Programming Guide

SR500 *Camargue* – Subanosecond Pulse Generator

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1 General Information

1.1 Introduction

The *SR500 Nanosecond Pulse Generator* is remotely controlled *via* either USB or POF interfaces. Only one interface is used by the SR500 to communicate with the computer. This interface is selected using the dedicated switch on the front panel of the serial interface module (SMZ320).

1.2 Communicating with USB - Virtual COM Port

The SR500 can be controlled *via* USB through the SMZ320 module which includes an USB2.0 to serial interface bridge. Before using the USB interface, a virtual COM port (VCP) driver has to be installed on the computer. The VCP driver causes the USB device to appear as an additional COM port available and the application software can therefore access the USB device in the same way as it would access a standard COM port. VCP drivers can be downloaded and installed from `https://www.ftdichip.com/Drivers/VCP.htm`.

Once the VCP driver is installed on the computer, the COM port has to be configured:

- baudrate: 9600 bauds;
- parity : none;
- stop bits: two;
- data word length : 8-bit.

Hardware handshaking is not supported.

1.3 Status Indicators

To assist in programming, the SR500 and the SMZ320 have interface status indicators. The **Tx** and **Rx** indicators of the SMZ320 flash when a character is transmitted (Tx) or received (Rx) over the interface. This activity is also monitored by the **Remote Controller Status** indicators of the SR500. The yellow indicator flashes whenever a character is received or transmitted over the SR500 serial interface whereas the red one flashes when an error is detected. This error indicator reports an illegal command or an out of range parameter.

1.4 Command Syntax

Communications with the SR830 uses ASCII characters. Commands may be in either upper or lower case and may contain any number of embedded space characters.

A command to the SR500 consists of a four character command mnemonic, arguments if necessary, and a command terminator.

The terminator must be a carriage return (`<cr>`). No command processing occurs until a command terminator is received. Commands may require one parameter.

Multiple commands may be sent on one command line by separating them with semicolons (`;`).

There is no need to wait between commands. The SR500 has two 256 character buffers (input and output) and processes commands in the order received. If either buffer overflows, both buffers are cleared and an error is reported.

The present value of a particular parameter may be determined by querying the SR500 for its value. A query is formed by appending a question mark (`?`) to the command mnemonic and omitting the desired parameter from the command.

Values returned by the SR500 are sent as a string of ASCII characters terminated by a carriage return (`<cr>`). If multiple queries are sent on one command line (separated by semicolons, of course) the answers will be returned individually, each with a terminator.

Examples of command formats:

- `*IDN?` queries the device identification
- `FANE` enables the fan cooler.
- `LEIS 10000` sets the leading-edge sharpener bias current to 10 mA.

1.5 Important Notice

2 Detailled Command List

The four letter mnemonic in each command sequence specifies the command. The rest of the sequence consists of parameters. Parameters shown in are optional or may be queried while those not in { } are required. Commands that may be queried have a question mark in parentheses (`?`) after the mnemonic. Commands that may *only* be queried have a `?` after the mnemonic. Commands that *may not* be queried have no `?`. Do not send ( ) or { } as part of the command.

The variables are defined as follows.

- `u16` unsigned 16-bit integer ranging from 0 to 65 535.
- `u8` unsigned 8-bit integer ranging from 0 to 255.
- `b` boolean.
- `str` string.

2.1 Edges-Sharpener

2.1.1 Trailing-Edge sharpener blas Setpoint (TEIS)

Group	Edges-Sharpener
Action	Command/Query
Description	The `TEIS` command sets or queries the bias current setpoint of the trailing-edge sharpener. The parameter `u16` is the setpoint expressed in µA. The setpoint may be programmed from 0 µA to 29 882 µA but actual value will be rounded to 0.39 % due to the internal digital format. When a command is programming the setpoint value out of the range delimited by the low- and high-limit value, the actual setpoint is automatically clamped.
Syntax	`TEIS(?) {u16}`
Command Syntax	`TEIS u16`
Query Syntax	`TEIS?`
Response Format	`u16`
Example	`TEIS 10000` sets the setpoint of the trailing-edge sharpener current to 10 mA. `TEIS?` queries the setpoint of the trailing-edge sharpener current.
Related Commands	`TEIL`, `TEIH`.

