

Technical information

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RS-232 Interface Programmers Guide

for NHQ High Precision and Standard Modules

Document history

| Version | Date | Major changes |
|---------|------------|--------------------------|
| 1.0 | 06.03.2012 | Initial release |
| 2.0 | 20.04.2016 | Relayouted documentation |

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1 RS-232 Interface NHQ High Precision

The RS-232 interface provides the following functionality for the operation of the high voltage units.

1.1 RS-232 Control Mode

- Write function: set voltage; ramp speed; maximal output current (current trip); auto start
- Switch function: output voltage = set voltage, output voltage = 0
- Read function: set voltage; actual output voltage; ramp speed; actual output current; current trip; auto start; hardware limits voltage and current; status

Front panel switches have priority over software control.

1.2 Manual Control Mode

While the unit is operated in manual control mode, only RS-232 read cycles are interpreted. Commands are accepted, but do not result in an output voltage change.

1.3 RS-232 Interface Specification

The RS-232 interface is located at a D-SUB-9 connector on the back panel.

The electric transfer is performed via RxD and TxD, related to floating GND of the interface. The D-SUB-9 pin assignment is given in the following table.

The cable connection to the computer is 1:1 (no null modem-cable!). If no 9-pin cable is available, connections must be set up as shown in the table.

| | Signal | HV-supply | | PC | PC | Connection |
|-----------------------|--------|-----------|----------|---------|----------|--------------|
| | RS-232 | D-SUB-9 | Internal | D-SUB-9 | D-SUB-25 | 3-lead cable |
| Signal pin assignment | RxD | 2 | | 2 | 3 | |
| | TxD | 3 | | 3 | 2 | |
| | GND | 5 | | 5 | 7 | |
| | | 4 | -□ | 4 | 20 | -□ |
| | | 6 | -□ | 6 | 6 | -□ |
| | | 8 | -□ | 8 | 5 | -□ |

1.4 Interface Programming

The serial interface is set to 9600 Bit/s, 8 Bit/character, no parity, 1 Stop-Bit.

The data transfer is character based, with echos as handshake between the compu and the HV power supply unit (Input direction). The transfer direction "HV power supply to computer" (Output direction) is free running.

Between two characters, a programmable delay time is included to allow the computer to receive and evaluate the incoming data. The default delay time setting is 3 ms.

The command transfer uses ASCII characters. Commands are terminated by <CR><LF> (\$0D \$0A or 13 10). Leading zeros can be omitted on input, output is in fixed format.

In order to assure synchronization between the computer and the supply, <CR><LF> has to be sent as first command.

1.5 Command Set

| Command | Computer | HV-supply | Description |
|---------------------------------|------------------|--|--|
| Read module identifier | # * | # * nnnnnn;m.mm;Vmax;lmax * | Serial number; software release; $V_{out\ max}$; $I_{out\ max}$ |
| Read answer delay time | W * | W * nnn * | Answer delay time $0 \leq W \leq 255$ ms |
| Write answer delay time | W=nnn * | W=nnn * * | Answer delay time $0 \leq W \leq 255$ ms |
| Read measured voltage channel A | U1 * | U1 * { polarity / mantissa / signed exp. } * | (in V) |
| Read measured current channel A | I1 * | I1 * { mantissa / signed exp. } * | (in A) |
| Read voltage limit channel A | M1 * | M1 * nnn * | (in % of $V_{out\ max}$) |
| Read current limit channel A | N1 * | N1 * nnn * | (in % of $I_{out\ max}$) |
| Read set voltage channel A | D1 * | D1 * { mantissa / signed exp. } * | (in V) |
| Write set voltage channel A | D1=nnnn.n n * | D1=nnnn.nn * * | (voltage corresponding resolution in V; $0 \leq D1 \leq M1$) |
| Read ramp speed channel A | V1 * | V1 * nnn * | (in V/s) |
| Write ramp speed channel A | V1=nnn * | V1=nnn * * | (in V/s; $2 \leq V1 \leq 255$) |
| Start voltage ramp channel A | G1 * | G1 * S1=xxx * | see Status Information |
| Write current trip channel A | L1=nnnn * | L1=nnnn * * | Trip corresponding resolution range $I_{OUTmax} > 0$ Current trip disabled for nnnn = 0 |
| Read current trip channel A | L1 * | L1 * { mantissa / signed exp. } * | (see above, current trip in A) |
| Read status word channel A | S1 * | S1 * xxx * | see Status Information |
| Read module status channel A | T1 * | T1 * nnn * | Code 0...255, see Module Status |
| Write auto start channel A | A1=nn * | A1=nn * * | Conditions, see Auto Start |
| Read auto start channel A | A1 * | A1 * nnn * | 8 = Auto start is active; 0 = inactive |

* = <CR><LF>

The channel B of the supply is addressed by replacing 1 with 2.

