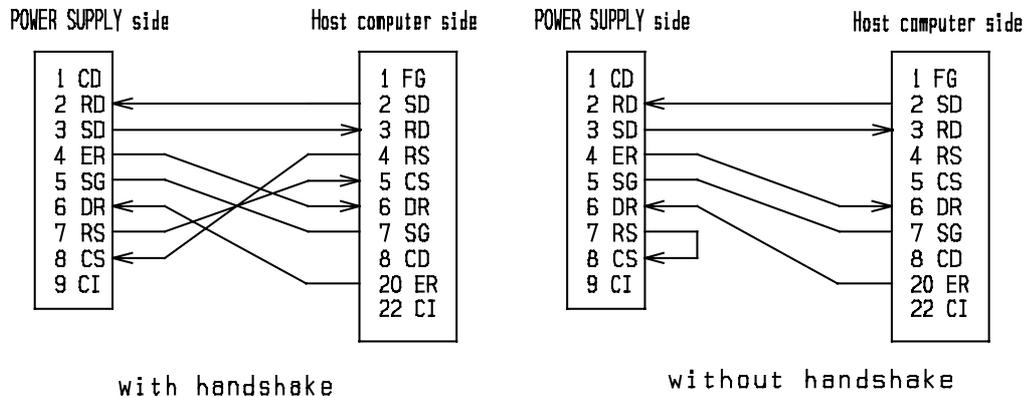
a) If the RS232C connector on the host computer is a D-Sub 9pins connector:

Short between pin No. 7 and pin No. 8, if the host computer does not have a handshake function (figure 2).



**Figure 2 Host computer with D-sub 9 pin connector**

- b) If the the RS232C connector on the host computer is a D-Sub 25 pin connector:  
Short between pin No. 7 and pin. No. 8, if the host computer does not have a handshake function (figure 3).



**Figure 3 Host computer with D-sub 25 pin connector**

## 4. Preparation

### 4-1. Cable connection

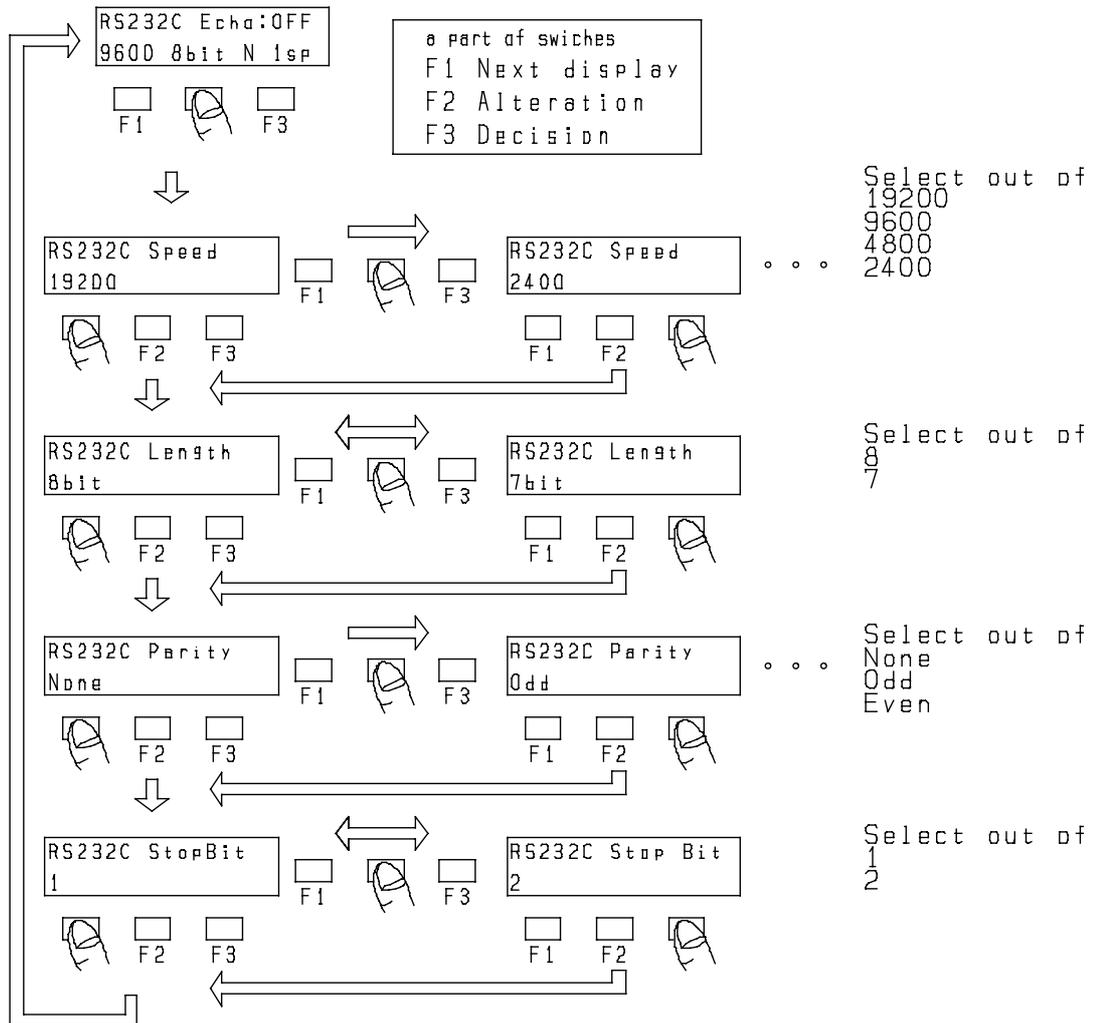
Cut off the input power of the power supply and the host computer. Then connect "SERIAL" on the rear panel of the power supply to the host computer's RS232C port with a cable. Tighten the screws to secure the connector.