2.1.2 Trailing-Edge sharpener bIas Low (TEIL)

Group	Edges-Sharpener.
Action	Command/Query
Description	The `TEIL` command sets or queries the low-limit of the bias current setpoint. The trailing-edge sharpener is not allowed to operate at bias current below this limit. The parameter `u16` is the low-limit expressed in µA. This limit may be programmed from 0 µA to 14 882 µA but actual value will be rounded to 0.39 % due to the internal digital format. When a command is setting a low-limit above the actual operating setpoint, the setpoint value is automatically adjusted.
Syntax	`TEIL(?) {u16}`
Command Syntax	`TEIL u16`
Query Syntax	`TEIL?`
Response Format	`u16`
Example	`TEIL 5000` sets the low-limit of the trailing-edge sharpener setpoint to 5 mA. `TEIL?` queries the low-limit of the trailing-edge sharpener setpoint.
Related Commands	`TEIS`, `TEIH`.

2.1.3 Trailing-Edge sharpener bIas High (TEIH)

Group	Edges-Sharpener.
Action	Command/Query
Description	The `TEIH` command sets or queries the high-limit of the bias current setpoint. The trailing-edge sharpener is not allowed to operate at bias current above this limit. The parameter `u16` is the high-limit expressed in µA. This limit may be programmed from 15 000 µA to 29 882 µA but actual value will be rounded to 0.39 % due to the internal digital format. When a command is setting a high-limit below the actual operating setpoint, the setpoint value is automatically adjusted.
Syntax	`TEIH(?) {u16}`
Command Syntax	`TEIH u16`
Query Syntax	`TEIH?`
Response Format	`u16`
Example	`TEIH 20000` sets the low-limit of the trailing-edge sharpener to 20 mA. `TEIH?` queries the low-limit of the trailing-edge sharpener.
Related Commands	`TEIS`, `TEIL`.

2.1.4 Leading-Edge sharpener bIas Setpoint (LEIS)

Group	Edges-Sharpener.
Action	Command/Query
Description	The `LEIS` command sets or queries the bias current setpoint of the leading-edge sharpener. The parameter `u16` is the bias current setpoint expressed in µA. The setpoint may be programmed from 0 µA to 29 882 µA but actual value will be rounded to 0.39 % due to the internal digital format. When a command is trying to set the value operating setpoint out of the range delimited by the low- and high-limit value, the actual setpoint is automatically clamped.
Syntax	`LEIS(?) {u16}`
Command Syntax	`LEIS u16`
Query Syntax	`LEIS?`
Response Format	`u16`
Example	`LEIS 10000` sets the current setpoint of the leading-edge sharpener to 10 mA. `LEIS?` queries the current setpoint of the leading-edge sharpener.
Related Commands	`LEIL`, `LEIH`.

2.1.5 Leading-Edge sharpener bIas Low (LEIL)

Group	Edges-Sharpener.
Action	Command/Query
Description	The `LEIL` command sets or queries the low-limit of the bias current setpoint. The leading-edge sharpener is not allowed to operate at bias current below this limit. The parameter `u16` is the low-limit expressed in µA. This limit may be programmed from 0 µA to 14 882 µA but actual value will be rounded to 0.39 % due to the internal digital format. When a command is setting a low-limit above the actual operating setpoint, the current setpoint value is automatically adjusted.
Syntax	`LEIL(?) {u16}`
Command Syntax	`LEIL u16`
Query Syntax	`LEIL?`
Response Format	`u16`
Example	`LEIL 10000` sets the low-limit of the leading-edge sharpener setpoint to 10 mA. `LEIL?` queries the low-limit of the leading-edge sharpener setpoint.
Related Commands	`LEIS`, `LEIH`.