1.6 Status Information

The answer for the command S1 is one of the following:

| | |
|--------|--|
| ON<SP> | Output voltage according to set voltage |
| OFF | Channel front panel switch off |
| MAN | Channel is on, set to manual mode |
| ERR | V_{max} or I_{max} is or was exceeded |
| INH | Inhibit signal is or was active |
| QUA | Quality of output voltage not given at present |
| L2H | Output voltage increasing |
| H2L | Output voltage decreasing |
| LAS | Look at Status (only after G-command) |

| | |
|-----|-------------------------|
| TRP | Current trip was active |
|-----|-------------------------|

<SP> = 0x30 = Space

If output voltage has been shut off permanently (by ERR or INH at KILL-ENABLE or TRP) the command "Read Status Word" must be executed before the output voltage can be restored.

1.7 Error Codes

| | |
|----------------|--|
| ???? | Syntax error |
| ?WCN | Wrong channel number |
| ?TOT | Timeout error (with following reinitialization) |
| ?<SP>UMAX=nnnn | Set voltage exceeds voltage limit, max. possible value is nnnn |

1.8 Module Status

| | | | | | | | |
|-------|-------|-------|----------|-------|-------|-------|---------------|
| Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| QUA | ERR | INH | KILL_ENA | OFF | POL | MAN | U/I resp. A/B |

| Status-Bit | Description | Bit is 0 | Bit is 1 |
|------------------|-----------------------------|----------------------|---------------------|
| QUA | Quality of output voltage | guaranteed | not guaranteed |
| ERR | V_{max} or I_{max} | is not exceeded | is or was exceeded |
| INH | External INHIBIT signal | is inactive | is or was active |
| KILL_ENA | KILL-ENABLE is | off | on |
| OFF | Front panel HV-ON switch is | in ON position | in OFF position |
| POL | Polarity is set to | negative | positive |
| MAN | Control | via RS-232 interface | manual |
| U/I (command T1) | Display dialled to | current measurement | voltage measurement |
| A/B (command T2) | Channel dialled to | channel B | channel A |

Reading the Module Status ("Tx") does not reset the flags "ERR" and "INH". This can be done by reading the corresponding channels status word ("Sx").

1.9 Auto Start

When writing to this register, the corresponding values are permanently stored (a minimum of one million write cycles is guaranteed). The stored values are read back into the registers after POWER-ON.

| | | | | |
|-----------|---------------------------------|-------------------|------------------|-----------------|
| Bit 7...4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| reserved | Enable Auto Start ^{*)} | Save Current Trip | Save Set Voltage | Save Ramp Speed |

^{*)} If the precondition for Auto start (module status: OFF + ERR + INH + MAN = 0) is satisfied, the output voltage is automatically ramped to the set voltage. Thus the G-command or POWER-ON and OFF → ON are not required.

If output voltage has been shut off permanently (by ERR or INH at KILL-ENABLE or TRP), the previous voltage setting will be restored with software ramp after "Read status word".

2 RS-232 Interface NHQ Standard

The RS-232 interface provides the following functionality for the operation of the high voltage units.

2.1 RS-232 Control Mode

- Write function: set voltage; ramp speed; maximal output current (current trip); auto start
- Switch function: output voltage = set voltage, output voltage = 0
- Read function: set voltage; actual output voltage; ramp speed; actual output current; current trip; auto start; hardware limits voltage and current; status

Front panel switches have priority over software control.

2.2 Manual Control Mode

While the unit is operated in manual control mode, only RS-232 read cycles are interpreted. Commands are accepted, but do not result in an output voltage change.

2.3 RS-232 Interface Specification

The RS-232 interface is located at a D-SUB-9 connector on the back panel.

The electric transfer is performed via RxD and TxD, related to floating GND of the interface. The D-SUB-9 pin assignment is given in the following following table.

The cable connection to the computer is 1:1 (no null modem-cable!). If no 9-pin cable is available, connections must be set up as shown in the table.

| | Signal | HV-supply | | PC | PC | Connection |
|-----------------------|--------|-----------|------|-------|--------|--------------|
| | RS 232 | DSUB9 | Int. | DSUB9 | DSUB25 | 3-lead cable |
| Signal pin assignment | RxD | 2 | | 2 | 3 | |
| | TxD | 3 | | 3 | 2 | |
| | GND | 5 | | 5 | 7 | |
| | | 4 | -□ | 4 | 20 | -□ |
| | | 6 | -□ | 6 | 6 | -□ |
| | | 8 | -□ | 8 | 5 | -□ |

2.4 Programming

The serial interface is set to 9600 Bit/s, 8 Bit/character, no parity, 1 Stop-Bit.

The data transfer is character based, with echos as handshake between the computer and the HV power supply unit (Input direction). The transfer direction "HV power supply to computer" (Output direction) is free running.

Between two characters, a programmable delay time is included to allow the computer to receive and evaluate the incoming data. The default delay time setting is 3 ms.

The command transfer uses ASCII characters. Commands are terminated by <CR><LF> (\$0D \$0A or 13 10). Leading zeros can be omitted on input, output is in fixed format.