### 4-2. Transmission configuration

- 1) Push the "F1" button on front panel and change the page of the liquid crystal display. The transmission configuration is displayed on page 3 as follows.

<b>RS232C_Echo:OFF</b> <b>9600_8 b i t _N_1sp</b>
--

- 2) Next, push the "F2" button on front panel and change to the display for setting and altering parameters. Parameter display changes every time the "F1" button is pushed, like the following : " RS232C Speed " => " RS232C Length " => " RS232C Parity " => " RS232C Stop Bit " .  
Select the parameter to alter by pushing the "F1" button (figure 4).
- 3) The value of the parameter changes every time the "F2" button is pushed. Select the value to set (figure 5).
- 4) When the value to set is displayed, push the "F3" button to set the value.
- 5) Repeat the operation as described above in 2), 3), and 4) untill all parameters are set. After all the parameters are set, push the "F1" button to return to page 1 of the display.



**Figure 4 Setting of transmission specifications**

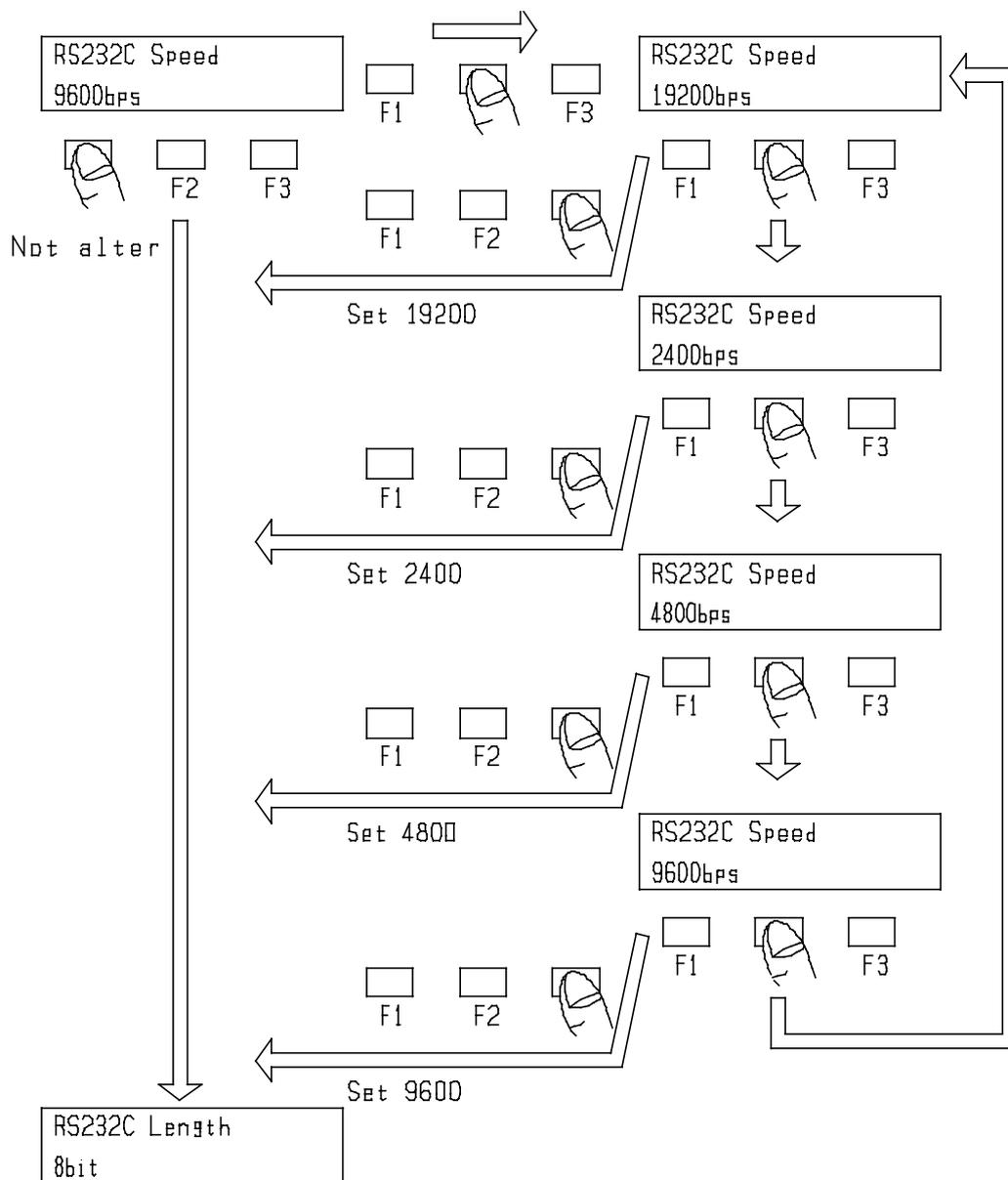


Figure 5 Details of data setting

## 5. Protocol specifications

- 1) String transmitted from host computer  
Command (or command + parameter) + carriage return (0dh) is one unit. Use capital letters for commands, and use capital letters or digits for parameters. No break mark is needed between the command and the parameter.  
To set two or more parameters, insert a space after each parameter.
- 2) String that host computer receives  
Parameter (or “#” + error code) + carriage return (0dh) is one unit.
- 3) Sum check  
The CRC method is used for checking sums (refer to the following for details). Transmit “SCC1” from the host computer to check. Transmit “SCC0” with CRC code (\*1) to end. The power supply will send “#06” to host computer, if a CRC error has occurred.

(\*1) The CRC code equivalent to "SCC0" is "b89a". In the event that CRC communication is abnormally functioning, transmit "SCC0b89a" without the CRC code.

<Details of the CRC method>

Make the CRC code in right-transmission with 0x8408 (in hexadecimal notation) which is generated from the Checking Polynomial( $x^{16}+x^{12}+x^5+1$ ) 0x11021 (in hexadecimal notation) by reversing right and left, according to CCITT(X.25) recommendations. To send a string, attach the generated code (or command + parameter) as 4 byte data after the command. When receiving, the 4byte data before the carriage return (0dh) is the CRC code. Samples of CRC code are shown below.

