

5 Software Description

Note: The following description is based on Firmware Version 2.0.0 and later. For any older versions please refer to previous documentation.

5.1 Files

The software was built with the IDE:

Raisonance RIDE51 Version 06.10.15 BN:732-51, 8051Toolchain 6.4.32 (<http://www.raisonance.com>)

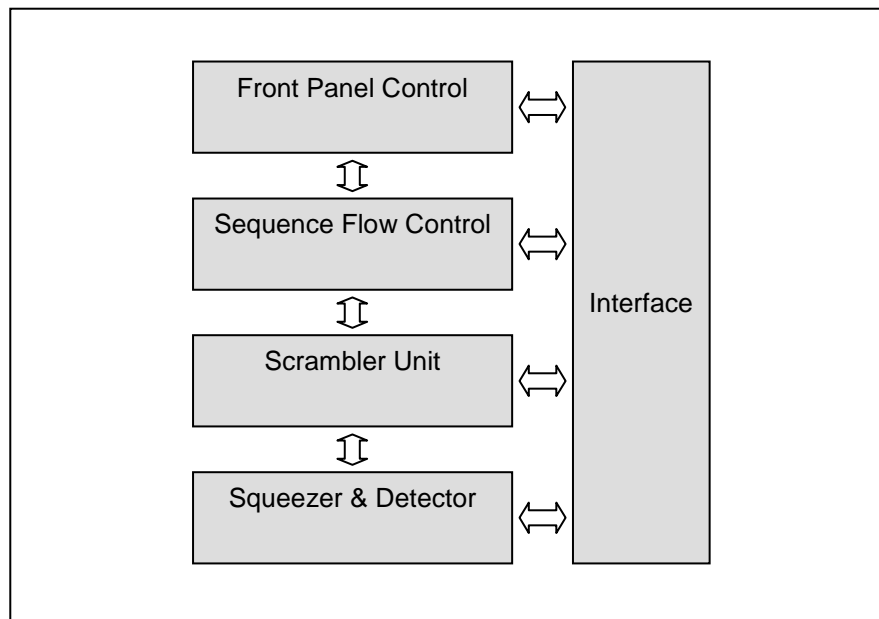
All source code may be found in: <..\..\E-SW\Firmware\08090>

The Binary file name is: 08090.hex

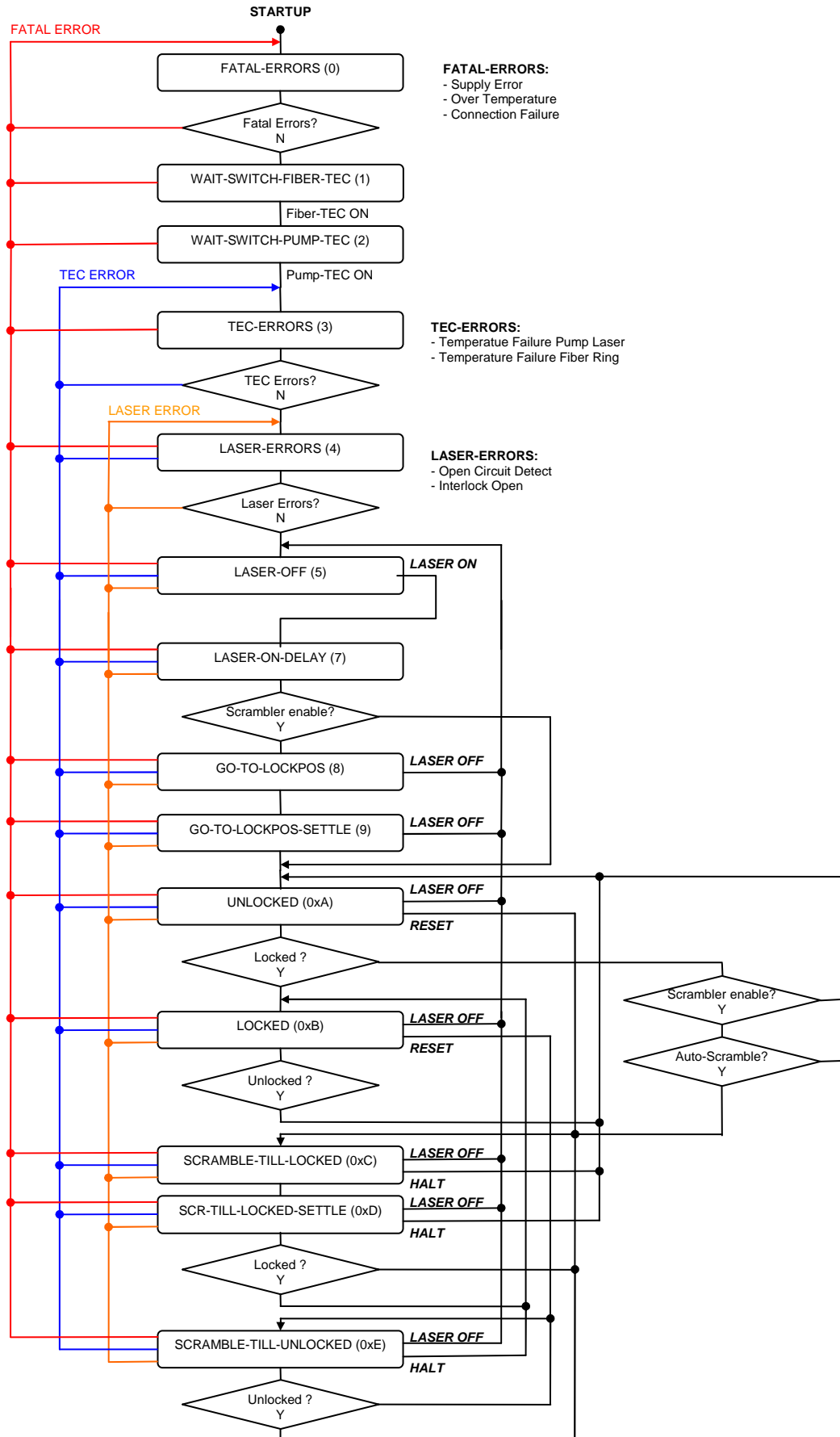
5.1.1 Uploading Firmware

To bring the device into the firmware upload state switch off the device and wait till the 'ON' LED is off. Press the hidden 'Upload' button and keep it pressed while switching the unit on again. To upload the Binary to the microprocessor use the tool Atmel-FLIP ([Atmel 8051 Microcontrollers Homepage](http://www.atmel.com), <http://www.atmel.com>). After completion of the upload process switch the unit off.

5.2 Architectural Overview



5.3 Device Operation Sequence (simplified)



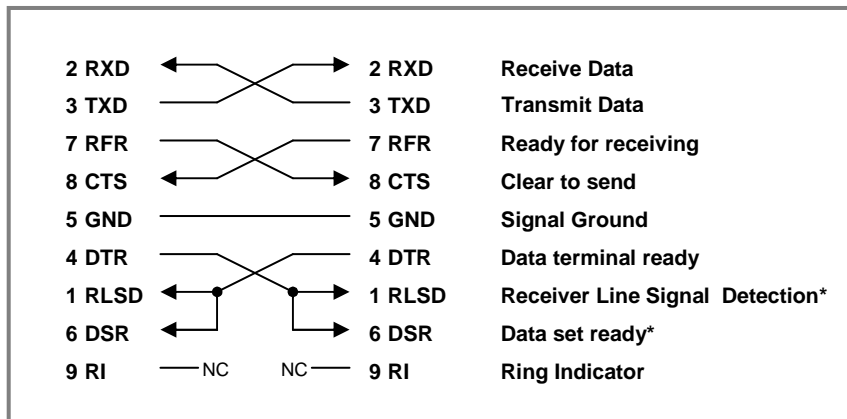
5.6 Interface

5.6.1 Serial link

This device provides an interface which is similar to the IEEE1174 "Serial Interface for Programmable Instrumentation" standard which provides a way to emulate the common IEEE488 interface over a serial link using SCPI-style commands.