In order to assure synchronisation between the computer and the supply, <CR><LF> has to be sent as first command.

2.5 Command Set

| Command | Computer | HV-supply | Description |
|---------------------------------|-----------|-----------------------------------|---|
| Read module identifier | # * | # * nnnnnn;m.mm;Vmax;lmax * | Serial number; software release; $V_{out\ max}$; $I_{out\ max}$ |
| Read answer delay time | W * | W * nnn * | Answer delay time $0 \leq W \leq 255$ ms |
| Write answer delay time | W=nnn * | W=nnn * * | Answer delay time $0 \leq W \leq 255$ ms |
| Read measured voltage channel A | U1 * | U1 * { polarity / voltage } * | (in V) |
| Read measured current channel A | I1 * | I1 * { mantissa / signed exp. } * | (in A) |
| Read voltage limit channel A | M1 * | M1 * nnn * | (in % of $V_{out\ max}$) |
| Read current limit channel A | N1 * | N1 * nnn * | (in % of $I_{out\ max}$) |
| Read set voltage channel A | D1 * | D1 * { voltage } * | (in V) |
| Write set voltage channel A | D1=nnnn * | D1=nnnn * * | (in V; $0 \leq D1 \leq M1$) |
| Read ramp speed channel A | V1 * | V1 * nnn * | (in V/s) |
| Write ramp speed channel A | V1=nnn * | V1=nnn * * | (in V/s; $2 \leq V1 \leq 255$) |
| Start voltage ramp channel A | G1 * | G1 * S1=xxx * | see Status information |
| Write current trip channel A | L1=nnnn * | L1=nnnn * * | Trip corresponding current resolution > 0 Current trip disabled for nnnn = 0 |
| Read current trip channel A | L1 * | L1 * nnnn * | (see above, current trip in A) |
| Read status word channel A | S1 * | S1 * xxx * | see Status Information |
| Read module status channel A | T1 * | T1 * nnn * | Code 0...255, see Module Status |
| Write auto start channel A | A1=nn * | A1=nn * * | Conditions, see Auto Start |
| Read auto start channel A | A1 * | A1 * nnn * | 8 = Auto start is active; 0 = inactive |

* = <CR><LF>

The channel B of the supply is addressed by replacing 1 with 2.

2.6 Status Information

The answer for the command S1 or S2 is one of the following:

| | |
|--------|--|
| ON<SP> | Output voltage according to set voltage |
| OFF | Channel front panel switch off |
| MAN | Channel is on, set to manual mode |
| ERR | V_{max} or I_{max} is or was exceeded |
| INH | Inhibit signal is or was active |
| QUA | Quality of output voltage not given at present |
| L2H | Output voltage increasing |
| H2L | Output voltage decreasing |
| LAS | Look at Status (only after G-command) |
| TRP | Current trip was active |

<SP> = 0x30 = Space

If output voltage has been shut off permanently (by ERR or INH at KILL-ENABLE or TRP) the command "Read Status Word" must be executed before the output voltage can be restored.

2.7 Error Codes

| | |
|----------------|--|
| ???? | Syntax error |
| ?WCN | Wrong channel number |
| ?TOT | Timeout error (with following reinitialization) |
| ?<SP>UMAX=nnnn | Set voltage exceeds voltage limit, max. possible value is nnnn |

<SP> = 0x30 = Space

2.8 Module Status

| | | | | | | | |
|-------|-------|-------|----------|-------|-------|-------|---------------|
| Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| QUA | ERR | INH | KILL_ENA | OFF | POL | MAN | U/I resp. A/B |

| Status-Bit | Description | Bit is 0 | Bit is 1 |
|------------------|-----------------------------|----------------------|---------------------|
| QUA | Quality of output voltage | guaranteed | not guaranteed |
| ERR | V_{max} or I_{max} | is not exceeded | is or was exceeded |
| INH | External INHIBIT signal | is inactive | is or was active |
| KILL_ENA | KILL-ENABLE is | off | on |
| OFF | Front panel HV-ON switch is | in ON position | in OFF position |
| POL | Polarity is set to | negative | positive |
| MAN | Control | via RS-232 interface | manual |
| U/I (command T1) | Display dialled to | current measurement | voltage measurement |
| A/B (command T2) | Channel dialled to | channel B | channel A |

2.9 Auto Start

When writing to this register, the corresponding values are permanently stored (a minimum of one million write cycles is guaranteed). The stored values are read back into the registers after POWER-ON.

| | | | | |
|-----------|----------------------|-------------------|------------------|-----------------|
| Bit 7...4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| reserved | Enable Auto Start *) | Save Current Trip | Save Set Voltage | Save Ramp Speed |

*) If the precondition for Auto start (module status: OFF + ERR + INH + MAN = 0) is satisfied, the output voltage is automatically ramped to the set voltage. Thus the G-command or POWER-ON and OFF → ON are not required. If output voltage has been shut off permanently (by ERR or INH at KILL-ENABLE or TRP), the previous voltage setting will be restored with software ramp after "Read status word".

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