A Passion For Precision

DLCpro - Digital Laser Controller

Remote Command Reference

for TCP/IP and USB

Firmware 2.0.3

TOPTICA Photonics AG

Contents

1 Introduction **29**

2 Control Language **29**
2.1 Parameters . . . 30
2.1.1 param-ref . . . 31
2.1.2 param-set! . . . 31
2.1.3 param-disp . . . 32
2.2 Commands . . . 32
2.3 Errors and Warnings . . . 33
2.4 Remote Monitoring . . . 33

3 List of all Parameters and Commands **35**
3.1 General Operation . . . 35
emission-button-enabled . . . 35
interlock-open . . . 35
frontkey-locked . . . 35
emission . . . 35
system-health . . . 35
system-health-txt . . . 36
laser1: . . . 36
laser1:type . . . 36
laser1:product-name . . . 37
laser1:emission . . . 37
laser1:health . . . 37
laser1:health-txt . . . 38
laser1:dl: . . . 38
laser1:dl:legacy . . . 38
laser1:dl:type . . . 38
laser1:dl:version . . . 39
laser1:dl:model . . . 39
laser1:dl:serial-number . . . 39
laser1:dl:fru-serial-number . . . 39
laser1:dl:ontime . . . 39
laser1:dl:ontime-txt . . . 39
laser1:dl:cc: . . . 39
laser1:dl:cc:path . . . 40
laser1:dl:cc:variant . . . 40
laser1:dl:cc:enabled . . . 40
laser1:dl:cc:emission . . . 40
laser1:dl:cc:current-set . . . 40
laser1:dl:cc:current-offset . . . 40
laser1:dl:cc:current-set-dithering . . . 41

laser1:dl:cc:external-input: . . . 41
laser1:dl:cc:external-input:signal . . . 41
laser1:dl:cc:external-input:factor . . . 41
laser1:dl:cc:external-input:enabled . . . 41
laser1:dl:cc:output-filter: . . . 41
laser1:dl:cc:output-filter:slew-rate . . . 41
laser1:dl:cc:output-filter:slew-rate-enabled . . . 42
laser1:dl:cc:output-filter:slew-rate-limited . . . 42
laser1:dl:cc:current-act . . . 42
laser1:dl:cc:positive-polarity . . . 42
laser1:dl:cc:current-clip . . . 42
laser1:dl:cc:current-clip-limit . . . 42
laser1:dl:cc:voltage-act . . . 42
laser1:dl:cc:voltage-clip . . . 43
laser1:dl:cc:feedforward-enabled . . . 43
laser1:dl:cc:feedforward-factor . . . 43
laser1:dl:cc:pd . . . 43
laser1:dl:cc:aux . . . 43
laser1:dl:cc:snubber . . . 43
laser1:dl:cc:status . . . 44
laser1:dl:cc:status-txt . . . 44
laser1:dl:tc: . . . 44
laser1:dl:tc:path . . . 44
laser1:dl:tc:enabled . . . 44
laser1:dl:tc:temp-act . . . 44
laser1:dl:tc:temp-set . . . 45
laser1:dl:tc:external-input: . . . 45
laser1:dl:tc:ready . . . 45
laser1:dl:tc:fault . . . 45
laser1:dl:tc:status . . . 45
laser1:dl:tc:status-txt . . . 46
laser1:dl:tc:t-loop: . . . 46
laser1:dl:tc:t-loop:p-gain . . . 46
laser1:dl:tc:t-loop:i-gain . . . 46
laser1:dl:tc:t-loop:d-gain . . . 46
laser1:dl:tc:t-loop:ok-tolerance . . . 46
laser1:dl:tc:t-loop:ok-time . . . 46
laser1:dl:tc:limits: . . . 47
laser1:dl:tc:limits:temp-min . . . 47
laser1:dl:tc:limits:temp-max . . . 47
laser1:dl:tc:limits:timeout . . . 47
laser1:dl:tc:limits:timed-out . . . 47
laser1:dl:tc:limits:out-of-range . . . 47
laser1:dl:tc:current-set . . . 48

laser1:dl:tc:current-act . . . 48
laser1:dl:tc:temp-set-min . . . 48
laser1:dl:tc:temp-set-max . . . 48
laser1:dl:tc:temp-roc-enabled . . . 48
laser1:dl:tc:temp-roc-limit . . . 48
laser1:dl:pc: . . . 48
laser1:dl:pc:path . . . 48
laser1:dl:pc:enabled . . . 49
laser1:dl:pc:voltage-set . . . 49
laser1:dl:pc:voltage-min . . . 49
laser1:dl:pc:voltage-max . . . 49
laser1:dl:pc:voltage-set-dithering . . . 49
laser1:dl:pc:external-input: . . . 49
laser1:dl:pc:output-filter: . . . 49
laser1:dl:pc:voltage-act . . . 49
laser1:dl:pc:feedforward-enabled . . . 50
laser1:dl:pc:feedforward-factor . . . 50
laser1:dl:pc:heatsink-temp . . . 50
laser1:dl:pc:status . . . 50
laser1:dl:pc:status-txt . . . 50
laser1:dl:lock: . . . 50
laser1:dl:lock:type . . . 51
laser1:dl:lock:lock-without-lockpoint . . . 51
laser1:dl:lock:state . . . 51
laser1:dl:lock:state-txt . . . 52
laser1:dl:lock:lock-enabled . . . 52
laser1:dl:lock:hold . . . 52
laser1:dl:lock:spectrum-input-channel . . . 52
laser1:dl:lock:pid-selection . . . 52
laser1:dl:lock:setpoint . . . 53
laser1:dl:lock:relock: . . . 53
laser1:dl:lock:relock:enabled . . . 53
laser1:dl:lock:relock:output-channel . . . 53
laser1:dl:lock:relock:frequency . . . 53
laser1:dl:lock:relock:amplitude . . . 53
laser1:dl:lock:relock:delay . . . 53
laser1:dl:lock:reset: . . . 54
laser1:dl:lock:reset:enabled . . . 54
laser1:dl:lock:window: . . . 54
laser1:dl:lock:window:enabled . . . 54
laser1:dl:lock:window:input-channel . . . 54
laser1:dl:lock:window:level-high . . . 54
laser1:dl:lock:window:level-low . . . 54
laser1:dl:lock:window:level-hysteresis . . . 54

laser1:dl:lock:pid1: . . . 54
laser1:dl:lock:pid1:enabled . . . 55
laser1:dl:lock:pid1:gain: . . . 55
laser1:dl:lock:pid1:gain:all . . . 55
laser1:dl:lock:pid1:gain:p . . . 55
laser1:dl:lock:pid1:gain:i . . . 55
laser1:dl:lock:pid1:gain:d . . . 55
laser1:dl:lock:pid1:gain:i-cutoff . . . 56
laser1:dl:lock:pid1:gain:i-cutoff-enabled . . . 56
laser1:dl:lock:pid1:gain:fc-ip . . . 56
laser1:dl:lock:pid1:gain:fc-pd . . . 56
laser1:dl:lock:pid1:sign . . . 56
laser1:dl:lock:pid1:slope . . . 56
laser1:dl:lock:pid1:output-channel . . . 57
laser1:dl:lock:pid1:outputlimit: . . . 57
laser1:dl:lock:pid1:outputlimit:enabled . . . 57
laser1:dl:lock:pid1:outputlimit:max . . . 57
laser1:dl:lock:pid1:hold . . . 57
laser1:dl:lock:pid1:lock-state . . . 57
laser1:dl:lock:pid1:hold-state . . . 57
laser1:dl:lock:pid1:regulating-state . . . 58
laser1:dl:lock:pid2: . . . 58
laser1:dl:lock:lockin: . . . 58
laser1:dl:lock:lockin:modulation-enabled . . . 58
laser1:dl:lock:lockin:modulation-output-channel . . . 58
laser1:dl:lock:lockin:frequency . . . 58
laser1:dl:lock:lockin:amplitude . . . 59
laser1:dl:lock:lockin:phase-shift . . . 59
laser1:dl:lock:lockin:lock-level . . . 59
laser1:dl:lock:lockin:auto-lir: . . . 59
laser1:dl:lock:lockin:auto-lir:progress . . . 59
laser1:dl:lock:lockin:auto-lir:auto-lir . . . 59
laser1:dl:lock:lockpoint: . . . 59
laser1:dl:lock:lockpoint:position . . . 59
laser1:dl:lock:lockpoint:type . . . 60
laser1:dl:lock:candidate-filter: . . . 60
laser1:dl:lock:candidate-filter:top . . . 60
laser1:dl:lock:candidate-filter:bottom . . . 60
laser1:dl:lock:candidate-filter:positive-edge . . . 60
laser1:dl:lock:candidate-filter:negative-edge . . . 60
laser1:dl:lock:candidate-filter:edge-level . . . 60
laser1:dl:lock:candidate-filter:peak-noise-tolerance . . . 60
laser1:dl:lock:candidate-filter:edge-min-distance . . . 61
laser1:dl:lock:candidates . . . 61

