# Instruction Manual

STP Series Turbomolecular Pumps
STP-301/451 Series
Serial Interface Module
(First Edition - e)

This Manual describes Serial Interface Module of the STP-301/451 Series.

For the "Safety Precautions," installation, operation and maintenance, read the "STP-301/451 Series Turbomolecular Pump Instruction Manual".

Keep this Manual in a place where you can quickly access it at any time.

**EDWARDS**

Jan. 2008

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# FIGURES

# TABLES

# 1    Introduction

The STP pump can connect to the RS232 serial communication port to allow interfacing to other equipment. The serial port is on the rear panel and is provided by the Serial Interface Module (SIM).

Pump performance and operational information can be read over the serial link, and all user commands can be controlled remotely from PC by the use.

This feature is used, for example, to connect to a Supervisory Control and Data Acquisition (SCADA) program running on a personal computer (PC).

Hereafter, the name of the serial port on the STP control unit side is called SIM (Serial Interface Module).
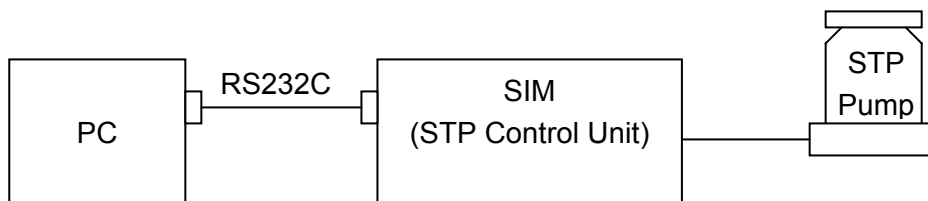


Figure 1.1    Connection PC with SIM

## 2 Setting up

### 2.1 Hardware Connections

Connection to the RS232 port (CON3) is via the D-sub type connecter (25 pin, socket type) connected to the rear panel. (see Figure 2.1)

<div align="center">Table 2.1    RS232 Port (CON3)</div>

| Item | Specification |
|---|---|
| Control unit side connector (CON3) | D-sub type connecter (25 pin, socket type) |
| Size of screw for fixed metal fittings | M2.6 |

NOTICE

◇ Procure the Serial Interface Cable at your company.

Connect the D-sub type connecter (25 pin, pin type) with the R232C serial port (CON3) connector at the rear panel. Connect the connector on the other side with the appropriate communication equipment (PC).

Typically this will be the D-sub type connecter for the connection to the COM port of an IBM-compatible PC.
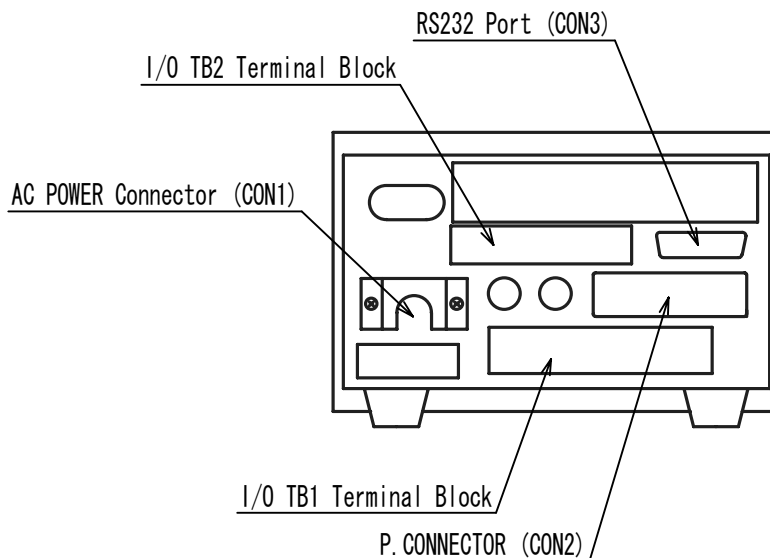


<div align="center">Figure 2.1    STP Control Unit Rear Panel</div>

2.1.1    Pin Assignments

Connect SIM (STP control unit) to PC with the Serial Interface Cable connected according to Table 2.2 or Table 2.3.