For further information see <http://www.ieee.org>

The device is considered to be a Data Terminal Equipment (DTE). To connect it with a control PC use a 9 pole nullmodem cable which is connected like shown in the following figure.



* The short between pins 1 and 6 on either side of the cable is only required for older revisions of the TC1550.

The device has some limitations to the original IEEE1174 standard:

1. The data flow control protocol is limited to Hardware flow control, making use of the RFR/CTS circuit.
2. The "break" signal detection is not supported.
3. The communication speed is limited to 115200 bit/s. It is not possible to select other bit rates.
4. Framing error detection is not supported.

Set up your control PC to meet the following communication setup:

Line setup: **115200-8N1-RFR/CTS**
 Program message end character: **<LF>** (Line Feed, 0A_{hex})
 Response message end characters: **<CR><LF>** (Carriage Return, 0D_{hex} Line Feed, 0A_{hex})

The device will switch to remote operation mode after recognition of the first valid command sent to the device. It will switch back to local operation mode by pressing the 'LOCAL' button on the device front panel, by receiving the '>L' emulation code (see below) or by disconnecting the cable connection.

5.6.2 IEEE488 function emulation

The device uses special codes to emulate IEEE488 functionality. These codes always start with the character '&' (ampersand, 26_{hex}). The device uses the IEEE488.1 emulation mode. This means that emulation codes are recognized and sent anywhere in the input data stream. A 'double &' (&&) mechanism is used to distinguish between the leading '&' of an emulation code and an ordinary '&' data character.

The Service Request (SRQ) function of IEEE488 is used by the device to alert the controller that it requires service. To emulate the SRQ function the following sequence is used:

1. The device sends '&SRQ<CR><LF>' to the controller showing that it requires service.
2. The controller has to respond with '&POL' to query the device's Status Byte.
3. The device then responds by sending '&ddd<CR><LF>' where 'ddd' is the 3 digit decimal value of the Status Byte.

The following list shows all emulation codes supported by the device. Other emulation codes defined by IEEE1174 are not supported.

Emulation code	Direction	Description
&SRQ<CR><LF>	Device ► Controller	Informs the controller that the device requires service.
&POL	Controller ► Device	Polls the device's Status Byte.
&ddd<CR><LF>	Device ► Controller	Response to '&POL'. 'ddd' is the 3 digit decimal value of the device's Status Byte.
>L	Controller ► Device	Switches to local operation mode (Go To Local).
&LLO	Controller ► Device	Disables the the 'LOCAL' button on the device front panel (Local LockOut).

5.6.3 Message Exchange

The device supports the IEEE488.2 Message Exchange Control (MEC) protocol. It does not send data until it is asked for (this does not apply to the emulation codes).

Whitespace characters (ASCII codes 0 – 9, 0B_{hex} – 20_{hex}) are ignored on reception. To terminate a program message (Controller ► Device) the '<LF>' character (Line Feed, 0A_{hex}) is used. It is possible to put more than one command into a program message using the ';' character (semicolon, 3B_{hex}) as a separator.

The character sequence '<CR><LF>' (Carriage Return, 0D_{hex} Line Feed, 0A_{hex}) is used as the response message (Device ► Controller) terminator.

5.6.4 IEEE488.2 Common Commands

The device supports several IEEE488.2 common commands and queries. Additional descriptive information may be found in the IEEE488.2-1992-§10 standard.

5.6.4.1 Command List

Command	Description
*IDN?	Identification query. (IEEE488.2-1992-§10.14)
*SAV	Save setup. (IEEE488.2-1992-§10.33)
*RCL	Recall setup. (IEEE488.2-1992-§10.29)
*TST?	Selftest query. (IEEE488.2-1992-§10.38)
*OPC	Operation complete command. (IEEE488.2-1992-§10.18)
*OPC?	Operation complete query. (IEEE488.2-1992-§10.19)
*WAI	Wait command. (IEEE488.2-1992-§10.39)
*RST	Reset command. (IEEE488.2-1992-§10.32)
*SRE	Service Request Enable command. (IEEE488.2-1992-§10.34)
*SRE?	Service Request Enable query. (IEEE488.2-1992-§10.35)
*STB?	Read Status Byte query. (IEEE488.2-1992-§10.36)
*ESE	Standard Event Status Enable command. (IEEE488.2-1992-§10.10)
*ESE?	Standard Event Status Enable query. (IEEE488.2-1992-§10.11)
*ESR?	Standard Event Status Register query. (IEEE488.2-1992-§10.12)
*CLS	Clear Status command. (IEEE488.2-1992-§10.3)
*OPT?	Option Identification Query. (IEEE488.2-1992-§10.20)

5.6.4.2 IEEE488.2 Common Commands Description

5.6.4.2.1 Identification Query

Command syntax: ***IDN?**
 Response syntax: **<ARBITRARY ASCII RESPONSE DATA>**
 Prerequisite: None
 Description: Identification query (see also IEEE488.2-1992-§10.14).
 The response is organised into four fields separated by commas.
 (Manufacturer, Model, Serial number, Firmware level)

5.6.4.2.2 Save Command

Command syntax: ***SAV <DECIMAL NUMERIC PROGRAM DATA>**
 Response syntax: None
 Prerequisite: None
 Description: Saves the device setup values (see also IEEE488.2-1992-§10.33).
 This command saves all data entered by the following commands:

- ' :DET:AC:THRESH' – AC Summary Detector Thresholds
- ' :DET:AC:WEIGHT' – AC Summary Detector Weighting
- ' :DET:DC:WINDOW' – DC Detector Window
- ' :SCRA:STAGE1:' – Squeezer stage #1 scrambling values
- ' :SCRA:STAGE2:' – Squeezer stage #2 scrambling values
- ' :SCRA:STAGE3:' – Squeezer stage #3 scrambling values
- ' :SCRA:STAGE4:' – Squeezer stage #4 scrambling values
- ' :SCRA:TRITIM:' – Scrambler triangle step time
- ' :SCRA:LCKTIM:' – Scrambler go to lock position step time
- ' :SCRA:LCKNST:' – Scrambler go to lock position step count
- ' :SCRA:LCKDEL:' – Lock position settle delay time
- ' :SYST:BEEP:KEYPRESS' – Sound when key is pressed enable/disable
- ' :SYST:BEEP:KEYERROR' – Sound on erroneous keypress enable/disable
- ' :SYST:BEEP:UNLOCK' – Sound when laser unlocks enable/disable
- ' :SYST:BEEP:LOCK' – Sound when laser locks enable/disable
- ' :SYST:BEEP:LASEROFF' – Sound when laser switches off enable/disable
- ' :SYST:AUTOSCR' – Automatic scrambling enable/disable
- ' :SYST:AUTOSAV' – Automatic lock position saving enable/disable

The memory bank is selected with the **<DECIMAL NUMERIC PROGRAM DATA>** element which must be in the range from 0 to 9.

Note 1: Memory bank #0 is reserved for manufacturer default setup. To save to memory location #0 the access level 'SAVE-DEFAULT-DATA' must be set (see chapter 'Access Level' in this document).

Note 2: Memory bank #1 is reserved for local mode operation. When switching to local operation mode the values from memory bank #1 are restored automatically. To change local operation mode setup save to memory bank #1.

5.6.4.2.3 Recall Command

Command syntax: ***RCL <DECIMAL NUMERIC PROGRAM DATA>**
 Response syntax: None
 Prerequisite: None
 Description: Recalls the device setup values stored with the ***SAV** command (see also IEEE488.2-1992-§10.29).
 The memory bank is selected with the **<DECIMAL NUMERIC PROGRAM DATA>** element which must be in the range from 0 to 9.