laser1:dl:lock:locking-delay . . . 61
laser1:dl:lock:background-trace . . . 61
laser1:dl:lock:lock-tracking . . . 61
laser1:dl:lock:show-candidates . . . 62
laser1:dl:lock:find-candidates . . . 62
laser1:dl:lock:select-lockpoint . . . 62
laser1:dl:lock:close . . . 63
laser1:dl:lock:open . . . 64
laser1:dl:pressure-compensation: . . . 64
laser1:dl:pressure-compensation:enabled . . . 64
laser1:dl:pressure-compensation:air-pressure . . . 64
laser1:dl:pressure-compensation:factor . . . 64
laser1:dl:pressure-compensation:compensation-voltage . . . 65
laser1:dl:pd: . . . 65
laser1:dl:pd:power . . . 65
laser1:dl:pd:cal-offset . . . 65
laser1:dl:pd:cal-factor . . . 65
laser1:dl:factory-settings: . . . 65
laser1:dl:factory-settings:wavelength . . . 65
laser1:dl:factory-settings:threshold-current . . . 65
laser1:dl:factory-settings:power . . . 65
laser1:dl:factory-settings:cc: . . . 66
laser1:dl:factory-settings:cc:feedforward-factor . . . 66
laser1:dl:factory-settings:cc:current-set . . . 66
laser1:dl:factory-settings:cc:current-clip . . . 66
laser1:dl:factory-settings:cc:voltage-clip . . . 66
laser1:dl:factory-settings:cc:positive-polarity . . . 66
laser1:dl:factory-settings:cc:snubber . . . 66
laser1:dl:factory-settings:tc: . . . 66
laser1:dl:factory-settings:tc:temp-min . . . 66
laser1:dl:factory-settings:tc:temp-max . . . 67
laser1:dl:factory-settings:tc:temp-set . . . 67
laser1:dl:factory-settings:tc:temp-roc-enabled . . . 67
laser1:dl:factory-settings:tc:temp-roc-limit . . . 67
laser1:dl:factory-settings:tc:current-max . . . 67
laser1:dl:factory-settings:tc:current-min . . . 67
laser1:dl:factory-settings:tc:p-gain . . . 67
laser1:dl:factory-settings:tc:i-gain . . . 67
laser1:dl:factory-settings:tc:d-gain . . . 67
laser1:dl:factory-settings:tc:c-gain . . . 67
laser1:dl:factory-settings:tc:ok-tolerance . . . 68
laser1:dl:factory-settings:tc:ok-time . . . 68
laser1:dl:factory-settings:tc:timeout . . . 68
laser1:dl:factory-settings:tc:power-source . . . 68

laser1:dl:factory-settings:tc:ntc-series-resistance . . . 68
laser1:dl:factory-settings:tc:ntc-parallel-resistance . . . 68
laser1:dl:factory-settings:pc: . . . 68
laser1:dl:factory-settings:pc:voltage-min . . . 68
laser1:dl:factory-settings:pc:voltage-max . . . 68
laser1:dl:factory-settings:pc:feedforward-enabled . . . 69
laser1:dl:factory-settings:pc:feedforward-factor . . . 69
laser1:dl:factory-settings:pc:capacitance . . . 69
laser1:dl:factory-settings:pc:scan-offset . . . 69
laser1:dl:factory-settings:pc:scan-amplitude . . . 69
laser1:dl:factory-settings:pc:slew-rate . . . 69
laser1:dl:factory-settings:pc:slew-rate-enabled . . . 69
laser1:dl:factory-settings:pc:pressure-compensation-factor . . . 69
laser1:dl:factory-settings:pd: . . . 69
laser1:dl:factory-settings:pd:cal-offset . . . 70
laser1:dl:factory-settings:pd:cal-factor . . . 70
laser1:dl:factory-settings:apply . . . 70
laser1:ctl: . . . 70
laser1:ctl:fpga-fw-ver . . . 70
laser1:ctl:wavelength-set . . . 70
laser1:ctl:wavelength-act . . . 70
laser1:ctl:wavelength-min . . . 70
laser1:ctl:wavelength-max . . . 71
laser1:ctl:tuning-current-min . . . 71
laser1:ctl:tuning-power-min . . . 71
laser1:ctl:state . . . 71
laser1:ctl:state-txt . . . 72
laser1:ctl:head-temperature . . . 72
laser1:ctl:optimization: . . . 72
laser1:ctl:optimization:progress . . . 72
laser1:ctl:optimization:smile . . . 72
laser1:ctl:optimization:flow . . . 72
laser1:ctl:optimization:abort . . . 72
laser1:ctl:remote-control: . . . 72
laser1:ctl:remote-control:signal . . . 72
laser1:ctl:remote-control:factor . . . 73
laser1:ctl:remote-control:enabled . . . 73
laser1:ctl:mode-control: . . . 73
laser1:ctl:mode-control:loop-enabled . . . 73
laser1:ctl:motor: . . . 73
laser1:ctl:motor:position-accuracy-fullstep . . . 73
laser1:ctl:motor:position-hysteresis-fullstep . . . 73
laser1:ctl:motor:position-accuracy-microstep . . . 74
laser1:ctl:motor:position-hysteresis-microstep . . . 74

laser1:ctl:motor:microsteps . . . 74
laser1:ctl:motor:power-save-disabled . . . 74
laser1:ctl:power: . . . 74
laser1:ctl:power:power-act . . . 74
laser1:ctl:factory-settings: . . . 74
laser1:ctl:factory-settings:wavelength-min . . . 75
laser1:ctl:factory-settings:wavelength-max . . . 75
laser1:ctl:factory-settings:tuning-current-min . . . 75
laser1:ctl:factory-settings:tuning-power-min . . . 75
laser1:ctl:factory-settings:apply . . . 75
laser1:amp: . . . 75
laser1:amp:legacy . . . 75
laser1:amp:type . . . 75
laser1:amp:version . . . 76
laser1:amp:serial-number . . . 76
laser1:amp:fru-serial-number . . . 76
laser1:amp:ontime . . . 76
laser1:amp:ontime-txt . . . 76
laser1:amp:cc: . . . 76
laser1:amp:cc:path . . . 76
laser1:amp:cc:variant . . . 77
laser1:amp:cc:enabled . . . 77
laser1:amp:cc:emission . . . 77
laser1:amp:cc:current-set . . . 77
laser1:amp:cc:current-offset . . . 77
laser1:amp:cc:output-filter: . . . 78
laser1:amp:cc:current-act . . . 78
laser1:amp:cc:current-clip . . . 78
laser1:amp:cc:current-clip-limit . . . 78
laser1:amp:cc:voltage-act . . . 78
laser1:amp:cc:voltage-out . . . 78
laser1:amp:cc:voltage-clip . . . 78
laser1:amp:cc:feedforward-enabled . . . 78
laser1:amp:cc:feedforward-factor . . . 79
laser1:amp:cc:aux . . . 79
laser1:amp:cc:status . . . 79
laser1:amp:cc:status-txt . . . 79
laser1:amp:tc: . . . 79
laser1:amp:pd: . . . 80
laser1:amp:pd:seed: . . . 80
laser1:amp:pd:amp: . . . 80
laser1:amp:seed-limits: . . . 80
laser1:amp:seed-limits:power . . . 80
laser1:amp:seed-limits:power-min . . . 80

laser1:amp:seed-limits:power-min-warning-delay 80
laser1:amp:seed-limits:power-min-shutdown-delay 81
laser1:amp:seed-limits:power-max 81
laser1:amp:seed-limits:power-max-warning-delay 81
laser1:amp:seed-limits:power-max-shutdown-delay 81
laser1:amp:seed-limits:status 81
laser1:amp:seed-limits:status-txt 81
laser1:amp:output-limits: 81
laser1:amp:seedonly-check: 82
laser1:amp:seedonly-check:warning-delay 82
laser1:amp:seedonly-check:shutdown-delay 82
laser1:amp:seedonly-check:status 82
laser1:amp:seedonly-check:status-txt 82
laser1:amp:factory-settings: 82
laser1:amp:factory-settings:wavelength 83
laser1:amp:factory-settings:power 83
laser1:amp:factory-settings:cc: 83
laser1:amp:factory-settings:cc:feedforward-factor 83
laser1:amp:factory-settings:cc:current-set 83
laser1:amp:factory-settings:cc:current-clip 83
laser1:amp:factory-settings:cc:voltage-clip 83
laser1:amp:factory-settings:tc: 83
laser1:amp:factory-settings:pd: 83
laser1:amp:factory-settings:pd:seed: 84
laser1:amp:factory-settings:pd:amp: 84
laser1:amp:factory-settings:seed-limits: 84
laser1:amp:factory-settings:seed-limits:power-min 84
laser1:amp:factory-settings:seed-limits:power-min-warning-delay 84
laser1:amp:factory-settings:seed-limits:power-min-shutdown-delay 84
laser1:amp:factory-settings:seed-limits:power-max 84
laser1:amp:factory-settings:seed-limits:power-max-warning-delay 85
laser1:amp:factory-settings:seed-limits:power-max-shutdown-delay 85
laser1:amp:factory-settings:output-limits: 85
laser1:amp:factory-settings:seedonly-check: 85
laser1:amp:factory-settings:seedonly-check:warning-delay 85
laser1:amp:factory-settings:seedonly-check:shutdown-delay . . . 85
laser1:amp:factory-settings:apply 85
laser1:dpss: 85
laser1:dpss:enabled 85
laser1:dpss:status 86
laser1:dpss:status-txt 86
laser1:dpss:tc-status 86
laser1:dpss:tc-status-txt 86
laser1:dpss:error-code 86