Table 2.2    Pin Assignments of Serial Interface Cable (25pin-25pin)

| SIM (STP control unit) side connector (DB25 pin type) | Connection | PC side connector (DB25 pin type) |
|---|---|---|
| Pin2 (TxD) | ———— | Pin3 (RxD) |
| Pin3 (RxD) | ———— | Pin2 (TxD) |
| Pin7 (GND) | ———— | Pin7 (GND) |

Table 2.3    Pin Assignments of Serial Interface Cable (25pin-9pin)

| SIM (STP control unit) side connector (DB25 pin type) | Connection | PC side connector (DB9 socket type) |
|---|---|---|
| Pin2 (TxD) | ———— | Pin2 (RxD) |
| Pin3 (RxD) | ———— | Pin3 (TxD) |
| Pin7 (GND) | ———— | Pin5 (GND) |

2.2    Serial settings

Set the serial parameter of the PC side connection port according to Table 2.4.

Table 2.4    Serial Parameter

| Serial parameter | Set value |
|---|---|
| Baudrate | 9600 baud |
| Data bits | 8 bits |
| Stop bits | 1 stop bit |
| Parity | no parity |

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2.3   Communication mode


This STP control unit has two remote input modes. (see Figure 2.2)


Remote input mode is selected by DSW-B No.5.


- DSW-B 5 ON:        Remote input from CON3 is effective (RS-232C)
- DSW-B 5 OFF:       Remote input from I/O TB2 Terminal Block is effective.
                     (Setting "OFF" at delivery)
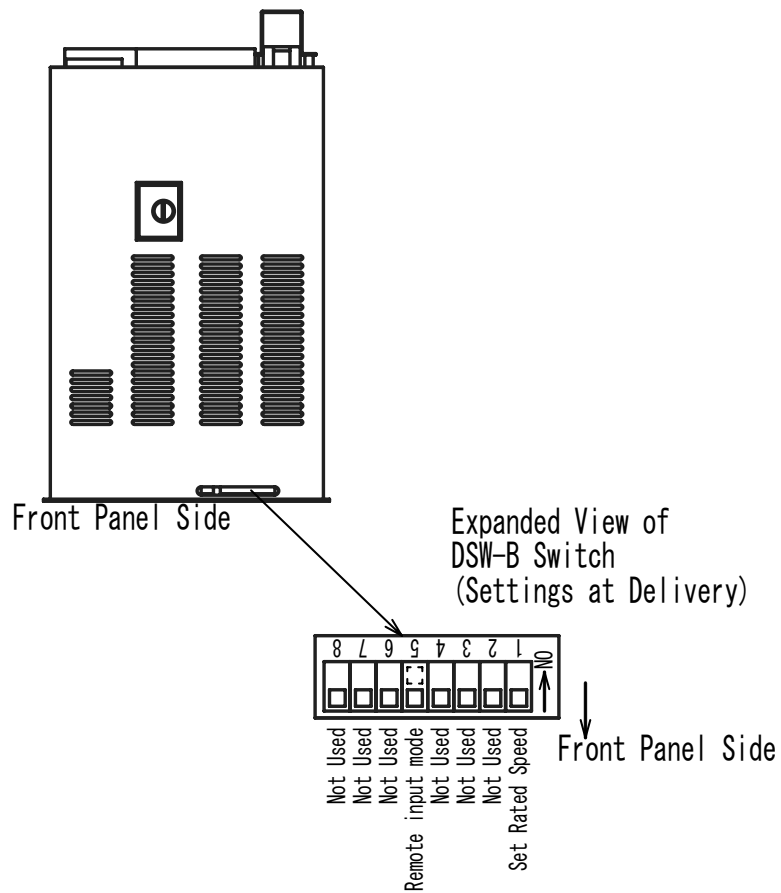


Figure 2.2    Setting of DSW-B


Table 2.5    Remote Input / Output Signal

| DSW-B5 | Operation Mode | Remote Input | Remote Output |
|--------|----------------|--------------|---------------|
| ON | MANUAL | | TB1 |
| | REMOTE | CON3 (RS-232C) | |
| OFF | MANUAL | | |
| | REMOTE | TB2 | |

# 3   Serial Protocol

## 3.1   Overview

The serial protocol used on the SIM is called Query-Command. The serial link and operations remotely controlled can be confirmed on the PC (Personal computer).

The SIM replies the value when receiving the query.