5.6.4.2.4 Selftest Query

Command syntax: ***TST?**

Response syntax: **<NR1 NUMERIC RESPONSE DATA>**

Prerequisite: None

Description: Selftest query (see also IEEE488.2-1992-§10.38).
There is no selftest functionality implemented in this device. Therefore this query always returns '0' which means success.

5.6.4.2.5 Operation Complete Command

Command syntax: ***OPC**

Response syntax: None

Prerequisite: None

Description: Sets the 'OPC' bit in the 'Standard Event Status Register' (see also IEEE488.2-1992-§10.18).

5.6.4.2.6 Operation Complete Query

Command syntax: ***OPC?**

Response syntax: **<NR1 NUMERIC RESPONSE DATA>**

Prerequisite: None

Description: The Operation Complete Query places a '1' into the device's output queue (see also IEEE488.2-1992-§10.19).

5.6.4.2.7 Wait Command

Command syntax: ***WAI**

Response syntax: None

Prerequisite: None

Description: This command is required for IEEE488 compatibility and has no effect. (see also IEEE488.2-1992-§10.39).

5.6.4.2.8 Reset Command

Command syntax: ***RST**

Response syntax: None

Prerequisite: None

Description: This command resets the device into a known state. It recalls values from memory location #1 and enables the scrambler unit. This is similar to the local operation mode (see also IEEE488.2-1992-§10.32).

Note: The laser output is not affected by the '*RST' command.

5.6.4.2.9 Service Request Enable Command

Command syntax: ***SRE <DECIMAL NUMERIC PROGRAM DATA>**

Response syntax: None

Prerequisite: None

Description: Sets the device's Service Request Enable Register (see also IEEE488.2-1992-§10.34 and Chapter 'Status Reporting' in this document).

5.6.4.2.10 Service Request Enable Query

Command syntax: ***SRE?**

Response syntax: **<NR1 NUMERIC RESPONSE DATA>**

Prerequisite: None

Description: Queries the device's Service Request Enable Register (see also IEEE488.2-1992-§10.35 and Chapter 'Status Reporting' in this document).

5.6.4.2.11 Read Status Byte Query

Command syntax: ***STB?**

Response syntax: **<NR1 NUMERIC RESPONSE DATA>**

Prerequisite: None

Description: Queries the device's Status Byte (see also IEEE488.2-1992-§10.36 and Chapter 'Status Reporting' in this document).

5.6.4.2.12 Standard Event Status Enable Command

Command syntax: ***ESE <DECIMAL NUMERIC PROGRAM DATA>**

Response syntax: None

Prerequisite: None

Description: Sets the device's Standard Event Status Enable Register (see also IEEE488.2-1992-§10.10 and Chapter 'Status Reporting' in this document).

5.6.4.2.13 Standard Event Status Enable Query

Command syntax: ***ESE?**

Response syntax: **<NR1 NUMERIC RESPONSE DATA>**

Prerequisite: None

Description: Queries the device's Standard Event Status Enable Register (see also IEEE488.2-1992-§10.11 and Chapter 'Status Reporting' in this document).

5.6.4.2.14 Standard Event Status Register Query

Command syntax: ***ESR?**

Response syntax: **<NR1 NUMERIC RESPONSE DATA>**

Prerequisite: None

Description: Queries the device's Standard Event Status Register (see also IEEE488.2-1992-§10.12 and Chapter 'Status Reporting' in this document).

5.6.4.2.15 Clear Status Command

Command syntax: ***CLS**

Response syntax: None

Prerequisite: None

Description: Clears the following device's status registers (see also IEEE488.2-1992-§10.3):

- Standard Event Status Register
- Device Error Event Register and Device Error Event Enable Register
- Device State Event Register and Device State Event Enable Register

5.6.4.2.16 Option Identification Query

Command syntax: ***OPT?**

Response syntax: **<ARBITRARY ASCII RESPONSE DATA>**

Prerequisite: None

Description: Option identification query (see also IEEE488.2-1992-§10.20).
The device response is organised as one field containing a decimal value which may be interpreted like a **<NR1 NUMERIC RESPONSE DATA>**. The returned value is a 8 bit bitfield showing the options present. See also chapter 'Device Options' in this document.

5.6.5 Device Specific Commands

5.6.5.1 Fiberlaser Command List

Command	Description
:LASER	Switch the laser output on/off.
:LASER?	Query the state of the laser output
:AMPLIFIER	Switch the optical amplifier on/off.
:AMPLIFIER?	Query the state of the optical amplifier
:LOCK?	Query the detector's lock state
:POWER?	Query the optical output power
:DET:AC:RNG?	Query the AC summary signal detector output value range
:DET:AC:VAL?	Query the AC summary signal detector output value
:DET:AC:THRESH	Set the AC summary signal detector thresholds
:DET:AC:THRESH?	Query the AC summary signal detector thresholds
:DET:AC:WEIGHT	Set the AC signal weighting
:DET:AC:WEIGHT?	Query the AC signal weighting
:DET:DC:RNG?	Query the DC signal detector output value range
:DET:DC:VAL?	Query the DC signal detector output value
:DET:DC:WINDOW	Set the DC signal detector window
:DET:DC:WINDOW?	Query the DC signal detector window
:SQUE:RNG?	Query the squeezer's set value range
:SQUE:SET	Set the squeezer's values
:SQUE:VAL?	Query the squeezer's current values
:SCRA:ENABLE	Enable/Disable the scrambler unit
:SCRA:ENABLE?	Query the scrambler unit enable state
:SCRA:HALT	Stop scrambling
:SCRA:RESET	Reset the scrambler unit to the next lock position
:SCRA:STAGE1	Set the scrambling parameters for stage 1
:SCRA:STAGE1?	Query the scrambling parameters for stage 1
:SCRA:STAGE2	Set the scrambling parameters for stage 2
:SCRA:STAGE2?	Query the scrambling parameters for stage 2
:SCRA:STAGE3	Set the scrambling parameters for stage 3
:SCRA:STAGE3?	Query the scrambling parameters for stage 3
:SCRA:STAGE4	Set the scrambling parameters for stage 4
:SCRA:STAGE4?	Query the scrambling parameters for stage 4
:SCRA:TRITIM	Set the scrambler's 'triangle' step time
:SCRA:TRITIM?	Query the scrambler's 'triangle' step time
:SCRA:LCKTIM	Set the scrambler's 'go to lock position' step time
:SCRA:LCKTIM?	Query the scrambler's 'go to lock position' step time