laser1:dpss:error-txt . . . 86
laser1:dpss:operation-time . . . 86
laser1:dpss:power-set . . . 86
laser1:dpss:power-act . . . 87
laser1:dpss:power-max . . . 87
laser1:dpss:power-margin . . . 87
laser1:dpss:current-act . . . 87
laser1:dpss:current-max . . . 87
laser1:scan: . . . 87
laser1:scan:enabled . . . 87
laser1:scan:hold . . . 87
laser1:scan:signal-type . . . 87
laser1:scan:frequency . . . 88
laser1:scan:output-channel . . . 88
laser1:scan:unit . . . 88
laser1:scan:amplitude . . . 88
laser1:scan:offset . . . 88
laser1:scan:start . . . 88
laser1:scan:end . . . 88
laser1:wide-scan: . . . 89
laser1:wide-scan:state . . . 89
laser1:wide-scan:state-txt . . . 89
laser1:wide-scan:output-channel . . . 89
laser1:wide-scan:scan-begin . . . 89
laser1:wide-scan:scan-end . . . 89
laser1:wide-scan:continuous-mode . . . 89
laser1:wide-scan:shape . . . 89
laser1:wide-scan:offset . . . 90
laser1:wide-scan:amplitude . . . 90
laser1:wide-scan:speed . . . 90
laser1:wide-scan:speed-min . . . 90
laser1:wide-scan:speed-max . . . 90
laser1:wide-scan:duration . . . 90
laser1:wide-scan:value-set . . . 90
laser1:wide-scan:value-act . . . 90
laser1:wide-scan:value-unit . . . 90
laser1:wide-scan:recorder-stepsize-set . . . 90
laser1:wide-scan:recorder-stepsize . . . 91
laser1:wide-scan:progress . . . 91
laser1:wide-scan:remaining-time . . . 91
laser1:wide-scan:trigger: . . . 91
laser1:wide-scan:trigger:input-enabled . . . 91
laser1:wide-scan:trigger:input-channel . . . 91
laser1:wide-scan:trigger:output-enabled . . . 91

laser1:wide-scan:trigger:output-channel . . . 91
laser1:wide-scan:trigger:output-threshold . . . 92
laser1:wide-scan:start . . . 92
laser1:wide-scan:stop . . . 92
laser1:wide-scan:set-output-to-zoom-offset . . . 92
laser1:wide-scan:set-scan-range-to-zoom-range . . . 92
laser1:wide-scan:set-zoom-range-to-scan-range . . . 92
laser1:scope: . . . 92
laser1:scope:variant . . . 92
laser1:scope:update-rate . . . 93
laser1:scope:channel1: . . . 93
laser1:scope:channel1:signal . . . 93
laser1:scope:channel1:unit . . . 93
laser1:scope:channel1:name . . . 94
laser1:scope:channel2: . . . 94
laser1:scope:channelx: . . . 94
laser1:scope:channelx:xy-signal . . . 94
laser1:scope:channelx:scope-timescale . . . 94
laser1:scope:channelx:spectrum-range . . . 94
laser1:scope:channelx:spectrum-omit-dc . . . 94
laser1:scope:channelx:unit . . . 95
laser1:scope:channelx:name . . . 95
laser1:scope:timescale . . . 95
laser1:scope:data . . . 95
laser1:recorder: . . . 95
laser1:recorder:state . . . 95
laser1:recorder:state-txt . . . 95
laser1:recorder:inputs: . . . 96
laser1:recorder:inputs:channel1: . . . 96
laser1:recorder:inputs:channel1:signal . . . 96
laser1:recorder:inputs:channel1:low-pass-filter: . . . 96
laser1:recorder:inputs:channel1:low-pass-filter:enabled . . . 96
laser1:recorder:inputs:channel1:low-pass-filter:cut-off-frequency 96
laser1:recorder:inputs:channel2: . . . 96
laser1:recorder:inputs:channelx: . . . 96
laser1:recorder:inputs:channelx:signal . . . 96
laser1:recorder:recording-mode . . . 97
laser1:recorder:recording-time . . . 97
laser1:recorder:sample-count-set . . . 97
laser1:recorder:sample-count . . . 97
laser1:recorder:sampling-interval . . . 97
laser1:recorder:sampling-rate . . . 97
laser1:recorder:memory-size . . . 98
laser1:recorder:data: . . . 98

laser1:recorder:data:channel1: . . . 98
laser1:recorder:data:channel1:signal . . . 98
laser1:recorder:data:channel1:unit . . . 98
laser1:recorder:data:channel1:name . . . 98
laser1:recorder:data:channel2: . . . 98
laser1:recorder:data:channelx: . . . 98
laser1:recorder:data:zoom-data . . . 99
laser1:recorder:data:zoom-offset . . . 99
laser1:recorder:data:zoom-amplitude . . . 99
laser1:recorder:data:recorded-sampling-interval . . . 99
laser1:recorder:data:recorded-sample-count . . . 99
laser1:recorder:data:last-recorded-sample . . . 99
laser1:recorder:data:last-valid-sample . . . 99
laser1:recorder:data:zoom-out . . . 100
laser1:recorder:data:get-data . . . 100
laser1:recorder:data:show-data . . . 100
laser1:nlo: . . . 101
laser1:nlo:servo: . . . 101
laser1:nlo:servo:ta1-hor: . . . 101
laser1:nlo:servo:ta1-hor:display-name . . . 101
laser1:nlo:servo:ta1-hor:enabled . . . 101
laser1:nlo:servo:ta1-hor:value . . . 101
laser1:nlo:servo:ta1-vert: . . . 101
laser1:nlo:servo:ta2-hor: . . . 101
laser1:nlo:servo:ta2-vert: . . . 101
laser1:nlo:servo:shg1-hor: . . . 102
laser1:nlo:servo:shg1-vert: . . . 102
laser1:nlo:servo:shg2-hor: . . . 102
laser1:nlo:servo:shg2-vert: . . . 102
laser1:nlo:servo:fhg1-hor: . . . 102
laser1:nlo:servo:fhg1-vert: . . . 102
laser1:nlo:servo:fhg2-hor: . . . 102
laser1:nlo:servo:fhg2-vert: . . . 102
laser1:nlo:servo:fiber1-hor: . . . 103
laser1:nlo:servo:fiber1-vert: . . . 103
laser1:nlo:servo:fiber2-hor: . . . 103
laser1:nlo:servo:fiber2-vert: . . . 103
laser1:nlo:servo:uv-outcpl: . . . 103
laser1:nlo:servo:uv-cryst: . . . 103
laser1:nlo:pd: . . . 103
laser1:nlo:pd:dl: . . . 104
laser1:nlo:pd:dl:power . . . 104
laser1:nlo:pd:dl:cal-offset . . . 104
laser1:nlo:pd:dl:cal-factor . . . 104

laser1:nlo:pd:amp: . . . 104
laser1:nlo:pd:fiber: . . . 104
laser1:nlo:pd:shg: . . . 104
laser1:nlo:pd:shg-input: . . . 104
laser1:nlo:pd:shg-int: . . . 105
laser1:nlo:pd:shg-int:photodiode . . . 105
laser1:nlo:pd:shg-int:cal-offset . . . 105
laser1:nlo:pd:shg-pdh-dc: . . . 105
laser1:nlo:pd:shg-pdh-rf: . . . 105
laser1:nlo:pd:shg-pdh-rf:photodiode . . . 105
laser1:nlo:pd:shg-pdh-rf:gain . . . 105
laser1:nlo:pd:fhg: . . . 105
laser1:nlo:pd:fhg-int: . . . 106
laser1:nlo:pd:fhg-pdh-dc: . . . 106
laser1:nlo:pd:fhg-pdh-rf: . . . 106
laser1:nlo:power-optimization: . . . 106
laser1:nlo:power-optimization:ongoing . . . 106
laser1:nlo:power-optimization:progress . . . 106
laser1:nlo:power-optimization:status . . . 107
laser1:nlo:power-optimization:status-string . . . 107
laser1:nlo:power-optimization:shg-advanced . . . 107
laser1:nlo:power-optimization:stage1: . . . 107
laser1:nlo:power-optimization:stage1:input: . . . 107
laser1:nlo:power-optimization:stage1:input:value-calibrated . 107
laser1:nlo:power-optimization:stage1:progress . . . 107
laser1:nlo:power-optimization:stage1:optimization-in-progress . . 108
laser1:nlo:power-optimization:stage1:restore-on-abort . . . 108
laser1:nlo:power-optimization:stage1:restore-on-regress . . . 108
laser1:nlo:power-optimization:stage1:regress-tolerance . . . 108
laser1:nlo:power-optimization:stage1:start-optimization . . . 108
laser1:nlo:power-optimization:stage2: . . . 108
laser1:nlo:power-optimization:stage3: . . . 108
laser1:nlo:power-optimization:stage4: . . . 108
laser1:nlo:power-optimization:stage5: . . . 109
laser1:nlo:power-optimization:progress-data-amp . . . 109
laser1:nlo:power-optimization:progress-data-shg . . . 109
laser1:nlo:power-optimization:progress-data-fiber . . . 109
laser1:nlo:power-optimization:progress-data-fhg . . . 109
laser1:nlo:power-optimization:abort . . . 110
laser1:nlo:power-optimization:start-optimization-all . . . 110
laser1:nlo:power-optimization:start-optimization-amp . . . 110
laser1:nlo:power-optimization:start-optimization-shg . . . 110
laser1:nlo:power-optimization:start-optimization-fiber . . . 110
laser1:nlo:power-optimization:start-optimization-fhg . . . 110