**Samples of CRC code**

Without CRC code	With CRC code
RRS	RRS70ce
35	35f5a3
SCC0	SCC0b89a

## 6. Commands

### 6-1. Operation commands

Operation commands allow you to set the CRC configuration, to start/stop the pump, to change the rated rotational speed and to confirm these operations.

Command	Parameter	Returned value	Function	Example (command)	Example (returned value)
SCC	[0,1]	-	Config CRC [0]---Set CRC to null [1]---Set CRC effective	SCC1!	-
SCC	-	[0,1]	Read CRC setting	SCC!	1!
SDR	[0,1]	-	Start/stop pump [0]---stop pump [1]---start pump	SDR0!	-

**Characters in table as above**

Character	Signification	Character	Signification
!	CR	[ ]	Select one in [ ]

**6-2. Monitor commands**

Monitor commands are used to monitor the status of the pump .

Command	Returned value (normal) *1	Unit	Function	Example (command)	Example (return value)
RDT	d	h	Read the total operational time of pump	RDT!	100!
RSS	[1,2,3,4,6,7]	-	Read the pump status *2	RSS!	2!
RSA	[1,#03,#12,#20 #23#30,#31,#32 #33,#34,#35,#60 #61]	-	Read the failure details *3	RSA!	#12!
RRS	d	Hz	Read the output frequency (~rotating speed)	RRS!	100!

\*1 Refer to section 6-3 "error code table" for returned value in case of failure.

"d" means decimal integer.

\*2 Refer to 6-4 " pump status code table ".

\*3 Refer to 6-5 " alarm code table ".

**6-3. Error codes**

When the command from the host computer is irregular, the power supply returns one of the error codes described in the following table.

**Table of error code**

Code	Signification
#00	There is no such command.
#01	The set parameter is irregular.
#02	The set parameter is beyond the available range.
#03	Despite failure, the operation command is inputted.
#05	The "operation mode select switch" is not set to SERIAL.
#06	The CRC code is irregular.

**6-4. Pump status codes**

The following table of pump status codes describes the signification of the returned value to the command "RSS".

**Table of pump status codes**

Code	Signification
1	Standby
2	Acceleration
3	Normal
4	Brake
6	Reacceleration
7	Failure

## 6-5. Alarm codes

The following table of the alarm codes describes the signification of return values to the command "RSA".