:SCRA:LCKNST	Set the scrambler's 'go to lock position' number of steps
:SCRA:LCKNST?	Query the scrambler's 'go to lock position' number of steps
:SCRA:LCKDEL	Set the scrambler's 'lock position' settle delay time
:SCRA:LCKDEL?	Query the scrambler's 'lock position' settle delay time
:STAT:DEC?	Query the 'Device Error Condition' register
:STAT:DEE?	Query the 'Device Error Event' register
:STAT:EDE?	Query the 'Device Error Event Enable' register
:STAT:EDE	Set the 'Device Error Event Enable' register
:STAT:DSC?	Query the 'Device State Condition' register
:STAT:DSE?	Query the 'Device State Event' register
:STAT:EDS?	Query the 'Device State Event Enable' register
:STAT:EDS	Set the 'Device State Event Enable' register
:SYST:ERR?	Query the device's error queue
:SYST:BEEP	Make an audible signal
:SYST:AUTH	Authenticate and set an access level to get special access rights
:SYST:AUTH?	Query the access level
:SYST:BEEP:KEYPRESS	Set the device's 'Beep On Keypress Event' flag
:SYST:BEEP:KEYPRESS?	Query the device's 'Beep On Keypress Event' flag
:SYST:BEEP:KEYERROR	Set the device's 'Beep On Erroneous Keypress Event' flag
:SYST:BEEP:KEYERROR?	Query the device's 'Beep On Erroneous Keypress Event' flag
:SYST:BEEP:UNLOCK	Set the device's 'Beep On Unlock Event' flag
:SYST:BEEP:UNLOCK?	Query the device's 'Beep On Unlock Event' flag
:SYST:BEEP:LOCK	Set the device's 'Beep On Lock Event' flag
:SYST:BEEP:LOCK?	Query the device's 'Beep On Lock Event' flag
:SYST:BEEP:LASEROFF	Set the device's 'Beep On Laser-Off Event' flag
:SYST:BEEP:LASEROFF?	Query the device's 'Beep On Laser-Off Event' flag
:SYST:AUTOSCR	Set the device's 'Automatic Scramble' flag
:SYST:AUTOSCR?	Query the device's 'Automatic Scramble' flag
:SYST:AUTOSAV	Set the device's 'Automatic Lock Position Save' flag
:SYST:AUTOSAV?	Query the device's 'Automatic Lock Position Save' flag
:SERVICE:VENDOR	Set the device's vendor name
:SERVICE:PRODUCT	Set the device's product name
:SERVICE:SERNR	Set the device's serial number
:SERVICE:OPTION	Set the device's options
:SERVICE:ADJ:POWER	Set the device's optical power adjustment (amplifier off).
:SERVICE:ADJ:POWER?	Query the device's optical power adjustment (amplifier off).
:SERVICE:ADJ:POWAMP	Set the device's optical power adjustment (amplifier on).
:SERVICE:ADJ:POWAMP?	Query the device's optical power adjustment (amplifier on).

5.6.5.2 Fiberlaser Command Description

5.6.5.2.1 Switch Laser Output Command

Command syntax: **:LASER OFF | ON**

Prerequisite: There must not be any Device Errors in the Device Error Condition Register to switch the Laser output on.

Description: Switches the laser output on/off.

5.6.5.2.2 Laser Output State Query

Command syntax: **:LASER?**

Response syntax: **OFF | STARTING | ON**

Prerequisite: None

Description: Queries the state of the laser output.

5.6.5.2.3 Switch Amplifier Command

Command syntax: **:AMPLIFIER OFF | ON**

Prerequisite: The device must have the Amplifier option set.
The Laser output must be switched on to switch on the amplifier.

Description: Switches the optical amplifier on/off.

5.6.5.2.4 Amplifier State Query

Command syntax: **:AMPLIFIER?**

Response syntax: **OFF | ON**

Prerequisite: The device must have the Amplifier option set.

Description: Queries the state of the optical amplifier.

5.6.5.2.5 Lock State Query

Command syntax: **:LOCK?**

Response syntax: **UNLOCKED | LOCKED**

Prerequisite: None

Description: Queries the detector's lock state.

Note: The detector unit reports a locked state when both the overtone summary detector and the DC signal detector reports a locked state.

5.6.5.2.6 Optical Power Query

Command syntax: **:POWER?**

Response syntax: **<NR3 NUMERIC RESPONSE DATA>**

Prerequisite: None

Description: Queries the optical output power. The value is given in Watts.

5.6.5.2.7 Overtone Summary Detector Value Range Query

Command syntax: **:DET:AC:RNG?**
 Response syntax: Minimum value <HEXADECIMAL NUMERIC RESPONSE DATA>,
 Maximum value <HEXADECIMAL NUMERIC RESPONSE DATA>
 Prerequisite: None
 Description: Queries the overtone summary detector output value range.

5.6.5.2.8 Overtone Summary Detector Value Query

Command syntax: **:DET:AC:VAL?**
 Response syntax: Detector value <HEXADECIMAL NUMERIC RESPONSE DATA>
 Prerequisite: None
 Description: Queries the current overtone summary detector value.

5.6.5.2.9 Set Overtone Summary Detector Lock Thresholds

Command syntax: **:DET:AC:THRESH**
 Threshold low value <NONDECIMAL NUMERIC PROGRAM DATA>,
 Threshold high value <NONDECIMAL NUMERIC PROGRAM DATA>
 Prerequisite: None
 Description: Sets the overtone summary detector lock/unlock threshold values.

5.6.5.2.10 Query Overtone Summary Detector Lock Thresholds

Command syntax: **:DET:AC:THRESH?**
 Response syntax: Threshold low value <HEXADECIMAL NUMERIC RESPONSE DATA>,
 Threshold high value <HEXADECIMAL NUMERIC RESPONSE DATA>
 Prerequisite: None
 Description: Queries the overtone summary detector lock/unlock threshold values.

5.6.5.2.11 Set Overtone Summary Detector Weights

Command syntax: **:DET:AC:WEIGHT**
 Channel #1 weight <NONDECIMAL NUMERIC PROGRAM DATA>,
 Channel #2 weight <NONDECIMAL NUMERIC PROGRAM DATA>,
 Channel #3 weight <NONDECIMAL NUMERIC PROGRAM DATA>,
 Channel #4 weight <NONDECIMAL NUMERIC PROGRAM DATA>
 Prerequisite: None
 Description: Sets the overtone summary detector weighting.

5.6.5.2.12 Query Overtone Summary Detector Weights

Command syntax: **:DET:AC:WEIGHT?**
 Response syntax: Channel #1 weight <HEXADECIMAL NUMERIC RESPONSE DATA>,
 Channel #2 weight <HEXADECIMAL NUMERIC RESPONSE DATA>,
 Channel #3 weight <HEXADECIMAL NUMERIC RESPONSE DATA>,
 Channel #4 weight <HEXADECIMAL NUMERIC RESPONSE DATA>
 Prerequisite: None
 Description: Queries the overtone summary detector weighting.

5.6.5.2.13 DC Signal Detector Value Range Query

Command syntax: **:DET:DC:RNG?**

Response syntax: Minimum value **<HEXADECIMAL NUMERIC RESPONSE DATA>**,
Maximum value **<HEXADECIMAL NUMERIC RESPONSE DATA>**

Prerequisite: None

Description: Queries the DC signal detector output value range.

5.6.5.2.14 DC Signal Detector Value Query

Command syntax: **:DET:DC:VAL?**

Response syntax: Detector value **<HEXADECIMAL NUMERIC RESPONSE DATA>**

Prerequisite: None

Description: Queries the current DC signal detector value.

Note: The DC signal detector value is also used for calculation of the optical output power.

5.6.5.2.15 Set DC Signal Detector Lock Window Borders

Command syntax: **:DET:DC:WINDOW**

Bottom window border low value **<NONDECIMAL NUMERIC PROGRAM DATA>**,
Bottom window border high value **<NONDECIMAL NUMERIC PROGRAM DATA>**,
Top window border low value **<NONDECIMAL NUMERIC PROGRAM DATA>**,
Top window border high value **<NONDECIMAL NUMERIC PROGRAM DATA>**

Prerequisite: None

Description: Sets the DC signal detector lock/unlock window borders.

5.6.5.2.16 Query DC Signal Detector Lock Window Borders

Command syntax: **:DET:DC:WINDOW?**

Response syntax: Bottom window border low value **<HEXADECIMAL NUMERIC RESPONSE DATA>**,
Bottom window border high value **<HEXADECIMAL NUMERIC RESPONSE DATA>**,
Top window border low value **<HEXADECIMAL NUMERIC RESPONSE DATA>**,
Top window border high value **<HEXADECIMAL NUMERIC RESPONSE DATA>**

Prerequisite: None

Description: Queries the DC signal detector lock/unlock window borders.