laser1:nlo:auto-nlo: . . . 110
laser1:nlo:auto-nlo:automatic-mode . . . 110
laser1:nlo:auto-nlo:laser-on . . . 111
laser1:nlo:auto-nlo:emission . . . 111
laser1:nlo:auto-nlo:operation-time-master . . . 111
laser1:nlo:auto-nlo:operation-time-amplifier . . . 111
laser1:nlo:auto-nlo:operation-time-cavity . . . 111
laser1:nlo:auto-nlo:amplifier-current-margin . . . 111
laser1:nlo:auto-nlo:perform-single-mode-optimization . . . 111
laser1:nlo:auto-nlo:perform-auto-align . . . 111
laser1:nlo:shg: . . . 111
laser1:nlo:shg:tc: . . . 112
laser1:nlo:shg:pc: . . . 112
laser1:nlo:shg:scan: . . . 112
laser1:nlo:shg:scan:enabled . . . 112
laser1:nlo:shg:scan:frequency . . . 112
laser1:nlo:shg:scan:amplitude . . . 112
laser1:nlo:shg:scan:offset . . . 112
laser1:nlo:shg:scope: . . . 112
laser1:nlo:shg:scope:variant . . . 113
laser1:nlo:shg:scope:update-rate . . . 113
laser1:nlo:shg:scope:channel1: . . . 113
laser1:nlo:shg:scope:channel1:signal . . . 113
laser1:nlo:shg:scope:channel1:unit . . . 113
laser1:nlo:shg:scope:channel1:name . . . 114
laser1:nlo:shg:scope:channel2: . . . 114
laser1:nlo:shg:scope:channelx: . . . 114
laser1:nlo:shg:scope:channelx:xy-signal . . . 114
laser1:nlo:shg:scope:channelx:scope-timescale . . . 114
laser1:nlo:shg:scope:channelx:spectrum-range . . . 114
laser1:nlo:shg:scope:channelx:spectrum-omit-dc . . . 114
laser1:nlo:shg:scope:channelx:unit . . . 114
laser1:nlo:shg:scope:channelx:name . . . 115
laser1:nlo:shg:scope:timescale . . . 115
laser1:nlo:shg:scope:data . . . 115
laser1:nlo:shg:lock: . . . 115
laser1:nlo:shg:lock:state . . . 115
laser1:nlo:shg:lock:state-txt . . . 115
laser1:nlo:shg:lock:lock-enabled . . . 115
laser1:nlo:shg:lock:pid-selection . . . 116
laser1:nlo:shg:lock:setpoint . . . 116
laser1:nlo:shg:lock:relock: . . . 116
laser1:nlo:shg:lock:relock:enabled . . . 116
laser1:nlo:shg:lock:relock:frequency . . . 116

laser1:nlo:shg:lock:relock:amplitude . . . 116
laser1:nlo:shg:lock:relock:delay . . . 116
laser1:nlo:shg:lock:window: . . . 117
laser1:nlo:shg:lock:window:input-channel . . . 117
laser1:nlo:shg:lock:window:threshold . . . 117
laser1:nlo:shg:lock:window:level-hysteresis . . . 117
laser1:nlo:shg:lock:window:calibration: . . . 117
laser1:nlo:shg:lock:pid1: . . . 117
laser1:nlo:shg:lock:pid1:gain: . . . 117
laser1:nlo:shg:lock:pid1:gain:all . . . 117
laser1:nlo:shg:lock:pid1:gain:p . . . 117
laser1:nlo:shg:lock:pid1:gain:i . . . 118
laser1:nlo:shg:lock:pid1:gain:d . . . 118
laser1:nlo:shg:lock:pid1:gain:i-cutoff . . . 118
laser1:nlo:shg:lock:pid1:gain:i-cutoff-enabled . . . 118
laser1:nlo:shg:lock:pid2: . . . 118
laser1:nlo:shg:lock:analog-dl-gain: . . . 118
laser1:nlo:shg:lock:analog-dl-gain:p-gain . . . 118
laser1:nlo:shg:lock:local-oscillator: . . . 118
laser1:nlo:shg:lock:local-oscillator:enabled . . . 118
laser1:nlo:shg:lock:local-oscillator:use-external-oscillator . . . 119
laser1:nlo:shg:lock:local-oscillator:amplitude . . . 119
laser1:nlo:shg:lock:local-oscillator:attenuation-raw . . . 119
laser1:nlo:shg:lock:local-oscillator:phase-shift . . . 119
laser1:nlo:shg:lock:local-oscillator:auto-pdh . . . 120
laser1:nlo:shg:lock:cavity-fast-pzt-voltage . . . 120
laser1:nlo:shg:lock:cavity-slow-pzt-voltage . . . 120
laser1:nlo:shg:lock:background-trace . . . 120
laser1:nlo:shg:factory-settings: . . . 120
laser1:nlo:shg:factory-settings:tc: . . . 120
laser1:nlo:shg:factory-settings:tc:temp-min . . . 120
laser1:nlo:shg:factory-settings:tc:temp-max . . . 120
laser1:nlo:shg:factory-settings:tc:temp-set . . . 121
laser1:nlo:shg:factory-settings:tc:temp-roc-limit . . . 121
laser1:nlo:shg:factory-settings:tc:temp-roc-enabled . . . 121
laser1:nlo:shg:factory-settings:tc:current-max . . . 121
laser1:nlo:shg:factory-settings:tc:current-min . . . 121
laser1:nlo:shg:factory-settings:tc:p-gain . . . 121
laser1:nlo:shg:factory-settings:tc:i-gain . . . 121
laser1:nlo:shg:factory-settings:tc:d-gain . . . 121
laser1:nlo:shg:factory-settings:tc:c-gain . . . 121
laser1:nlo:shg:factory-settings:tc:ok-tolerance . . . 121
laser1:nlo:shg:factory-settings:tc:ok-time . . . 122
laser1:nlo:shg:factory-settings:tc:timeout . . . 122

laser1:nlo:shg:factory-settings:tc:power-source 122
laser1:nlo:shg:factory-settings:tc:ntc-series-resistance 122
laser1:nlo:shg:factory-settings:pc: 122
laser1:nlo:shg:factory-settings:pc:voltage-min 122
laser1:nlo:shg:factory-settings:pc:voltage-max 122
laser1:nlo:shg:factory-settings:pc:feedforward-enabled 122
laser1:nlo:shg:factory-settings:pc:feedforward-factor 122
laser1:nlo:shg:factory-settings:pc:capacitance 123
laser1:nlo:shg:factory-settings:pc:scan-offset 123
laser1:nlo:shg:factory-settings:pc:scan-amplitude 123
laser1:nlo:shg:factory-settings:pc:scan-frequency 123
laser1:nlo:shg:factory-settings:pd: 123
laser1:nlo:shg:factory-settings:pd:shg: 123
laser1:nlo:shg:factory-settings:pd:shg:cal-offset 123
laser1:nlo:shg:factory-settings:pd:shg:cal-factor 123
laser1:nlo:shg:factory-settings:pd:shg-input: 124
laser1:nlo:shg:factory-settings:pd:fiber: 124
laser1:nlo:shg:factory-settings:pd:int: 124
laser1:nlo:shg:factory-settings:pd:int:cal-offset 124
laser1:nlo:shg:factory-settings:pd:pdh-dc: 124
laser1:nlo:shg:factory-settings:pd:pdh-rf: 124
laser1:nlo:shg:factory-settings:pd:pdh-rf:gain 124
laser1:nlo:shg:factory-settings:lock: 124
laser1:nlo:shg:factory-settings:lock:pid-selection 124
laser1:nlo:shg:factory-settings:lock:setpoint 125
laser1:nlo:shg:factory-settings:lock:relock: 125
laser1:nlo:shg:factory-settings:lock:relock:enabled 125
laser1:nlo:shg:factory-settings:lock:relock:frequency 125
laser1:nlo:shg:factory-settings:lock:relock:amplitude 125
laser1:nlo:shg:factory-settings:lock:relock:delay 125
laser1:nlo:shg:factory-settings:lock:window: 125
laser1:nlo:shg:factory-settings:lock:window:input-channel . 125
laser1:nlo:shg:factory-settings:lock:window:threshold . . . 125
laser1:nlo:shg:factory-settings:lock:window:level-hysteresis 125
laser1:nlo:shg:factory-settings:lock:pid1-gain: 126
laser1:nlo:shg:factory-settings:lock:pid1-gain:all 126
laser1:nlo:shg:factory-settings:lock:pid1-gain:p 126
laser1:nlo:shg:factory-settings:lock:pid1-gain:i 126
laser1:nlo:shg:factory-settings:lock:pid1-gain:d 126
laser1:nlo:shg:factory-settings:lock:pid1-gain:i-cutoff 126
laser1:nlo:shg:factory-settings:lock:pid1-gain:i-cutoff-enabled126
laser1:nlo:shg:factory-settings:lock:pid2-gain: 126
laser1:nlo:shg:factory-settings:lock:analog-p-gain 127
laser1:nlo:shg:factory-settings:lock:local-oscillator: 127