2.1.6 Leading-Edge sharpener bIas High (LEIH)

Group	Edges-Sharpener
Action	Command/Query
Description	The `LEIH` command sets or queries the high-limit of the bias current setpoint. The leading-edge sharpener is not allowed to operate at bias current above this limit. The parameter `u16` is the high-limit expressed in µA. This limit may be programmed from 15 000 µA to 29 882 µA but actual value will be rounded to 0.39 % due to the internal digital format. When a command is setting a high-limit below the actual operating setpoint, the bias current setpoint value is automatically adjusted.
Syntax	`LEIH(?) {u16}`
Command Syntax	`LEIH u16`
Query Syntax	`LEIH?`
Response Format	`u16`
Example	`LEIH 20000` sets the high-limit of the leading-edge sharpener setpoint to 20 mA. `LEIH?` queries the high-limit of the leading-edge sharpener setpoint.
Related Commands	`LEIS`, `LEIL`.

2.2 Output

2.2.1 OUTput Enable (OUTE)

Group	Output.
Action	Command/Query
Description	The `OUTE` command enables the output of the pulse generator while the query form returns the current state of the output. When a `OUTE` command is received, the SR500 enables the output power stage and increments its power supply from +5 V to the value programmed by the previous `REGS` command. Because the power supply is increased of 200 mV at a rate of 10 ms, the settling time should be no longer than 2 s. The query form returns `1` if the pulse generator output is enabled, `0` otherwise.
Syntax	`OUTE(?)`
Command Syntax	`OUTE`
Query Syntax	`OUTE?`
Response Format	`b`
Example	`OUTE` enables the output generator. `OUTE?` queries the output generator status.
Related Commands	`REGS`, `OUTD`.

2.2.2 OUTput Disable (OUTD)

Group	Output.
Action	Command/Query
Description	The `OUTD` command disables the output of the pulse generator while the query form returns the current state of the output. When a `OUTD` command is received, the SR500 first decreases the power supply of the output stage from its current value to +5 V, then the power stage is disabled. Since the power supply is decreased by 200 mV every 10 ms, the shutdown prcedure should not take more than 2 s. The query form returns `1` if the pulse generator output is disabled, `0` otherwise.
Syntax	`OUTD(?)`
Command Syntax	`OUTD`
Query Syntax	`OUTD?`
Response Format	`b`
Example	`OUTD` disables the output generator. `OUTD?` queries the output generator status.
Related Commands	`REGS`, `OUTE`.

2.2.3 REGulator Setpoint (REGS)

Group	Output.
Action	Command/Query
Description	The `REGS` command sets or queries the setpoint voltage of the regulator output. The parameter `u16` is the setpoint expressed in mV. This value may be programmed from 0 mV to 29 882 mV but actual value will be rounded to 0.39 % due to the internal digital format. When a command is trying to set the setpoint value out of the range delimited by the low- and high-limit value, the actual setpoint is automatically clamped. The SR500's response to a voltage modification differs according to the output status. Whereas the setpoint value is immediately updated when the ouput is disabled, the regulator output voltage is adjusted step-by-step to the new setpoint value if the output is enabled. This progressive change is produced at a rate of 10 ms for each 200-mV increment, allowing a maximal settling time of 2 V.
Syntax	`REGS(?) {u16}`
Command Syntax	`REGS u16`
Query Syntax	`REGS?`
Response Format	`u16`
Example	`REGS 15000` sets the regulator output setpoint to 15 V. `REGS?` queries the regulator output setpoint.
Related Commands	`REGL`, `REGH`, `OUTE`, `OUTD`.