The SIM operates according to the command when receiving it, and returns a message indicating whether the command is valid or not.
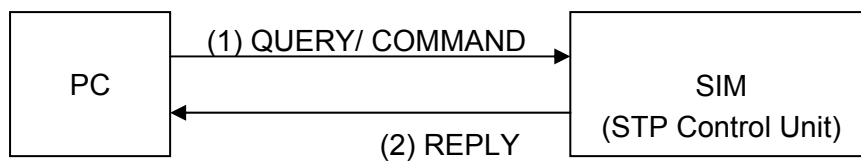
```
┌──────────┐   (1) QUERY/ COMMAND    ┌──────────────────┐
│          │ ──────────────────────► │                  │
│   PC     │                         │      SIM         │
│          │ ◄────────────────────── │ (STP Control Unit)│
└──────────┘        (2) REPLY        └──────────────────┘
```

Figure 3.1   Serial protocol on the STP

## 3.2   Sending a command or query to the SIM

Each command or query is sent to the SIM via the Serial Interface Cable, as a text message - a sequence of ASCII coded characters.
The first character of the text message is "!" for a command, or "?" for a query. The next characters are the mnemonic representation of the particular query or command, followed by other data if required. The last character must be a carriage return CR (ASCII char 13 [$0D_{hex}$]).

The input buffer for Query-Command may be reset at any time by sending a "/" character (ASCII char 47 [$2F_{hex}$]). The system then ignores any previous sent characters that have not been processed. This should be used to reset Query-Command at the beginning of the control program, rather than by sending CR, which resets by copying the current contents of the input buffer to query or command for execution.

Spaces can be added to improve readability or make queries/commands fixed length.

NOTICE

◇ Put the delay (10 ms or more) between the characters. The command cannot be received at short delays. In this case, the error message replies. Refer to Section 3.6 for details.

3.3   SIM replies to queries or commands

When a query or command is received by the SIM, a reply is always returned on the serial link. The replies sent by the SIM are text messages - sequences of ASCII coded characters terminated by two control characters CR, LF (ASCII chars 13 [0D$_{hex}$], 10 [0A$_{hex}$]).
The response from SIM is composed of the character string. It is recommended to receive as the character string rather than as a number when receiving the response with the communication equipment (PC).

NOTICE

◇  Put the delay (10ms or more) between the characters. The command cannot be received at short delays. In this case, the error message replies. Refer to Section 3.6 for details.

PC                                                          SIM

| CR | COMMAND | !,? |

The last character        The first character

| REPLY | CR | LF |

The last character
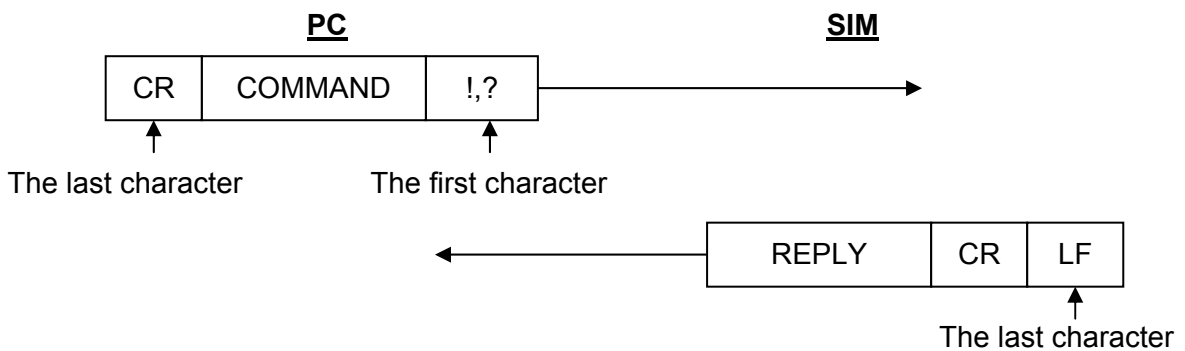
Figure 3.2   Command syntax

Each query or command must comply with its correct syntax, otherwise an error will be flagged. If a query or command is syntactically correct then the error number is set to 0. The reply to a query is normally the ASCII text string representing the number or result of the item queried. The reply to a faulty query will be a message of the form "ERR n", where "n" is the error number.

The reply to a command will always be a message of the form "ERR n", if there is no error, the reply will be "ERR 0". Refer to section 3.6 a list of error messages and their meanings.

3.4   Queries

3.4.1   List of Queries

| Query | Syntax | Replies |
|-------|--------|---------|
| Alarm State | ?A | {alarm state, alarm code1, alarm code 2---} |
| Control state | ?C | {SIM control state} |
| Pump state | ?P | {pump state, alarm state} |
| Parameter | ?V {n}<br>n=1, 2 or 3 | {value} |

If a value cannot be returned because the hardware is not functioning, a space character is returned.