laser1:nlo:shg:factory-settings:lock:local-oscillator:enabled 127
laser1:nlo:shg:factory-settings:lock:local-oscillator:attenuation-shg-raw . . . 127
laser1:nlo:shg:factory-settings:lock:local-oscillator:attenuation-fhg-raw . . . 127
laser1:nlo:shg:factory-settings:lock:local-oscillator:phase-shift-shg . . . 127
laser1:nlo:shg:factory-settings:lock:local-oscillator:phase-shift-fhg . . . 127
laser1:nlo:shg:factory-settings:apply . . . 127
laser1:nlo:fhg: . . . 127
laser1:nlo:fhg:tc: . . . 128
laser1:nlo:fhg:pc: . . . 128
laser1:nlo:fhg:scan: . . . 128
laser1:nlo:fhg:scope: . . . 128
laser1:nlo:fhg:lock: . . . 128
laser1:nlo:fhg:lock:state . . . 128
laser1:nlo:fhg:lock:state-txt . . . 129
laser1:nlo:fhg:lock:lock-enabled . . . 129
laser1:nlo:fhg:lock:pid-selection . . . 129
laser1:nlo:fhg:lock:setpoint . . . 129
laser1:nlo:fhg:lock:relock: . . . 129
laser1:nlo:fhg:lock:window: . . . 129
laser1:nlo:fhg:lock:pid1: . . . 129
laser1:nlo:fhg:lock:pid2: . . . 130
laser1:nlo:fhg:lock:local-oscillator: . . . 130
laser1:nlo:fhg:lock:local-oscillator:enabled . . . 130
laser1:nlo:fhg:lock:local-oscillator:amplitude . . . 130
laser1:nlo:fhg:lock:local-oscillator:attenuation-raw . . . 130
laser1:nlo:fhg:lock:local-oscillator:phase-shift . . . 130
laser1:nlo:fhg:lock:local-oscillator:auto-pdh . . . 131
laser1:nlo:fhg:lock:cavity-fast-pzt-voltage . . . 131
laser1:nlo:fhg:lock:cavity-slow-pzt-voltage . . . 131
laser1:nlo:fhg:lock:background-trace . . . 131
laser1:nlo:fhg:factory-settings: . . . 131
laser1:nlo:fhg:factory-settings:tc: . . . 131
laser1:nlo:fhg:factory-settings:pc: . . . 131
laser1:nlo:fhg:factory-settings:pd: . . . 132
laser1:nlo:fhg:factory-settings:pd:fhg: . . . 132
laser1:nlo:fhg:factory-settings:pd:int: . . . 132
laser1:nlo:fhg:factory-settings:pd:pdh-dc: . . . 132
laser1:nlo:fhg:factory-settings:pd:pdh-rf: . . . 132
laser1:nlo:fhg:factory-settings:lock: . . . 132
laser1:nlo:fhg:factory-settings:apply . . . 132

laser1:nlo:ssw-ver . . . 132
laser1:uv: . . . 132
laser1:uv:pump: . . . 133
laser1:uv:eom: . . . 133
laser1:uv:eom:tc: . . . 133
laser1:uv:cavity: . . . 133
laser1:uv:cavity:tc: . . . 133
laser1:uv:cavity:pc: . . . 133
laser1:uv:crystal: . . . 133
laser1:uv:crystal:tc: . . . 133
laser1:uv:crystal:optics-shifters: . . . 134
laser1:uv:crystal:optics-shifters:current-spot . . . 134
laser1:uv:crystal:optics-shifters:remaining-spots . . . 134
laser1:uv:servo: . . . 134
laser1:uv:servo:shg1-hor: . . . 134
laser1:uv:servo:shg1-vert: . . . 134
laser1:uv:servo:shg2-hor: . . . 134
laser1:uv:servo:shg2-vert: . . . 134
laser1:uv:servo:hwp: . . . 135
laser1:uv:servo:lens: . . . 135
laser1:uv:servo:outcpl: . . . 135
laser1:uv:servo:cryst: . . . 135
laser1:uv:servo:comp-hor: . . . 135
laser1:uv:servo:comp-vert: . . . 135
laser1:uv:pd: . . . 135
laser1:uv:pd:shg: . . . 136
laser1:uv:pd:pdh-rf: . . . 136
laser1:uv:pd:pdh-dc: . . . 136
laser1:uv:power-optimization: . . . 136
laser1:uv:power-optimization:ongoing . . . 136
laser1:uv:power-optimization:status . . . 136
laser1:uv:power-optimization:status-string . . . 136
laser1:uv:power-optimization:cavity: . . . 136
laser1:uv:power-optimization:progress-data . . . 137
laser1:uv:power-optimization:abort . . . 137
laser1:uv:power-stabilization: . . . 137
laser1:uv:power-stabilization:enabled . . . 137
laser1:uv:power-stabilization:gain: . . . 137
laser1:uv:power-stabilization:gain:all . . . 137
laser1:uv:power-stabilization:gain:p . . . 137
laser1:uv:power-stabilization:gain:i . . . 137
laser1:uv:power-stabilization:gain:d . . . 137
laser1:uv:power-stabilization:power-set . . . 138
laser1:uv:power-stabilization:power-act . . . 138

laser1:uv:power-stabilization:power-min . . . 138
laser1:uv:power-stabilization:power-max . . . 138
laser1:uv:power-stabilization:state . . . 138
laser1:uv:power-stabilization:update-strategy . . . 138
laser1:uv:scan: . . . 139
laser1:uv:scope: . . . 139
laser1:uv:lock: . . . 139
laser1:uv:factory-settings: . . . 139
laser1:uv:factory-settings:eom-tc: . . . 139
laser1:uv:factory-settings:crystal-tc: . . . 139
laser1:uv:factory-settings:cavity-tc: . . . 139
laser1:uv:factory-settings:pc: . . . 139
laser1:uv:factory-settings:pd: . . . 140
laser1:uv:factory-settings:pd:shg: . . . 140
laser1:uv:factory-settings:pd:pdh-rf: . . . 140
laser1:uv:factory-settings:pd:pdh-dc: . . . 140
laser1:uv:factory-settings:lock: . . . 140
laser1:uv:factory-settings:apply . . . 140
laser1:uv:status-parameters: . . . 140
laser1:uv:status-parameters:baseplate-temperature-limit . . . 140
laser1:uv:status-parameters:temperature-settle-time . . . 141
laser1:uv:status-parameters:pump-lock-settle-time . . . 141
laser1:uv:status-parameters:settle-down-delay . . . 141
laser1:uv:status-parameters:power-margin-tolerance-time . . . 141
laser1:uv:status-parameters:power-margin-threshold . . . 141
laser1:uv:status-parameters:cavity-lock-settle-time . . . 141
laser1:uv:status-parameters:cavity-lock-tolerance-factor . . . 141
laser1:uv:status-parameters:power-lock-settle-time . . . 141
laser1:uv:status-parameters:cavity-scan-duration . . . 142
laser1:uv:status-parameters:power-stabilization-strategy . . . 142
laser1:uv:status-parameters:power-stabilization-level-low-factor . . 142
laser1:uv:status-parameters:power-output-relative-error-max . . . 142
laser1:uv:status-parameters:power-output-relative-deviation-max . 142
laser1:uv:status-parameters:operational-pump-power . . . 142
laser1:uv:status-parameters:degradation-detection-slope-threshold . 142
laser1:uv:status-parameters:degradation-detection-measurement-interval143
laser1:uv:status-parameters:degradation-detection-number-of-measurements143
laser1:uv:power-margin . . . 143
laser1:uv:hwp-transmittance . . . 143
laser1:uv:status . . . 143
laser1:uv:status-txt . . . 144
laser1:uv:specs-fulfilled . . . 144
laser1:uv:error . . . 144
laser1:uv:error-txt . . . 144