2.2.4 REGulator Low (REGL)

Group	Output.
Action	Command/Query
Description	The `REGL` command sets or queries the low-limit of the regulator setpoint voltage. The regulator is not allowed to operate at output voltages below this limit. The parameter `u16` is the low-limit expressed in mV. This limit may be programmed from 0 mV to 14 482 mV but actual value will be rounded to 0.39 % due to the internal digital format. When a command is setting a low-limit above the actual operating setpoint, the regulator setpoint value is automatically adjusted.
Syntax	`REGL(?) {u16}`
Command Syntax	`REGL u16`
Query Syntax	`REGL?`
Response Format	`u16`
Example	`REGL 10000` sets the low-limit of the regulator setpoint to 10 V. `REGL?` queries the low-limit of the regulator setpoint.
Related Commands	`REGS`, `REGH`.

2.2.5 REGulator High (REGH)

Group	Output
Action	Command/Query
Description	The `REGH` command sets or queries the high-limit of the regulator setpoint. The regulator is not allowed to operate at output voltages above this limit. The parameter `u16` is the high-limit expressed in mV. This limit may be programmed from 15 000 mV to 29 882 mV but actual value will be rounded to 0.39 % due to the internal digital format. When a command is setting a high-limit below the actual operating setpoint, the setpoint is automatically adjusted.
Syntax	`REGH(?) {u16}`
Command Syntax	`REGH u16`
Query Syntax	`REGH?`
Response Format	`u16`
Example	`REGH 25000` sets the high-limit of the regulator setpoint to 25 V. `REGH?` queries the high-limit of the regulator setpoint.
Related Commands	`REGS`, `REGL`.

2.2.6 OVerLoad Setpoint (OVLS)

Group	Output.
Action	Command/Query
Description	The `OVLS` command sets or queries the threshold of the overload detector. The parameter `u8` is the threshold expressed in %. This value may be programmed from 0 % to 99 %. When a command is trying to set the setpoint value out of the range delimited by the low- and high-limit value, the actual threshold is automatically clamped.
Syntax	`OVLS(?) {u8}`
Command Syntax	`OVLS u8`
Query Syntax	`OVLS?`
Response Format	`u8`
Example	`OVLS 30` sets the threshold value to 30 %. `OVLS?` queries the threshold of the overload detector.
Related Commands	`OVLL`, `OVLH`.

2.2.7 OVerLoad High (OVLH)

Group	Output
Action	Command/Query
Description	The `OVLH` command sets or queries the high-limit of the overload detector threshold. An actual threshold above this limit is not allowed. The parameter `u8` is the high-limit expressed in %. This limit may be programmed from 50 % to 99 %. When a command is setting a high-limit below the actual operating threshold, the threshold value is automatically adjusted.
Syntax	`OVLH(?) {u8}`
Command Syntax	`OVLH u8`
Query Syntax	`OVLH?`
Response Format	`u8`
Example	`OVLH 99` sets the high-limit of threshold to 99 %. `OVLH?` queries the high-limit of the threshold.
Related Commands	`OVLS`, `OVLL`.

2.2.8 OVerLoad Low (OVLL)

Group	Output
Action	Command/Query
Description	The `OVLL` command sets or queries the low-limit of the overload detector threshold. An actual threshold below this limit is not allowed. The parameter `u8` is the low-limit expressed in %. This limit may be programmed from 0 % to 49 %. When a command is setting a low-limit above the actual operating threshold, the threshold value is automatically adjusted.
Syntax	`OVLL(?) {u8}`
Command Syntax	`OVLL u8`
Query Syntax	`OVLL?`
Response Format	`u8`
Example	`OVLL 10` sets the low-limit of threshold to 10 %. `OVLL?` queries the low-limit of the threshold.
Related Commands	`OVLS`, `OVLH`.

2.3 Memory

2.3.1 ReCalL (*RCL)

Group	Memory
Action	Command
Description	The `*RCL` command sets the state of the SR500 using the non-volatile memory content.
Command Syntax	`*RCL`
Example	`*RCL` recalls settings from non-volatile memory.
Related Commands	`*SAV`, `*RST`.