3.4.2   Description of individual queries

3.4.2.1   ?A Alarm state

See Section 4.2 for the alarm state and Section 4.3 for the alarm codes. Send all numbers if there are two or more alarms detected.

| Syntax | SIM reply |
|--------|-----------|
| ?A | Alarm state, Alarm code1, Alarm code2….. |
| | Example: 2, 4, 8 |

3.4.2.2   ?C SIM control state

See Section 4.4 for the SIM control state.

| Syntax | SIM reply |
|--------|-----------|
| ?C | 0 = no control<br>1 = SIM has control |
| | Example: 0 |

3.4.2.3   ?P Pump state

See Section 4.1 for pump state and Section 4.2 for alarm state.

| Syntax | SIM reply |
|--------|-----------|
| ?P | Status level, Alarm state |
| | Example: 3, 0 |

3.4.2.4   ?Vx Parameters

See Section 4.5 for value corresponding to the parameters.

| Syntax | SIM reply | Example |
|--------|-----------|---------|
| ?V1 | Total hours | 10 (10 hours) |
| ?V2 | Motor temperature | 80 (80 ºC) |
| ?V3 | Rotational speed | 15000 (15000 rpm) |

3.5   Commands

A reply of "ERR 0" indicates that the command has been accepted but does not mean that the command has operated. A program that needs positive verification needs to wait an appropriate time and then perform a query.

3.5.1   List of commands

| Command | Syntax |
|---------|--------|
| Pump | !P {0, 1} |
| Reset | !R {0, 1} |

3.5.2   Description of individual commands

3.5.2.1  !P x: Pump operation command

| Syntax | Description | Reply |
|--------|-------------|-------|
| !P 1 | Start the STP pump | ERR 0 |
| !P 0 | Stop the STP pump | ERR 0 |

3.5.2.2  !R x: Alarm Reset

| Syntax | Description | Reply |
|--------|-------------|-------|
| !R 1 | Reset the alarm state of control unit if the fault has removed. | ERR 0 |
| !R 0 | No operation | ERR 0 |

This command can work only the pump is in the levitation mode.

NOTICE

◇  Command "!R 0" has no meaning. Therefore, the SIM will send back "ERR 0".

3.6   Message


Each query or command sets the error number to indicate success or the reason for failure. The error number is returned by any command. If a query is in error (for example a parameter number is out of range) then instead of the normal reply, a message of the form "ERR n" is sent, where "n" is the error number.

| Error number | Meaning |
|:---:|---|
| 0 | No error |
| 1 | Not a valid query or command |
| 2 | Number not found - needed as part of query or command |
| 3 | Number not in valid range |
| 4 | Parameter's value not received by SIM |


NOTICE

◇  When the STP pump is in the abnormal (alarm) state, the STP pump cannot start before resetting the state. In this case, message should be "ERR 1".

◇  To reset alarm state, "!R" command is needed. But in some case, the alarm state cannot be reset because of the hard ware reason. In this case, the message should be "ERR 1".

# 4    Data Formats

## 4.1    Pump state

| Code | Pump state |
|------|------------|
| 0 | Levitation |
| 1 | Acceleration |
| 2 | Brake (Deceleration) |
| 3 | Normal |

## 4.2    Alarm state

| Code | Alarm state |
|------|-------------|
| 0 | No alarm |
| 2 | Alarm |

4.3　Alarm type

| Alarm code | Alarm type |
|:---:|:---|
| 0 | No Error |
| 3 | RAM Error |
| 4 | Disturbance |
| 5 | Power failure |
| 6 | Overspeed |
| 7 | Overload |
| 8 | Controller OT |
| 9 | Pump Overtemp |
| 10 | Thermal Error |
| 11 | Driver RA |
| 12 | Driver OC |
| 13 | Driver OV |
| 14 | Driver UV |
| 15 | Driver HF |
| 17 | Tuning Error 1 |
| 18 | Tuning Error 2 |
| 19 | Tuning Error 3 |
| 20 | Tuning Error 4 |
| 21 | Tuning Error 5 |
| 22 | Test Error |
| 24 | Cable Disconnect |
| 25 | Driver Error 1 |
| 26 | Driver Error 2 |
| 27 | Driver Error 3 |
| 28 | Driver Error 4 |
| 29 | Driver Error 5 |
| 30 | Driver Error 6 |

NOTICE

◇ Refer to the "STP-451/301 series Turbomolecular Pump Instruction Manual" for the contents of the alarm.

4.4　SIM control state

| Code | SIM control state |
|:---:|:---|
| 0 | No control |
| 1 | SIM has control |

4.5   Parameters

| Parameter | Description | Value units |
|:---:|---|---|
| 1 | Total run hours | hours |
| 2 | Motor temperature | degree centigrade |
| 3 | Rotational speed | rpm |

For more information, contact the nearest Service Office.

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