laser1:uv:operation-time . . . 144
laser1:uv:remaining-optics-spots . . . 144
laser1:uv:baseplate-temperature . . . 144
laser1:uv:ssw-ver . . . 144
laser1:uv:perform-optimization . . . 144
laser1:uv:perform-optics-shift . . . 144
laser1:uv:clear-errors . . . 145
laser1:pd-ext: . . . 145
laser1:pd-ext:input-channel . . . 145
laser1:pd-ext:photodiode . . . 145
laser1:pd-ext:power . . . 145
laser1:pd-ext:cal-offset . . . 145
laser1:pd-ext:cal-factor . . . 145
laser1:power-stabilization: . . . 145
laser1:power-stabilization:enabled . . . 146
laser1:power-stabilization:gain: . . . 146
laser1:power-stabilization:sign . . . 146
laser1:power-stabilization:input-channel . . . 146
laser1:power-stabilization:setpoint . . . 146
laser1:power-stabilization:window: . . . 146
laser1:power-stabilization:window:enabled . . . 146
laser1:power-stabilization:window:level-low . . . 146
laser1:power-stabilization:window:level-hysteresis . . . 147
laser1:power-stabilization:hold-output-on-unlock . . . 147
laser1:power-stabilization:output-channel . . . 147
laser1:power-stabilization:input-channel-value-act . . . 147
laser1:power-stabilization:state . . . 147
laser1:power-stabilization:feedforward-enabled . . . 147
laser1:power-stabilization:feedforward-factor . . . 148
laser1:config: . . . 148
laser1:config:source . . . 149
laser1:config:product-name . . . 149
laser1:config:date . . . 149
laser1:config:caption . . . 149
laser1:config:pristine . . . 149
laser1:config:load . . . 149
laser1:config:save . . . 150
laser1:config:import . . . 150
laser1:config:export . . . 150
laser1:config:retrieve . . . 150
laser1:config:apply . . . 150
laser1:config:show . . . 151
laser1:config:list . . . 151
laser1:save . . . 151

laser1:load . . . 151
laser1:load-head . . . 151
laser2: . . . 151
laser-common: . . . 151
laser-common:scan: . . . 151
laser-common:scan:sync-laser1 . . . 152
laser-common:scan:sync-laser2 . . . 152
laser-common:scan:frequency . . . 152
laser-common:scan:sync . . . 152
laser-common:scan:save . . . 152
laser-common:scan:load . . . 152
laser-common:save-all . . . 152
laser-common:load-all . . . 152
laser-common:store-all . . . 153
laser-common:restore-all . . . 153
laser-common:apply-all . . . 153
laser-common:retrieve-all . . . 153
uv: . . . 153
uv:laser-on . . . 153
uv:emission . . . 153
uv:status . . . 153
uv:status-txt . . . 154
uv:specs-fulfilled . . . 154
uv:error . . . 154
uv:error-txt . . . 154
uv:operation-time-pump . . . 154
uv:operation-time-uv . . . 154
uv:pump-power-margin . . . 155
uv:remaining-optics-spots . . . 155
uv:power-set . . . 155
uv:power-act . . . 155
uv:baseplate-temperature . . . 155
uv:idle-mode . . . 155
uv:perform-optimization . . . 155
uv:perform-optics-shift . . . 155
uv:clear-errors . . . 155
auto-nlo: . . . 155
auto-nlo:automatic-mode . . . 156
auto-nlo:laser-on . . . 156
auto-nlo:emission . . . 156
auto-nlo:status . . . 156
auto-nlo:status-txt . . . 156
auto-nlo:error . . . 157
auto-nlo:error-txt . . . 157

auto-nlo:operation-time-master . . . 157
auto-nlo:operation-time-amplifier . . . 157
auto-nlo:operation-time-cavity . . . 157
auto-nlo:amplifier-current-margin . . . 157
auto-nlo:power-set . . . 157
auto-nlo:power-act . . . 157
auto-nlo:idle-mode . . . 157
auto-nlo:perform-optimization . . . 157
auto-nlo:clear-errors . . . 158
cc1: . . . 158
cc1:slot . . . 158
cc1:serial-number . . . 158
cc1:revision . . . 158
cc1:fpga-fw-ver . . . 158
cc1:board-temp . . . 158
cc1:variant . . . 158
cc1:parallel-mode . . . 158
cc2: . . . 159
ampcc1: . . . 159
ampcc1:slot . . . 159
ampcc1:serial-number . . . 159
ampcc1:revision . . . 159
ampcc1:fpga-fw-ver . . . 159
ampcc1:board-temp . . . 159
ampcc1:variant . . . 159
ampcc1:parallel-mode . . . 160
ampcc1:power-15v . . . 160
ampcc1:channel1: . . . 160
ampcc2: . . . 160
pc1: . . . 160
pc1:slot . . . 160
pc1:serial-number . . . 160
pc1:revision . . . 161
pc1:variant . . . 161
pc1:channel-count . . . 161
pc1:fpga-fw-ver . . . 161
pc2: . . . 161
pc3: . . . 161
tc1: . . . 161
tc1:slot . . . 161
tc1:serial-number . . . 162
tc1:revision . . . 162
tc1:fpga-fw-ver . . . 162
tc1:board-temp . . . 162

tc1:channel1: . . . 162
tc1:channel2: . . . 162
tc2: . . . 162
mc: . . . 162
mc:serial-number . . . 162
mc:revision . . . 163
mc:fpga-fw-ver . . . 163
mc:board-temp . . . 163
mc:relative-humidity . . . 163
mc:air-pressure . . . 163
io: . . . 163
io:serial-number . . . 163
io:revision . . . 163
io:fpga-fw-ver . . . 163
io:fine-1: . . . 163
io:fine-1:value-act . . . 164
io:fine-2: . . . 164
io:fast-3: . . . 164
io:fast-4: . . . 164
io:out-a: . . . 164
io:out-a:voltage-set . . . 164
io:out-a:voltage-offset . . . 164
io:out-a:voltage-min . . . 164
io:out-a:voltage-max . . . 165
io:out-a:external-input: . . . 165
io:out-a:output-filter: . . . 165
io:out-a:feedforward-enabled . . . 165
io:out-a:feedforward-factor . . . 165
io:out-b: . . . 165
io:digital-in0: . . . 165
io:digital-in0:value-act . . . 166
io:digital-in1: . . . 166
io:digital-in2: . . . 166
io:digital-in3: . . . 166
io:digital-out0: . . . 166
io:digital-out0:value-act . . . 166
io:digital-out0:value-set . . . 166
io:digital-out0:mode . . . 167
io:digital-out0:invert . . . 167
io:digital-out1: . . . 167
io:digital-out2: . . . 167
io:digital-out3: . . . 168
io:save . . . 168
io:load . . . 168

power-supply: . . . 168
power-supply:type . . . 168
power-supply:serial-number . . . 168
power-supply:revision . . . 168
power-supply:board-temp . . . 168
power-supply:heatsink-temp . . . 169
power-supply:current-5V . . . 169
power-supply:current-15V . . . 169
power-supply:current-15Vn . . . 169
power-supply:voltage-5V . . . 169
power-supply:voltage-15V . . . 169
power-supply:voltage-15Vn . . . 169
power-supply:voltage-3V3 . . . 169
power-supply:load . . . 169
power-supply:status . . . 170
power-supply:status-txt . . . 170
buzzer: . . . 170
buzzer:welcome . . . 170
buzzer:play-welcome . . . 170
buzzer:play . . . 170
display: . . . 170
display:brightness . . . 171
display:auto-dark . . . 171
display:idle-timeout . . . 171
display:state . . . 171
display:save . . . 171
display:load . . . 171
display:update-state . . . 172
standby: . . . 172
standby:enabled . . . 172
standby:state . . . 172
standby:laser1: . . . 172
standby:laser1:dl: . . . 172
standby:laser1:dl:disable-pc . . . 172
standby:laser1:dl:disable-cc . . . 172
standby:laser1:dl:disable-tc . . . 173
standby:laser1:amp: . . . 173
standby:laser1:amp:disable-cc . . . 173
standby:laser1:amp:disable-tc . . . 173
standby:laser1:ctl: . . . 173
standby:laser1:ctl:disable . . . 173
standby:laser1:nlo: . . . 173
standby:laser1:nlo:disable-pc . . . 173
standby:laser1:nlo:disable-tc . . . 174

standby:laser2: . . . 174
standby:laser2:dl: . . . 174
pdh1: . . . 174
pdh1:slot . . . 174
pdh1:serial-number . . . 174
pdh1:revision . . . 174
pdh1:fpga-fw-ver . . . 174
pdh1:board-temp . . . 174
pdh1:channel1: . . . 174
pdh1:channel1:modulation-enabled . . . 175
pdh1:channel1:use-fast-oscillator . . . 175
pdh1:channel1:modulation-amplitude-dbm . . . 175
pdh1:channel1:modulation-amplitude-vpp . . . 175
pdh1:channel1:lo-output-amplitude-dbm . . . 175
pdh1:channel1:lo-output-amplitude-vpp . . . 175
pdh1:channel1:lo-output-enabled . . . 175
pdh1:channel1:phase-shift . . . 175
pdh1:channel1:input-level-max . . . 176
pdh1:channel1:lock-level . . . 176
pdh1:channel2: . . . 176
pdh1:save . . . 176
pdh1:load . . . 176
3.2 Maintenance . . . 176
time . . . 176
tan . . . 176
system-messages: . . . 177
system-messages:count . . . 178
system-messages:count-new . . . 178
system-messages:latest-message . . . 178
system-messages:mark-as-read . . . 178
system-messages:show-all . . . 178
system-messages:show-new . . . 178
system-messages:show-log . . . 179
system-messages:show-persistent . . . 179
licenses: . . . 180
licenses:options: . . . 180
licenses:options:lock: . . . 180
licenses:options:lock:enabled . . . 180
licenses:options:lock:licensee . . . 180
licenses:options:lock:valid-until . . . 180
licenses:options:dual-laser-operation: . . . 180
licenses:options:quad-laser-operation: . . . 180
licenses:options:automatic-nlo-operation: . . . 181
licenses:install . . . 181