2.3.2 ReSeT (*RST)

Group	Memory
Action	Command
Description	The `*RST` command initiates a reset of the SR500: all settings are set to their default values and the output is disabled.
Command Syntax	`*RST`
Example	`*RST` restores default settings and disables the output.
Related Commands	`*SAV`, `*RCL`.

2.3.3 SAVe (*SAV)

Group	Memory
Action	Command
Description	The `*SAV` command stores the current state of the SR500 in the non-volatile memory.
Command Syntax	`*SAV`
Example	`*SAV` saves current settings in non-volatile memory.
Related Commands	`*RST`, `*RCL`.

2.4 Interface

2.4.1 CLear all Status registers (*CLS)

Group	Interface
Action	Command
Description	The `*CLS` command clears all status registers.
Command Syntax	`*CLS`
Related Commands	`*ESR`, `DSBR`.

2.4.2 Device Status Byte Register (DSBR)

Group	Interface
Action	Query
Description	The `DSBR` queries the value of the *Device Status Byte Register*. The value is returned as a decimal number ranging from 0 to 255. Reading this byte will clear it.
Query Syntax	`DSBR?`
Response Format	`u8`
Related Commands	`*CLS`, `*ESR`.

The bits of the **Device Status Byte Register** are set to 1 when the event or state in the table below has occurred or is present.

Bit	Name	Usage
0	`OVL`	Overload detected.[a]
1	`OVH`	Overheating detected.[a]
2	`REG`	Regulator voltage failure detected.[b]
3	`PRI`	Under-voltage detected at the pre-regulator input fnm[2].
4	`FAN`	Fan driver voltage failure detected[c].
5	`PWR`	Power supply failure detected[d].
6	`HIZ`	Open-thermistor detected[a].
7		reserved.

[a] SMD10 module.
[b] SMD20 module.
[c] Not implemented.
[d] SMD30 module.

According to these bit definitions, the `*DSBR` query returns a decimal value as

$$val = 0 \times 2^7 + HIZ \times 2^6 + PWR \times 2^5 + FAN \times 2^4 + PRI \times 2^3 + REG \times 2^2 + OVH \times 2^1 + OVL \times 2^0$$

2.4.3 Event Status Register (*ESR)

Group	Interface
Action	Query
Description	The `*ESR` queries the value of the *Standard Event Status Register*. The value is returned as a decimal number ranging from 0 to 255. Reading this byte will clear it.
Query Syntax	`*ESR?`
Response Format	`u8`
Related Commands	`*CLS`, `DSBR`.

The bits of the **Standard Event Status Register** are set to 1 when the event or state in the table below has occurred or is present.

Bit	Name	Usage
0	ARGW	Wrong argument type
1	ARGO	Out-of-range argument
2	DATI	Invalid data type
3	PARI	Invalid paramater identifier
4	CMDU	Unknown command
5	CMDI	Invalid command identifier
6	ARGR	Rejected argument
7	SETA	Setpoint value adapted

According to these bit definitions, the `*ESR` query returns a decimal value as

$$val = SETA \times 2^7 + ARGR \times 2^6 + CMDI \times 2^5 + CMDU \times 2^4 + PARI \times 2^3 + DATI \times 2^2 + ARGO \times 2^1 + ARGW \times 2^0$$

2.4.4 OPeration Complete (*OPC)

Group	Interface
Action	Query
Description	The `*OPC` query always responds with the ASCII character `1` because the SR500 only responds to a query when the previous command has been entirely executed.
Query Syntax	`*OPC?`
Response Format	`1`