**Table of alarm codes**

Code	Signification	Code	Signification
1	Normal	#32	Motor temperature error
#03	Change Bearing warning	#33	Excessive current
#12	Protection signal error	#34	Excessive rotating speed
#20	External fan disconnected	#35	Acceleration time over
#23	System error	#55	P/S Fan stop error
#30	Input voltage low	#60	Reacceleration time over
#31	Driver temperature error	#61	No load

#03 is a code concerning only to TC223,TC353,TC1103,TC1104.

#55 is a code concerning only to TC443S,TC553,TC1003,TC1103,TC1503,TC1813,TC3213.

## 7. Troubleshooting

- 1) No string can be sent or received.
  - 1.Check the cable connection
  - 2.Check the transmission configuration
- 2) Received strings are irregular.
  - 1.Check the transmission speed
  - 2.Check the data bit length
  - 3.Check the parity bit
- 3) Characters sometimes change and a CRC code error occurs
  - 1.Remove noise source
  - 2.Change the cable to shielded cable
  - 3.Replace the cable with a shorter one
  - 4.Reduce the transmission speed

**OSAKA VACUUM, LTD.**

**CA OFFICE : 911 Bern Court, Suite 140, San Jose, CA 95112**

**(PHONE) 408-441-7658**

**(FAX) 408-441-7660**

**HEAD OFFICE : Nissay-Yodoyabashi Bldg., 5-29, Kitahama 3-chome, Chuo-ku, Osaka  
541-0041, Japan**

**(PHONE) +81-6-6203-3981**

**(FAX) +81-6-6222-3645**

**TOKYO OFFICE : Ginza Showa-Dori Bldg., 8-14-14, Ginza, Chuo-ku, Tokyo 104-0061,  
Japan**

**(PHONE) +81-3-3546-3731**

**(FAX) +81-3-3546-1560**

**HACHIOUJI FACTORY : Kunugida-cho, Hachioji-shi, Tokyo 193-0942, Japan**

**(PHONE) +81-426-64-5301**

**(FAX) +81-426-63-2016**

## STANDARD WARRANTY CONDITIONS

OSAKA VACUUM, LTD.

### Article 1 Warranty

In delivery of the product indicated in the Delivery Specifications and/or the Instruction Manual ( " Product " ), we warrant that the Product is designed and manufactured in accordance with our regulation, standard or rule etc. with respect to design, purchase, manufacture and quality control under ISO9001 Standard or ISO9002 Standard as well as the specifications in the sales contract, and that there is no defect in design, materials or manufacture of the Product.

### Article 2 Indemnification

In relation to the Product, in case any defect in design, materials or manufacture obviously attributable to us is found within the warranty period, one year from the delivery date of the Product ( unless otherwise stipulated in written documents ), and a notice of such defect is immediately given to us, we will, at our election, correct, repair or replace such defective part, or replace the whole Product without charge. The replacement is available only for standard Products, and no replacement may be allowed for any Custom-made Product.

### Article 3 Exception

The warranty and relevant indemnification shall be applied only when the Product is properly installed or fixed, handled, used, stored and appropriately maintained by a user in accordance with the instructions stipulated in the Delivery Specifications, the Instruction Manual of the Product, other handling instructions of ours and/or the Related Technical Documents which we provide ( " Related Technical Documents " ). Unless otherwise stipulated in other written document, the warranty and relevant indemnification shall not be applied to the cases described below;

- (1) Any failure due to any usage of the Product not described in the Related Technical Documents of the Product, or any other irregular usage of the Product;
- (2) Deterioration of the Product due to corrosive gases, organic solvent, radioactive rays, electromagnetic field etc.;
- (3) Expendable parts and wearable parts such as lubricant etc.;
- (4) Any failure due to repair or reconstruction by any party other than us;

- (5) Repaired Products ( the Standard Warranty Conditions for Repaired Products will apply to the repaired Products ) ;
- (6) An insignificant deviation from the specifications in the sales contract which has no effect on performance or function of the Product;
- (7) Any failure due to fire, flood, earthquake, lightning strike or any other event caused by force majeure.

#### Article 4 Scope of Indemnification

The scope of our indemnification shall be limited to the correction, repair or exchange of defective parts of the Product delivered, or replacement of the whole Product (in case of the standard Product only) , and shall not include any compensation for the consequential damages and business losses including the following;

- (1) Costs and expenses accrued in connection with the removal of the failed Product from the equipment in which the Product has been installed; or
- (2) Costs and expenses accrued in connection with installment of the repaired Product or replacement to the equipment.

In addition, the total amount of the indemnification shall be limited to the contract price of the Product.

As for “ Usage of the Product not described in the Related Technical Documents of the Product ” stipulated in Article 3 of this Standard Warranty Conditions, such usage shall be included in the scope of indemnification under this Standard Warranty Conditions only when we agree in writing prior to the use of the Product.