fw-update: . . . 181
fw-update:upload . . . 181
fw-update:show-log . . . 181
fw-update:show-history . . . 182
system-service-report: . . . 182
system-service-report:ready . . . 182
system-service-report:service-report . . . 182
system-service-report:request . . . 182
system-service-report:add-info . . . 182
system-service-report:print . . . 182
error-log . . . 182
service-script . . . 183
service-report . . . 183
3.3 Device Information . . . 183
uptime . . . 183
uptime-txt . . . 183
fw-ver . . . 183
ssw-ver . . . 183
echo . . . 183
serial-number . . . 184
system-type . . . 184
system-model . . . 184
system-label . . . 184
vcs-id . . . 184
ssw-vcs-id . . . 185
build-information: . . . 185
build-information:build-number . . . 185
build-information:build-id . . . 185
build-information:build-tag . . . 185
system-summary . . . 185
3.4 Network Configuration . . . 185
net-conf: . . . 185
net-conf:ip-addr . . . 186
net-conf:net-mask . . . 186
net-conf:mac-addr . . . 186
net-conf:dhcp . . . 186
net-conf:cmd-port . . . 186
net-conf:mon-port . . . 186
net-conf:set-dhcp . . . 186
net-conf:set-ip . . . 187
net-conf:apply . . . 187
3.5 Userlevel . . . 187
ul . . . 187
change-ul . . . 188

change-password 188

4 Appendix **189**
4.1 Signal Channel IDs 189
4.2 Scope, Lock and Recorder Binary Data 191
4.2.1 Data Blocks 192
4.2.2 Floating Point Format 193
4.2.3 Integer Format 194
4.2.4 Candidate Type 194
4.2.5 BASE64 195
4.2.6 Processing Binary Data 195
4.3 USB Connection 195
4.4 Ethernet Connection 196
4.4.1 Telnet Server: Command Console and Monitoring Line 196
4.4.2 Identification Server 197

Index **198**

1 Introduction

DLC pro devices can be completely controlled by remote commands sent via a serial RS232C line or via a TCP/IP network. The instruction set, the instruction syntax, as well as the responses, are identical in both cases. Instructions and responses consist of printable ASCII characters only. Any standard terminal or TELNET software can be used to operate the device. See appendix 4.3 and 4.4 for explanations on how to establish connections between a PC and a DLC pro.

2 Control Language

The device's control language is based on the *Scheme*[1] programming language.

Scheme instructions always have the same simple syntax. The instructions are enclosed by parentheses and use prefix notation. The function/instruction name is always the first text within the parentheses. If the instruction requires arguments, these are separated by whitespaces (spaces, tab, or linefeed):

```
(cmd arg1 arg2)
```

Instructions are terminated by a linefeed character (ASCII code 10 decimal, 0xA hexdecimal). Execution is finished when a *prompt* is received. The prompt consists of the "> " (larger than and space)characters at the beginning of a new line.

Each instruction returns a value of some type that can be used by other instructions, or, for example, can be assigned to a variable. The return value always is the last item before the prompt. Example:

```
> (+ 13 7 5)
25
>
```

Instructions can be nested, i.e. each element of an instruction can be the result of another instruction:

```
> (+ 13 (/ 21 3) (* 2.5 2))
25
>
```

Errors are indicated by the "Error: " string at the beginning of a new line:

```
> (/ 1 0)
Error: /: division by zero
>
```

Some instructions print out additional text preceding the return value:

[1] There is plenty of information about Scheme in the Internet, as well as some tutorials.

```
> (display "Hello World\n")
Hello World
#t
>
```

Here, the boolean value #t is the return value which could be used, for example, in nested instructions, while the"Hello World" string is printed out only.

All details of a DLC pro are controlled by *parameters* and *commands*. Parameters represent certain properties of the device like a laser power level, the serial number, or an enable/disable flag etc. Commands are used to execute specific tasks like a recalibration or a firmware update.

2.1 Parameters

Each parameter is charcterized by a specific name, a specific type, and a specific mode. For each available parameter, the following chapters provide all parameter information in detail.

Parameter names start with a letter and can contain letters, numerical digits, and special characters like hyphens, underscores, or alike.

The following parameter types are used:

integer - integer numbers, e.g. -10, 0, or 1998

real - floating point numbers, using decimal points, e.g. 3.1415 or 6.625e-34

string - text enclosed in quotation marks, e.g. "TOPTICA Photonics". The string content is stored as a bytestream[2].

boolean - true/false values, #t = true, #f = false

tuples - a set set of several values of the parameter types listed above in a fixed order, enclosed by parentheses, e.g. a pair of XY coordinates: (100 200).

The mode of a parameter provides information about accessing the parameter:

read-only - these parameters can not be modified but can only be read out.

read-write - these parameters can be modified. The new value immediately takes effect and is returned when the parameter is read out.

There are three different Scheme instructions for accessing parameters:

- param-ref
- param-set!
- param-disp

[2] `https://en.wikipedia.org/wiki/Bytestream`

2.1.1 param-ref

The value of a parameter can be retrieved with the *param-ref* instruction. Its return value is the value of the parameter being queried.

The following examples show queries for different parameter types:

```
> (param-ref 'int-param)
8375309
> (param-ref 'str-param)
"this is a string"
> (param-ref 'bool-param)
#t
> (param-ref 'real-param)
3.141592
> (param-ref 'tuple-param)
(0.8 15)
>
```

Note that parameter names must be quoted with the single, straight quotation mark (').

Reading the parameter value is possible for all parameters modes.

2.1.2 param-set!

To change a parameter value, use the *param-set!* instruction. Its return value is zero or positive integer in case of success and a negative number with in case of an error.

Here are a few examples for parameters of different type:

```
> (param-set! 'label "Example Device")
0
> (param-set! 'int-param 50)
0
> (param-set! 'bool-param #f)
0
> (param-set! 'tuple-param '(15 0.8))
0
>
```

Modifying a parameter value is only possible for parameters of *read-write* mode. Tuple-type arguments have to be quoted with the single, straight quotation mark. Please remember that nesting of instructions is possible. The following example shows a way to toggle a boolean parameter:

```
> (param-set! 'bool-param (not (param-ref 'bool-param)))
0
>
```

2.1.3 param-disp

While the *param-ref* instruction is the way to choose for software implemented parameter queries, there is a more human readable alternative for manual queries on the command console: the *param-disp* instruction.

In contrast to the *param-ref* instruction it *displays* the parameters values together with their names while its return value always is zero[3].

While *param-disp* can be used with single parameters, it is most useful when used with parameter sections:

```
> (param-disp 'laser1)
laser1
  :serial-number = "11092"
  :model = "DLCpro"
...
0
>
```

To get a complete list of all parameters, you can use the `(param-disp)` instruction without a parameter name .

2.2 Commands

Commands are used differently than parameters. They are called by the *exec* instruction as in the following example:

```
> (exec 'dummy-command)
()
>
```

Please note that command names, like parameter names, must be quoted by a single, straight quotation mark ('). As in the example, commands often don't return a specific return value but an empty tuple instead[4].

Some commands require one or more additional arguments, which are included in the parentheses and separated by whitespaces.

```
> (exec 'buzzer:play "A   A A   A A   A E   E H   E H   E AAAA")
()
> (exec 'net-conf:set-ip "192.168.1.1" "255.255.255.0")
()
```

Other commands return a result value. For all commands, the type of the return value is provided in this manual.

[3] i.e. it cannot be used reasonably in nested instructions or variable assignments

[4] Since all Scheme instructions must return a result value, these commands return an empty tuple `()`.

2.3 Errors and Warnings

When a parameter value is changed using the *param-set!* instruction, a negative number is returned in case of an error. A positive number returned indicates a warning condition. For error indications, "Error:" is displayed at the beginning of a line, followed by a specific, negative-number error code and a brief error description.
Examples of indicated errors:

```
> (param-set! 'laser1:dl:lock:spectrum-input-signal 555)
Error: -3 no such parameter
> (param-set! 'laser1:dl:lock:spectrum-input-channel 555)
Error: -1 invalid argument
> (param-set! 'laser1:dl:cc:current-act 5000)
Error: -11 parameter not settable
>
```

A positive number returned at the beginning of a line indicates a warning condition.
For numerical parameters, a return value of *2* indicates *"parameter value clipped"*. That is, the specified value has exceeded the valid data range limit and the parameter was set to the minimum or maximum allowed value, respectively.
Use the *param-ref* instruction to retrieve the actually set value. Example:

```
> (param-set! 'laser1:dl:cc:current-set 5000)
2
> (param-ref 'laser1:dl:cc:current-set)
234
>
```

2.4 Remote Monitoring

The Monitoring line enables automatic remote monitoring of device parameters. This feature can be especially valuable for GUI programming. It drastically reduces the traffic between PC and device.