2.4.5 IDentificatioN (*IDN)

Group	Interface
Action	Query
Description	The `*IDN` query returns the identification string of the current firmware. This string is in the format `str = s1 s2 s3 s4 s5` where • `s1` : `"Signals_and_Systems_for_Physics"` • `s2` : `"Hardware identifier"` • `s3` : `"Firmware identifier"` • `s4` : `"Firware build date"` • `s5` : `"Firware build time"`
Query Syntax	`*IDN?`
Response Format	`str`
Example	`*IDN?` returns the identification string.
Related Commands	`DEVI`

2.4.6 DEVice Identification (DEVI)

Group	Interface
Action	Query
Description	The `DEVI` query returns the device number. This device identifier can be assigned to the remote controller board (SMD30) by the user by selecting the dedicated switches on the remote controller board. This feature is usefull when several units are controlled over the computer interface. The device identifier's number ranges from 0 to 3 since only 2 switches are used.
Query Syntax	`DEVI?`
Response Format	`u8`
Example	`DEVI?` returns the device identifier number.
Related Commands	`*IDN`

2.5 Miscellaneous

2.5.1 OVerHeating Setpoint (OVHS)

Group	Miscellaneous.
Action	Command/Query
Description	The `OVHS` command sets or queries the overheating alarm setpoint. The temperature of the power stage is continuously monitored using a NTC resistor. When a thermistor resistance value is measured below this threshold, a fault is reported and the output of the pulse generator is disabled. The parameter `u16` is the NTC thermistor threshold resistance expressed in Ω. This value may be programmed from 0 Ω to 49 951 Ω but actual value will be rounded to 0.1 % due to the internal digital format. When a command is trying to set the threshold value out of the range delimited by the low- and high-limit value, the actual threshold is automatically clamped. Whatever the alarm threshold value programmed by the user, the internal fault detection task states a resistance value above 32 330 Ω (↦ 0 °C) as a disconnected sensor fault.
Syntax	`OVHS(?) {u16}`
Command Syntax	`OVHS u16`
Query Syntax	`OVHS?`
Response Format	`u16`
Example	`OVHS 2520` sets threshold value to 2520 Ω (↦ +60 °C). `OVHS?` queries the overheating threshold value.
Related Commands	`OVHL`, `OVHH`.

2.5.2 OVerHeating High (OVHH)

Group	Miscellaneous.
Action	Command/Query
Description	The `OVHH` command sets or queries the high-limit of the overheating detection threshold. The threshold resistance is not allowed to be greater than this high-limit value. The parameter `u16` is the high-limit value expressed in Ω. This limit may be programmed from 25 000 Ω to 49 951 Ω but actual value will be rounded to 0.1 % due to the internal digital format. When a command is setting a high-limit below the actual threshold, the threshold resistance value is automatically adjusted.
Syntax	`OVHH(?) {u16}`
Command Syntax	`OVHH u16`
Query Syntax	`OVHH?`
Response Format	`u16`
Example	`OVHH 2520` sets the threshold low-limit to 2520 Ω (↦ +60 °C). `OVHH?` queries the high-limit threshold resistance.
Related Commands	`OVHS`, `OVHL`.

2.5.3 OVerHeating Low (OVHL)

Group	Miscellaneous.
Action	Command/Query
Description	The `OVHL` command sets or queries the low-limit of the overheating detection threshold. The threshold resistance is not allowed to be lower than this low-limit value. The parameter `u16` is the low-limit value expressed in Ω. This limit may be programmed from 0 Ω to 24 951 Ω but actual value will be rounded to 0.1 % due to the internal digital format. When a command is setting a low-limit above the actual threshold, the threshold resistance value is automatically adjusted.
Syntax	`OVHL(?) {u16}`
Command Syntax	`OVHL u16`
Query Syntax	`OVHL?`
Response Format	`u16`
Example	`OVHL 10000` sets the threshold low-limit to 10 000 Ω (↦ +25 °C). `OVHL?` queries the low-limit threshold resistance.
Related Commands	`OVHS`, `OVHH`.