5.6.5.2.17 Squeezer Value Range Query

Command syntax: **:SQUE:RNG?**

Response syntax: Minimum value **<HEXADECIMAL NUMERIC RESPONSE DATA>** ,
Maximum value **<HEXADECIMAL NUMERIC RESPONSE DATA>**

Prerequisite: None

Description: Queries the squeezer value range. The values are valid for all four stages.

5.6.5.2.18 Set Squeezer values

Command syntax: **:SQUE:SET**
Stage #1 value <NONDECIMAL NUMERIC PROGRAM DATA>,
Stage #2 value <NONDECIMAL NUMERIC PROGRAM DATA>,
Stage #3 value <NONDECIMAL NUMERIC PROGRAM DATA>,
Stage #4 value <NONDECIMAL NUMERIC PROGRAM DATA>

Prerequisite: Laser output must be switched on.
Scrambler unit must be disabled.

Description: Sets squeezer values directly. The values must be in the range queried by
' :SQUE:RNG? '.

Note: This command may be used to generate a scrambling pattern via an external control PC. The command takes about 7ms to execute.

5.6.5.2.19 Query Squeezer values

Command syntax: **:SQUE:VAL?**

Response syntax: Stage #1 value <HEXADECIMAL NUMERIC RESPONSE DATA> ,
Stage #2 value <HEXADECIMAL NUMERIC RESPONSE DATA> ,
Stage #3 value <HEXADECIMAL NUMERIC RESPONSE DATA> ,
Stage #4 value <HEXADECIMAL NUMERIC RESPONSE DATA>

Prerequisite: None

Description: Queries the current squeezer values.

5.6.5.2.20 Enable/Disable Scrambler Unit

Command syntax: **:SCRA:ENABLE OFF | ON**

Prerequisite: None

Description: Switches the scrambler unit on/off.

Note: In local operating mode the scrambler unit is always enabled. Switching to local operating mode enables the scrambler unit.

5.6.5.2.21 Query Scrambler Unit State

Command syntax: **:SCRA:ENABLE?**

Response syntax: **OFF | ON**

Prerequisite: None

Description: Queries the state of the scrambler unit.

5.6.5.2.22 Stop Scrambling

Command syntax: **:SCRA:HALT**

Prerequisite: Laser output must be switched on.
Automatic scrambling must be disabled.

Description: Stops the Scrambler unit.

5.6.5.2.23 Reset Scrambler

Command syntax: **:SCRA:RESET**

Prerequisite: Laser output must be switched on.
Scrambler unit must be enabled.

Description: Starts scrambling and tries to reset to the next stable squeezer value (lock position).

5.6.5.2.24 Set Scrambler Stage Setup

Command syntax: **:SCRA:STAGE[1..4]**

Minimum value **<NONDECIMAL NUMERIC PROGRAM DATA>**,
Maximum value **<NONDECIMAL NUMERIC PROGRAM DATA>**,
Step width **<NONDECIMAL NUMERIC PROGRAM DATA>**,
Lock position **<NONDECIMAL NUMERIC PROGRAM DATA>**,
Lock direction **BOTTOMUP | TOPDOWN**

Prerequisite: None

Description: Sets the scrambler setup for squeezer stage 1..4.
The minimum value must be in the range queried by **:SQUE:RNG?**.
The maximum value must be in the range queried by **:SQUE:RNG?** and greater than the minimum value..
The step width value must be in the range from 0 to FF_{hex} .
The lock position must be within the minimum value and the maximum value.

5.6.5.2.25 Query Scrambler Stage Setup

Command syntax: **:SCRA:STAGE[1..4]?**

Response syntax: Minimum value **<HEXADECIMAL NUMERIC RESPONSE DATA>**,
Maximum value **<HEXADECIMAL NUMERIC RESPONSE DATA>**,
Step width **<HEXADECIMAL NUMERIC RESPONSE DATA>**,
Lock position **<HEXADECIMAL NUMERIC RESPONSE DATA>**,
Lock direction **BOTTOMUP | TOPDOWN**

Prerequisite: None

Description: Queries the scrambler setup values for squeezer stage 1..4.

5.6.5.2.26 Set Scrambler Triangle Step Time

Command syntax: **:SCRA:TRITIM <DECIMAL NUMERIC PROGRAM DATA>**

Prerequisite: None

Description: Sets the scrambler triangle step time in milliseconds.
The value must be in the range from 1ms to 1000ms. The resolution is 1ms.

5.6.5.2.27 Query Scrambler Triangle Step Time

Command syntax: **:SCRA:TRITIM?**

Response syntax: **<NR1 NUMERIC RESPONSE DATA>**

Prerequisite: None

Description: Queries the scrambler triangle step time. The value is given in milliseconds.

5.6.5.2.28 Set Scrambler 'Go To Lock Position' Step Time

Command syntax: **:SCRA:LCKTIM <DECIMAL NUMERIC PROGRAM DATA>**

Prerequisite: None

Description: Sets the scrambler 'Go To Lock Position' step time in milliseconds.
The value must be in the range from 1ms to 1000ms. The resolution is 1ms.

5.6.5.2.29 Query Scrambler 'Go To Lock Position' Step Time

Command syntax: **:SCRA:LCKTIM?**

Response syntax: **<NR1 NUMERIC RESPONSE DATA>**

Prerequisite: None

Description: Queries the scrambler 'Go To Lock Position' step time. The value is given in milliseconds.

5.6.5.2.30 Set Scrambler 'Go To Lock Position' Number Of Steps

Command syntax: **:SCRA:LCKNST <DECIMAL NUMERIC PROGRAM DATA>**

Prerequisite: None

Description: Sets the scrambler 'Go To Lock Position' number of steps.
The value must be in the range from 1 to 250.

5.6.5.2.31 Query Scrambler 'Go To Lock Position' Number Of Steps

Command syntax: **:SCRA:LCKNST?**

Response syntax: **<NR1 NUMERIC RESPONSE DATA>**

Prerequisite: None

Description: Queries the scrambler 'Go To Lock Position' number of steps.

5.6.5.2.32 Set Scrambler 'Lock Position Settle Delay' Time

Command syntax: **:SCRA:LCKDEL <DECIMAL NUMERIC PROGRAM DATA>**

Prerequisite: None

Description: Sets the scrambler 'Lock Position Settle Delay' time in seconds.
The value must be in the range from 1s to 600s. The resolution is 1s.

5.6.5.2.33 Query Scrambler 'Lock Position Settle Delay' Time

Command syntax: **:SCRA:LCKDEL?**

Response syntax: **<NR1 NUMERIC RESPONSE DATA>**

Prerequisite: None

Description: Queries the scrambler 'Lock Position Settle Delay' time. The value is given in seconds.

5.6.5.2.34 Query Device Error Condition Register

Command syntax: **:STAT:DEC?**

Response syntax: **<NR1 NUMERIC RESPONSE DATA>**

Prerequisite: None

Description: Queries the device's 'Device Error Condition' Register (see also: Chapter 'Status Reporting' in this document).

5.6.5.2.35 Query Device Error Event Register

Command syntax: **:STAT:DEE?**

Response syntax: **<NR1 NUMERIC RESPONSE DATA>**

Prerequisite: None

Description: Queries the device's 'Device Error Event' Register (see also: Chapter 'Status Reporting' in this document).

5.6.5.2.36 Set Device Error Event Enable Register

Command syntax: **:STAT:EDE <DECIMAL NUMERIC PROGRAM DATA>**

Prerequisite: None

Description: Sets the device's 'Device Error Event Enable' Register (see also: Chapter 'Status Reporting' in this document).

5.6.5.2.37 Query Device Error Event Enable Register

Command syntax: **:STAT:EDE?**

Response syntax: **<NR1 NUMERIC RESPONSE DATA>**

Prerequisite: None

Description: Queries the device's 'Device Error Event Enable' Register (see also: Chapter 'Status Reporting' in this document).

5.6.5.2.38 Query Device State Condition Register

Command syntax: **:STAT:DSC?**

Response syntax: **<NR1 NUMERIC RESPONSE DATA>**

Prerequisite: None

Description: Queries the device's 'Device State Condition' Register (see also: Chapter 'Status Reporting' in this document).

5.6.5.2.39 Query Device State Event Register

Command syntax: **:STAT:DSE?**

Response syntax: **<NR1 NUMERIC RESPONSE DATA>**

Prerequisite: None

Description: Queries the device's 'Device State Event' Register (see also: Chapter 'Status Reporting' in this document).

5.6.5.2.40 Set Device State Event Enable Register

Command syntax: **:STAT:EDS <DECIMAL NUMERIC PROGRAM DATA>**

Prerequisite: None

Description: Sets the device's 'Device State Event Enable' Register (see also: Chapter 'Status Reporting' in this document).

5.6.5.2.41 Query Device State Event Enable Register

Command syntax: **:STAT:EDE?**

Response syntax: **<NR1 NUMERIC RESPONSE DATA>**

Prerequisite: None

Description: Queries the device's 'Device State Event Enable' Register (see also: Chapter 'Status Reporting' in this document).

5.6.5.2.42 Error Query

Command syntax: **:SYST:ERR?**

Response syntax: Error number **<NR1 NUMERIC RESPONSE DATA>** ,
Error text **<ARBITRARY ASCII RESPONSE DATA>**

Prerequisite: None

Description: Queries the device's error queue (see also: Chapter 'Error Reporting' in this document).

5.6.5.2.43 Beep

Command syntax: **:SYST:BEEP ERR | SIG1 | SIG2 | SIG3 | SIG4**

Prerequisite: None

Description: Generates an audible signal.

5.6.5.2.44 Set Access Level

Command syntax: **:SYST:AUTH**
Access Level **<DECIMAL NUMERIC PROGRAM DATA>**,
Code **<STRING PROGRAM DATA>**

Prerequisite: None

Description: Sets an access level to achieve special access rights. For further information see chapter 'Access Level' in this document.

5.6.5.2.45 Query Access Level

Command syntax: **:SYST:AUTH?**

Response syntax: **<NR1 NUMERIC RESPONSE DATA>**

Prerequisite: None

Description: Queries the current access level. For further information see chapter 'Access Level' in this document.

5.6.5.2.46 Set Flag 'Beep On Keypress Event'

Command syntax: **:SYST:BEEP:KEYPRESS OFF | ON**

Prerequisite: None

Description: Sets/clears the 'Beep On Keypress Event' flag.

5.6.5.2.47 Query Flag 'Beep On Keypress Event'

Command syntax: **:SYST:BEEP:KEYPRESS?**
Response syntax: **OFF | ON**
Prerequisite: None
Description: Queries the 'Beep On Keypress Event' flag.

5.6.5.2.48 Set Flag 'Beep On Erroneous Keypress Event'

Command syntax: **:SYST:BEEP:KEYERROR OFF | ON**
Prerequisite: None
Description: Sets/clears the 'Beep On Erroneous Keypress Event' flag.

5.6.5.2.49 Query Flag 'Beep On Erroneous Keypress Event'

Command syntax: **:SYST:BEEP:KEYERROR?**
Response syntax: **OFF | ON**
Prerequisite: None
Description: Queries the 'Beep On Erroneous Keypress Event' flag.

5.6.5.2.50 Set Flag 'Beep On Unlock Event'

Command syntax: **:SYST:BEEP:UNLOCK OFF | ON**
Prerequisite: None
Description: Sets/clears the 'Beep On Unlock Event' flag.

5.6.5.2.51 Query Flag 'Beep On Unlock Event'

Command syntax: **:SYST:BEEP:UNLOCK?**
Response syntax: **OFF | ON**
Prerequisite: None
Description: Queries the 'Beep On Unlock Event' flag.

5.6.5.2.52 Set Flag 'Beep On Lock Event'

Command syntax: **:SYST:BEEP:LOCK OFF | ON**
Prerequisite: None
Description: Sets/clears the 'Beep On Lock Event' flag.

5.6.5.2.53 Query Flag 'Beep On Lock Event'

Command syntax: **:SYST:BEEP:LOCK?**
Response syntax: **OFF | ON**
Prerequisite: None
Description: Queries the 'Beep On Lock Event' flag.

5.6.5.2.54 Set Flag 'Beep On Laser-Off Event'

Command syntax: **:SYST:BEEP:LASEROFF OFF | ON**
 Prerequisite: None
 Description: Sets/clears the 'Beep On Laser-Off Event' flag.

5.6.5.2.55 Query Flag 'Beep On Laser-Off Event'

Command syntax: **:SYST:BEEP:LASEROFF?**
 Response syntax: **OFF | ON**
 Prerequisite: None
 Description: Queries the 'Beep On Laser-Off Event' flag.

5.6.5.2.56 Set Flag 'Automatic Scramble'

Command syntax: **:SYST:AUTOSCR OFF | ON**
 Prerequisite: None
 Description: Sets/clears the 'Automatic Scramble' flag.

5.6.5.2.57 Query Flag 'Automatic Scramble'

Command syntax: **:SYST:AUTOSCR?**
 Response syntax: **OFF | ON**
 Prerequisite: None
 Description: Queries the 'Automatic Scramble' flag.

5.6.5.2.58 Set Flag 'Automatic Lock Position Save'

Command syntax: **:SYST:AUTOSAV OFF | ON**
 Prerequisite: None
 Description: Sets/clears the 'Automatic Lock Position Save' flag.
 Note: If this flag is set and the device is in local operating mode it saves new found locking positions to memory location #1 overwriting the values of the '**:SCRA:STAGE[1..4]**' commands.

5.6.5.2.59 Query Flag 'Automatic Lock Position Save'

Command syntax: **:SYST:AUTOSAV?**
 Response syntax: **OFF | ON**
 Prerequisite: None
 Description: Queries the 'Automatic Lock Position Save' flag.

5.6.5.2.60 Set Vendor Name

Command syntax: **:SERVICE:VENDOR <STRING PROGRAM DATA>**
 Prerequisite: The access level 'SET-ID-ITEMS' must be set (see chapter 'Access Level' in this document).
 Description: Sets the vendor name returned by '***IDN?**'. The maximum length of this value is 40 characters.

5.6.5.2.61 Set Product Name

Command syntax: **:SERVICE:PRODUCT <STRING PROGRAM DATA>**

Prerequisite: The access level 'SET-ID-ITEMS' must be set (see chapter 'Access Level' in this document).

Description: Sets the product name returned by '*IDN?'. The maximum length of this value is 40 characters.

5.6.5.2.62 Set Serialnumber

Command syntax: **:SERVICE:SERNR <STRING PROGRAM DATA>**

Prerequisite: The access level 'SET-ID-ITEMS' must be set (see chapter 'Access Level' in this document).

Description: Sets the device's serialnumber returned by '*IDN?'. The maximum length of this value is 40 characters.

5.6.5.2.63 Set Device Options

Command syntax: **:SERVICE:OPTION <DECIMAL NUMERIC PROGRAM DATA>**

: The access level 'SET-ID-ITEMS' must be set (see chapter 'Access Level' in this document).

Description: Sets the device's options returned by '*OPT?'. For further information see chapter 'Device Options' in this document.

5.6.5.2.64 Set Power Adjustment (Optical Amplifier off / Option disabled)

Command syntax: **:SERVICE:ADJ:POWER**

Point #1 converter value <HEXADECIMAL NUMERIC RESPONSE DATA>,
Point #1 power value <NR3 NUMERIC RESPONSE DATA>,
Point #2 converter value <HEXADECIMAL NUMERIC RESPONSE DATA>,
Point #2 power value <NR3 NUMERIC RESPONSE DATA>

Prerequisite: None

Description: A linear 2 point adjustment is performed.