2.5.4 FAN cooler Setpoint (FANS)

Group	Miscellaneous
Action	Command/Query
Description	The `FANS` command sets or queries the setpoint voltage of the fan cooler. The parameter `u16` is the setpoint voltage expressed in mV. This value may be programmed from 0 mV to 4980 mV but actual value will be rounded to 0.39 % due to the internal digital format. When a command is trying to set the fan cooler setpoint out of the range delimited by the low- and high-limit value, the actual setpoint is automatically clamped.
Syntax	`FANS(?) {u16}`
Command Syntax	`FANS u16`
Query Syntax	`FANS?`
Response Format	`u16`
Example	`FANS 5000` sets the fan cooler setpoint to +5 V. `FANS?` queries the fan cooler setpoint.
Related Commands	`FANL`, `FANH`, `FANE`, `FAND`.

2.5.5 FAN cooler Low (FANL)

Group	Miscellaneous
Action	Command/Query
Description	The `FANL` command sets or queries the low-limit of the fan cooler setpoint. The fan cooler is not allowed to operate at voltages below this limit. The parameter `u16` is the low-limit expressed in mV. This limit may be programmed from 0 mV to 2480 mV but actual value will be rounded to 0.39 % due to the internal digital format. When a command is setting a low-limit above the actual setpoint, the fan cooler setpoint value is automatically adjusted.
Syntax	`FANL(?) {u16}`
Command Syntax	`FANL u16`
Query Syntax	`FANL?`
Response Format	`u16`
Example	`FANL 2000` sets the low-limit of the fan cooler setpoint to +2 V. `FANL?` queries the low-limit of the fan cooler setpoint.
Related Commands	`FANS`, `FANH`.

2.5.6 FAN cooler High (FANH)

Group	Miscellaneaous
Action	Command/Query
Description	The `FANH` command sets or queries the high-limit of the fan cooler setpoint. The fan cooler is not allowed to operate at voltages above this limit. The parameter `u16` is the high-limit expressed in mV. This limit may be programmed from 2500 mV to 4980 mV but actual value will be rounded to 0.39 % due to the internal digital format. When a command is setting a high-limit below the actual operating setpoint, the setpoint is automatically adjusted.
Syntax	`FANH(?) {u16}`
Command Syntax	`FANH u16`
Query Syntax	`FANH?`
Response Format	`u16`
Example	`FANH 4800` sets the high-limit of the fan cooler setpoint to +4.8 V. `FANH?` queries the high-limit of the fan cooler setpoint setpoint.
Related Commands	`FANS`, `FANL`.

2.5.7 FAN cooler Enable (FANE)

Group	Miscellaneous.
Action	Command/Query
Description	The `FANE` command enables the driver of the fan cooler. When a `OUTE` command is received, the voltage programmed by the previous `FANS` command is applied to the fan cooler. The query form returns `1` if fan cooler driver is enabled, `0` otherwise.
Syntax	`FANE(?)`
Command Syntax	`FANE`
Query Syntax	`FANE?`
Response Format	`b`
Example	`FANE` enables the fan cooler. `FANE?` queries the status of the fan cooler.
Related Commands	`FANS`, `FAND`.

2.5.8 FAN cooler Disable (FAND)

Group	Miscellaneous
Action	Command/Query
Description	The `FAND` command disables the driver of the fan cooler while the query form returns its current status . When a `FAND` command is received the fan cooler is disconnected from its driver. The query form returns `1` if the fan cooler is disabled, `0` otherwise.
Syntax	`FAND(?)`
Command Syntax	`FAND`
Query Syntax	`FAND?`
Response Format	`b`
Example	`FAND` disables the fan cooler. `FAND?` queries the fan cooler status.
Related Commands	`FANS`, `FANE`.

2.5.9 MONitorinG (MONG)

Group	Miscellaneous
Action	Command
Description	The `MONG` command returns the reading of the acquisition where the channel is specified by the parameter `u8` (see section 4.1). The result is scaled into engineering units and returned as an `u16` integer.
Command Syntax	`MONG u8`
Response Format	`u16`
Example	`MONG 7` returns the measured fan voltage expressed in mV. `MONG 2` returns the measured NTC thermistor resistance expressed in Ω.
Related Commands	`ADCG`.