5.6.5.2.65 Query Power Adjustment (Optical Amplifier off / Option disabled)

Command syntax: **:SERVICE:ADJ:POWER?**

Response syntax: Point #1 converter value <NONDECIMAL NUMERIC PROGRAM DATA>,
Point #1 power value <DECIMAL NUMERIC PROGRAM DATA>,
Point #2 converter value <NONDECIMAL NUMERIC PROGRAM DATA>,
Point #2 power value <DECIMAL NUMERIC PROGRAM DATA>

Prerequisite: None

Description: Queries the values of the linear 2 point adjustment.

5.6.5.2.66 Set Power Adjustment (Optical Amplifier on)

Command syntax: **:SERVICE:ADJ:POWAMP**
 Point #1 converter value **<HEXADECIMAL NUMERIC RESPONSE DATA>**,
 Point #1 power value **<NR3 NUMERIC RESPONSE DATA>**,
 Point #2 converter value **<HEXADECIMAL NUMERIC RESPONSE DATA>**,
 Point #2 power value **<NR3 NUMERIC RESPONSE DATA>**

Prerequisite: None

Description: A linear 2 point adjustment is performed.

5.6.5.2.67 Query Power Adjustment (Optical Amplifier on)

Command syntax: **:SERVICE:ADJ:POWAMP?**
 Response syntax: Point #1 converter value **<NONDECIMAL NUMERIC PROGRAM DATA>**,
 Point #1 power value **<DECIMAL NUMERIC PROGRAM DATA>**,
 Point #2 converter value **<NONDECIMAL NUMERIC PROGRAM DATA>**,
 Point #2 power value **<DECIMAL NUMERIC PROGRAM DATA>**

Prerequisite: None

Description: Queries the values of the linear 2 point adjustment.

5.6.5.3 Motor Control Command List

Starting with firmware version 2.4.0, motor control commands extend the fiberlaser command set described above. With these commands, the TC1550 can control up to 9 individual motors, used for different purposes, as reflected by the device options (see section 5.6.8). It is important to note that motors #0,#1,#2 and #3 are controlled by the mode locking algorithm in the control unit. Interfering with automated control by applying the following commands to any of these four motors will lead to undetermined behavior of the laser and is strongly discouraged. User applications utilizing low level motor control functions must restrict access to motors #4, #5, #6, #7 and #8.

In the following table, “#” is to be replaced by the motor number, 4 to 8.

Command	Description
:TMC428:STATE#?	Query the driving state of motor #
:TMC428:GOTO#	Move motor # to new absolute position
:TMC428:MOVE#	Move motor # to new relative position
:TMC428:SGOTO#	Move motor # to new absolute position (with hysteresis compensation)
:TMC428:SMOVE#	Move motor # to new relative position (with hysteresis compensation)
:TMC428:TELL#	Set the current position of motor #
:TMC428:POS#?	Query the current position of motor #
:TMC428:HYST#	Set the hysteresis compensation number of steps
:TMC428:HYST#?	Query the hysteresis compensation number of steps
:TMC428:SWITCHES67?	Query the limit switches of motors #6 and #7

5.6.5.4 Description

5.6.5.4.1 Query Motor Driving State Query

Command syntax: **:TMC428:STATE#?**

Response syntax: Motor State **<NONDECIMAL NUMERIC PROGRAM DATA>**

Prerequisite: Motor # must be present (see section 5.6.8).

Description: A return value different from 0 indicates the motor is moving.

5.6.5.4.2 Motor Goto Command

Command syntax: **:TMC428:GOTO#**

Absolute Position **<NONDECIMAL NUMERIC PROGRAM DATA>**

Response syntax: **OFF | STARTING | ON**

Prerequisite: Motor # must be present (see section 5.6.8).

Description: Move motor # to new absolute position

5.6.5.4.3 Motor Move Command

Command syntax: **:TMC428:MOVE#**

Number of steps **<NONDECIMAL NUMERIC PROGRAM DATA>**

Prerequisite: Motor # must be present (see section 5.6.8).

Description: Move motor # by a number of steps. The sign denotes direction of movement.

5.6.5.4.4 Motor S-Goto Command

Command syntax: **:TMC428:SGOTO#**

Absolute Position **<NONDECIMAL NUMERIC PROGRAM DATA>**

Prerequisite: Motor # must be present (see section 5.6.8).

Description: Move motor # to new absolute position (with hysteresis compensation)

5.6.5.4.5 Motor S-Move Command

Command syntax: **:TMC428:SMOVE#**

Number of steps **<NONDECIMAL NUMERIC PROGRAM DATA>**

Prerequisite: Motor # must be present (see section 5.6.8).

Description: Move motor # to new relative position (with hysteresis compensation)

5.6.5.4.6 Motor Set Position Command

Command syntax: **:TMC428:TELL#**

Absolute Position **<NONDECIMAL NUMERIC PROGRAM DATA>**

Prerequisite: Motor # must be present (see section 5.6.8).

Description: Set the current position of motor # (will not move motor)

5.6.5.4.7 Motor Position Query

Command syntax: **:TMC428:POS#?**

Response syntax: Absolute Position **<NONDECIMAL NUMERIC PROGRAM DATA>**

Prerequisite: Motor # must be present (see section 5.6.8).

Description: Queries the current position of motor #.

5.6.5.4.8 Motor Hysteresis Set Command

Command syntax: **:TMC428:HYST#**

Number of steps **<NONDECIMAL NUMERIC PROGRAM DATA>**

Prerequisite: Motor # must be present (see section 5.6.8).

Description: Sets the hysteresis compensation value for motor #.

Note: To compensate for mechanical hysteresis in the motor stage, the S-Move and S-Goto commands allow to always approach a new position from the same direction by overshooting the movement, if necessary. The direction indicated by the sign of the hysteresis value is the same as if used in the Motor Move Command. This means, for positive values, the new position is approached from lower positions. After startup, the hysteresis value is set to +100. The Goto and Move commands are not affected by the hysteresis setting.

5.6.5.4.9 Motor Hysteresis Query

Command syntax: **:TMC428:HYST#?**

Response syntax: Number of steps **<NONDECIMAL NUMERIC PROGRAM DATA>**

Prerequisite: Motor # must be present (see section 5.6.8).

Description: Queries the hysteresis setting for motor #.

5.6.5.4.10 Query Motor Limit Switches

Command syntax: **:TMC428:SWITCHES67?**

Response syntax: Motor #6 Limit State **<HEXADECIMAL NUMERIC RESPONSE DATA>**,
Motor #7 Limit State **<HEXADECIMAL NUMERIC RESPONSE DATA>**

Prerequisite: Motor # must be present (see section 5.6.8).

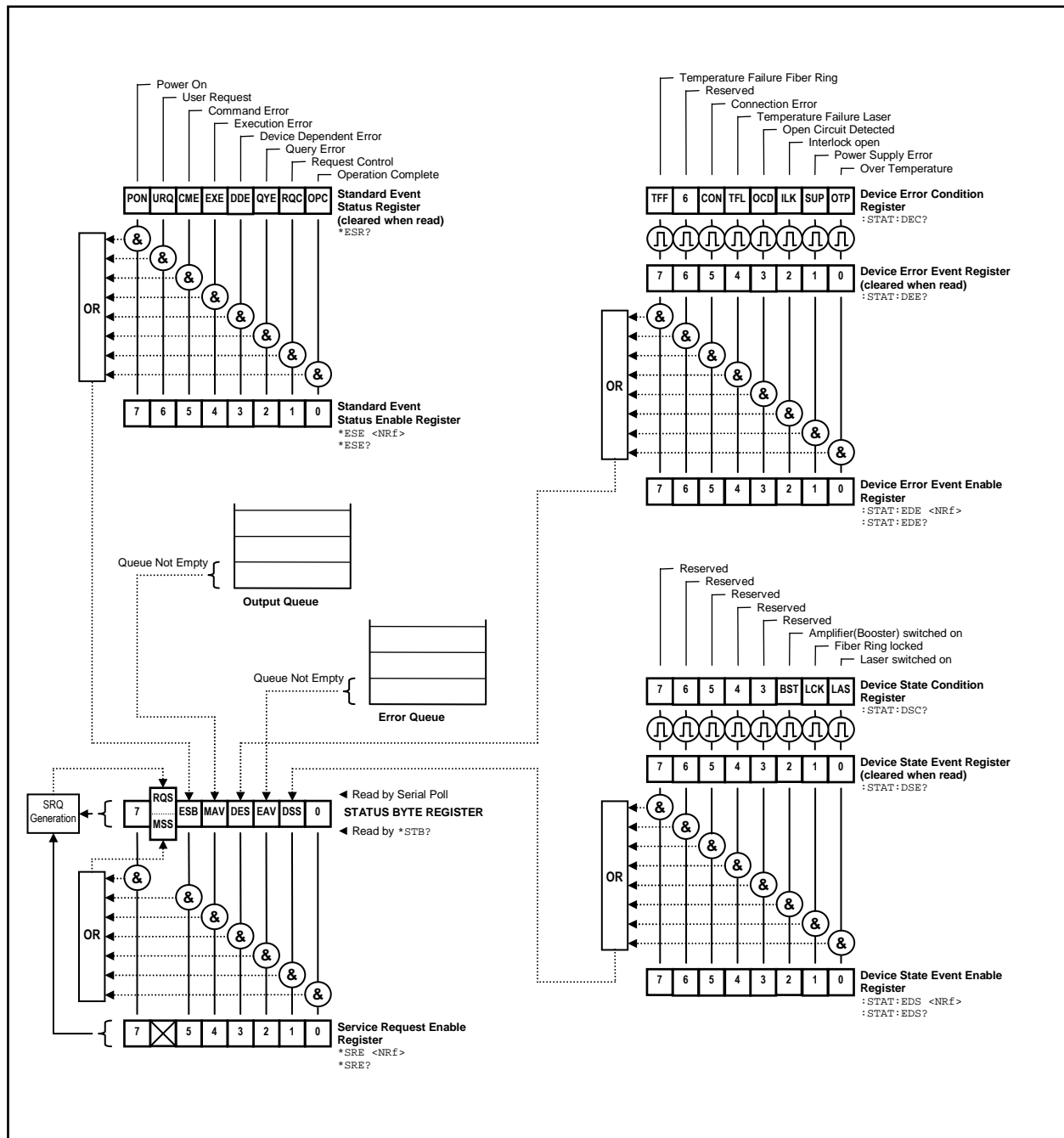
Description: Query the limit switches of motors #6 and #7.

Note: The response value is one of the following:
#h0: no limit switch is active
#h1: the limit is reached while moving in positive direction
#h2: the limit is reached while moving in negative direction
#h3: both limit switches are active (might indicate hardware problems)

5.6.6 Status Reporting

5.6.6.1 Status Structure

The device uses a status reporting structure like it is defined in IEEE488.2-1992-§11. The figure below shows the complete structure.



5.6.6.2 Register Description

5.6.6.2.1 Status Byte Register

The Status Byte Register gives a summary of all underlying status structures. See also IEEE488.2-1992-§11.2.

Bit #	Mnemonic	Description
7		Reserved
6	RQS/MSS	Request Service / Master Summary Status
5	ESB	Standard Event Status Bit
4	MAV	Message Available. Since IEEE1174 is a full duplex interface this bit is always 0.
3	DES	Device Error Summary
2	EAV	Error Available. There is at least one error in the error queue.
1	DSS	Device State Summary
0		Reserved

5.6.6.2.2 Standard Event Status Structure

The Standard Event Status Structure is described in IEEE488.2-1992-§11.5.

5.6.6.2.3 Device Error Status Structure

The Device Error Status Structure reflects asynchronous device errors. Bits in the according event register are rising and falling edge triggered

Bit #	Mnemonic	Description
7	TFF	Temperature Failure Fiber. The housing temperature is not stabilized.
6		Reserved
5	CON	Connection Error. The cable connection between the laser and the control unit failed.
4	TFL	Temperature Failure Pump Laser. The pump lasers temperature is not stabilized.
3	OCD	Open Circuit Detect. The pump laser is not connected correctly.
2	ILK	Interlock Open. The interlock loop is open
1	SUP	Supply Error. The power supply reported an error.
0	OTP	Over Temperature. The device temperature is too high.

5.6.6.2.4 Device State Status Structure

The Device State Status Structure reflects asynchronous device states. Bits in the according event register are rising edge and falling edge triggered

Bit #	Mnemonic	Description
7..3		Reserved
2	BST	Amplifier (Booster) on.
1	LCK	Loop Locked. The fiber loop has locked
0	LAS	Laser on. The laser has switched on and the startup sequence is finished.

5.6.7 Error Reporting

The device stores errors in a queue containing up to 30 entries. The error queue may be read out by the ``:SYST:ERR?'` command. The following table lists all error numbers and the according descriptive messages.

Error	Description	Category
0	No error	-
1	General fault	Device Dependent Error
2	Value out of range	Execution Error
3	Maximum value must be greater than the minimum value	Execution Error
4	Step width violation occurred	Execution Error
5	Value must be within the minimum and the maximum value	Execution Error
6	Upper window border must be greater than the lower window border	Execution Error
20	Operation failed - device temperature too high	Execution Error
21	Operation failed - power supply error detected	Execution Error
22	Operation failed - connection failure detected	Execution Error
23	Operation failed - interlock failure detected	Execution Error
24	Operation failed - open circuit detected	Execution Error
25	Operation failed - pump laser TEC not stabilized	Execution Error
26	Operation failed - fiber ring temperature not stabilized	Execution Error
50	Not possible while laser is off/starting	Execution Error
51	Operation failed - scrambler unit is busy	Execution Error
52	Not possible while scrambler unit is disabled	Execution Error
53	Not possible while scrambler unit is enabled	Execution Error
54	Not possible while automatic scrambling is enabled	Execution Error
100	Parser input buffer overflow, command message too long	Command Error
101	Unknown IEEE488 emulation command	Command Error
102	Unknown command	Command Error
110	Wrong number of command parameters	Command Error
111	Erroneous character/string program data	Command Error
112	Unknown character program data	Command Error
113	String program data too long	Command Error
114	Erroneous nondecimal program data	Command Error
115	Erroneous decimal program data	Command Error
200	Authentication required for operation	Execution Error
201	Authentication failed	Execution Error
210	Adjustment data invalid or missing	Execution Error
220	Optional functionality is not enabled	Execution Error
250	EEPROM checksum error	Device Dependent Error
255	Error queue overflow	-

5.6.8 Device Options

Device options are identified by the device option value which is organised as a 8 bit bitfield. Device options may be set with the command 'SERVICE:OPTION'. They are read out with the command '*OPT?'. The device option value is organised as follows.

Bit #	Mnemonic	Description
0	AMPLIFIER	Device has Internal optical amplifier/booster.
1	WAVEPLATES	Device is controlled via motor driven wave plates
2	WEDGE	Device has a motor controlled wedge for offset frequency control
3	AUX_SQUEEZER	Device allows to control squeezer voltages (for external use)
4	AUX_DRIVE	Device has auxiliary motor controlled (motors 7,8,9)
5	WEDGE_AT_AUX	Wedge is accessed as motor #8 rather than #4
6	WP_PCTRL	Motors #4 and #5 control polarization via half- and quarter-wave plates
7	WP_ICTRL	Motor #5 controls intensity