2.5.10 ADC readinG (ADCG)

Group	Memory
Action	Command
Description	The `ADCG` command returns the reading of the analog-to-digital converter (ADC) without any scaling. This value ranges from 0 (0 V) to 1023 (+5 V). The parameter `u8` specifies the ADC's channel (see section 4.1).
Command Syntax	`ADCG u8`
Response Format	`u16`
Example	`ADCG 7` returns the integer resulting from the measure of fan voltage. `ADCG 2` returns the integer resulting from the measure of NTC thermistor resistance.
Related Commands	`MONG`.

3 Default Settings

The default settings may also be recalled using the `*RST` command over the computer interface.

Parameter	Relative Command	Default Value
Dual-Edge Sharpener		
TE-Bias Current Setpoint	`TEIS`	29 882 µA
TE-Bias Current Limit High	`TEIH`	29 882 µA
TE-Bias Current Limit Low	`TEIL`	0 µA
LE-Bias Current Setpoint	`LEIS`	0 µA
LE-Bias Current Limit High	`LEIH`	29 882 µA
LE-Bias Current Limit Low	`LEIL`	0 µA
Output		
Status	`OUTD`, `OUTE`	disabled
Regulator Voltage Setpoint	`REGS`	0 mV
Regulator Voltage Limit High	`REGH`	29 882 mV
Regulator Voltage Limit Low	`REGL`	0 mV
Overload Trigger Setpoint	`OVLS`	50 %
Overload Trigger Limit High	`OVLH`	99 %
Overload Trigger Limit Low	`OVLL`	0 %
Miscellaneous		
Overheating Alarm Setpoint	`OVHS`	1284 Ω (+80 °C)
Overheating Alarm Limit High	`OVHH`	32 330 Ω (0 °C)
Overheating Alarm Limit Low	`OVHL`	1284 Ω (+80 °C)
Fan Cooler Status	`FAND`, `FANE`	enabled
Fan Cooler Voltage Setpoint	`FANS`	4980 mV
Fan Cooler Voltage Limit High	`FANH`	4980 mV
Fan Cooler Voltage Limit Low	`FANL`	0 mV

4 Tables

4.1 Acquisition Channel Assignements

Identifier	Parameter	Units[b]	Range[b]
0	TE-Bias Current	µA	0 to 50 000
1	LE-Bias Current	µA	0 to 50 000
2	NTC Thermistor	Ω	0 to 50 000
3	Regulator Output Current	mA	0 to 500
4	Bandgap Voltage [a]	mV	0 to 5000
5	Ground Voltage	mV	0 to 5000
6	reserved		
7	Fan Cooler Voltage	mV	0 to 5000
8	Fan Cooler Current	mA	0 to 500
9	Regulator Output Voltage	mV	0 to 50 000
10	Pre-Regulator Output Voltage	mV	0 to 5000
11	Pre-Regulator Input Voltage	mV	0 to 5000

[a] Bandgap voltage (+1.1 V) ±10 %.
[b] Applies for `MONG` command only.

4.2 Thermistor

4.2.1 Zero-power resistance

$$R(T) = R_0 \exp^{\beta\left(\frac{1}{T}-\frac{1}{T_0}\right)} \tag{1}$$

where $T_0 = 300\,\mathrm{K}$, $R_0 = 10\,\mathrm{k\Omega}$ and $\beta = 3982\,\mathrm{K}$ (25 °C to 85 °C).

4.2.2 Temperature Resistance

Temperature (°C)	Resistance (Ω)
25	10000
30	8072
35	6556
40	5356
45	4401
50	3635
55	3019
60	2521
65	2115
70	1781
75	1509
80	1284
85	1097

Contents

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