The idea is to *subscribe* for certain paramteter updates, rather than polling them frequently. After submitting a subscription, the monitoring line will automatically send a telegram with the newest value of that paramter whenever it has changed. Subscriptions are per connection. For opening a monitoring line, a dedicated telnet connection on the reserved monitoring line port 1999 is necessary.

The syntax for the monitoring line is similar to scheme commands, see Sec. 2. The structure for a monitoring command is:

```
(cmd_name ['{param_name}|userlevel] [period|stringvalue] [threshold])
```

cmd_name Possible commands are:

add Adds a param for monitoring, e.g.
"`(add 'laser1:dl:cc:current-act 100 0.1)`"

remove Removes the parameter from monitoring, e.g.
"`(remove 'laser1:dl:cc:current-act)`

remove-all Removes all parameters from monitoring line, e.g. "`(remove-all)`"

query Gets the current value of a parameter immediately, e.g.
"`(query 'laser1:dl:cc:current-set)`"

change-ul Changes the userlevel of the monitoring line. For more information, please read the acccording section about the use level in this manual. Syntax example: "`(change-ul 0 "secret")`"

param_name The name of the parameter to be monitored.

userlevel Integer value representing the userlevel.

period Update interval in ms. Every "period" ms, an update value is sent if the parameter is changed. The change must be above the "threshold" value. This allows to reduce traffic for parameters that change too often.

stringvalue Password that is needed for changing the userlevel.

threshold A threshold value for sending updates. If a parameter changes and the change does not exceed the threshold, no update will be sent. This allows to reduce traffic for floating point parameters where too small changes are not of interest.

If an error occurs, an empty list, `()`, is returned. Otherwise the current values of the registered parameter is returned. A value looks like:

```
(timestamp 'param_name value)
```

Example:

```
(2013-07-15T13:58:59.123Z 'laser1:dl:cc:current-act 98.354201)
(2013-07-15T13:59:00.842Z 'laser1:dl:cc:enabled #t)
```

timestamp A timestamp for the value in ISO 8601 format.

param_name The name of the monitored parameter

value The current value of the parameter.

3 List of all Parameters and Commands

3.1 General Operation

Commands and parameters for general device operation

emission-button-enabled

(BOOLEAN parameter, read-write)

Parameter indicating the state of the laser emission button.
#t - the emission button is enabled, laser emission is allowed
#f - the laser emission button is switched off
This parameter is writable only if the controller is qualified for system-integration ("SI" type on device's identification label) and the laser is qualified for emission remote control (currently only DFB pro laser heads).

interlock-open

(BOOLEAN parameter, read-only)

Parameter indicating whether the interlock circuit is open.
#t - interlock circuit open, no laser emission possible.
#f - interlock circuit closed

frontkey-locked

(BOOLEAN parameter, read-only)

Parameter indicating whether the key switch on the DLCpro front panel is locked.
#t - key switch locked, no laser emission possible
#f - key switch unlocked

emission

(BOOLEAN parameter, read-only)

Parameter indicating whether laser emission is switched on.
#t - at least one laser diode (in any of the attached laser heads) is switched on.
#f - all laser heads are switched off.
This parameter reflects the state of the white laser emission LEDs at the DLCpro front panel and laser head.

system-health

(INTEGER parameter, read-only)

Parameter indicating system health problems.
Returns *0* if the system has no problems. If a non-zero value is returned, each bit represents a specific failure.

bit 0 - main FPGA fault

bit 1 - power supply fault
bit 2 - laser 1 problem
bit 3 - laser 2 problem
bit 8 - problem with module in M-slot 1
bit 9 - problem with module in M-slot 2
bit 10 - problem with module in M-slot 3
bit 11 - problem with module in M-slot 4
bit 12 - problem with module in S-slot 1
bit 13 - problem with module in S-slot 2
bit 14 - problem with module in S-slot 3
bit 15 - problem with module in S-slot 4
bit 16 - problem with IO board

system-health-txt

(STRING parameter, read-only)

Parameter providing a text representation of the system's health problem(s).

laser1:

(parameter section)

This section provides controls for the first laser head attached to the DLCpro. It provides many commands and parameters, for example:

- switching on and off
- controlling laser diode temperature
- reading back status information
- etc.

laser1:type

(STRING parameter, read-only)

Parameter indicating the type of connected laser, e.g. "DLpro", "TApro".
Possible values are:
- DFBpro
- DLpro
- CTL
- DFB-TApro
- TApro
- DFB-SHGpro
- DL-SHGpro

- DFB-TA-SHGpro
- TA-SHGpro
- DFB-FHGpro
- DL-FHGpro
- DFB-TA-FHGpro
- TA-FHGpro
- DFB
- ECDL
- DFB-MOPA
- ECDL-MOPA

laser1:product-name

(STRING parameter, read-only)

Parameter indicating the model name of the laser head hardware.
For a legacy laser head - without factory settings stored in EEPROM - this parameter returns *"legacy ECDL"*. Basically, the value of this parameter is the type of the laser head followed by its serial number.

laser1:emission

(BOOLEAN parameter, read-only)

Parameter indicating the laser head emission status.
#t - laser is switched on
#f - laser is switched off

laser1:health

(INTEGER parameter, read-only)

Parameter indicating laser health problems.
Returns *0* if the system has no problems. If a non-zero value is returned, each bit represents a specific failure.

bit 0 - diode laser TC problem

bit 1 - diode laser CC problem

bit 2 - ECDL PC problem

bit 3 - CTL communication problem

bit 4 - CTL PC problem

bit 5 - CTL problem

bit 6 - DPSS problem

bit 7 - master replacement problem

bit 12 - amplifier TC problem

bit 13 - amplifier CC problem

bit 14 - amplifier seed problem
bit 15 - amplifier power problem
bit 16 - amplifier replacement problem
bit 20 - NLO communication problem
bit 21 - SHG crystal TC problem
bit 22 - SHG cavity PC problem
bit 23 - FHG crystal TC problem
bit 24 - FHG cavity PC problem
bit 25 - SHG cavity TC problem

laser1:health-txt

(STRING parameter, read-only)

Parameter providing a text representation of the system's health problem(s).

laser1:dl:

(parameter section)

Parameters of the laser head.

laser1:dl:legacy

(BOOLEAN parameter, read-only)

Parameter indicating whether a legacy laser head - without factory settings stored in EEPROM - is connected to the DLCpro.
#t - legacy laser head connected; factory settings cannot be identified
#f - TOPTICA laser head factory settings identified in EEPROM

laser1:dl:type

(STRING parameter, read-only)

Parameter indicating the type of laser head, e.g. "DLpro".
For a legacy laser head - without factory settings stored in EEPROM - this parameter returns *"legacy laser"*. Possible values are:
- DLpro
- DFBpro
- CTL
- TApro/master
- DFB-TApro/master
- DL-SHGpro/master
- DFB-SHGpro/master
- TA-SHGpro/master
- DFB-TA-SHGpro/master

- DL-FHGpro/master
- DFB-FHGpro/master
- TA-FHGpro/master
- DFB-TA-FHGpro/master
- legacy laser

laser1:dl:version

(STRING parameter, read-only)

Parameter indicating the version of the laser head hardware, e.g. "3V1".
For a legacy laser head - without factory settings stored in EEPROM - this parameter returns *"unknown"*.

laser1:dl:model

(STRING parameter, read-only)

Parameter indicating the model of the laser head hardware, e.g. "DFB pro BFY".
May return an empty string for some laser heads.

laser1:dl:serial-number

(STRING parameter, read-only)

Parameter indicating the serial number of the laser head, e.g. "020000".
For a legacy laser head - without factory settings stored in EEPROM - this parameter returns *"unknown"*.

laser1:dl:fru-serial-number

(STRING parameter, read-only)

Parameter indicating the serial number of the laser-diode unit.

laser1:dl:ontime

(INTEGER parameter, read-only)

Parameter indicating the accumulated time (in seconds) the laser has been emitting.
For a legacy laser head - without factory settings stored in EEPROM - this parameter returns *0*.

laser1:dl:ontime-txt

(STRING parameter, read-only)

Formatted string for the accumulated laser emission time:
hours:minutes:seconds
For a legacy laser head - without factory settings stored in EEPROM - this parameter returns *"0:00:00"*.

laser1:dl:cc:

(parameter section)

Current driver for laser 1

laser1:dl:cc:path

(STRING parameter, read-only)

Parameter describing the hardware location of the current control (CC) channel. Example: "cc1:channel1" indicates the first channel of the first current controller

laser1:dl:cc:variant

(STRING parameter, read-only)

Parameter describing the hardware variant of the current control (CC) channel. For example, "250 mA" or "500 mA"

laser1:dl:cc:enabled

(BOOLEAN parameter, read-write)

Parameter to switch the laser emission on/off:
#t - laser emission on
#f - laser emission off

laser1:dl:cc:emission

(BOOLEAN parameter, read-only)

Parameter indicating the laser emission status.
#t - all criteria for laser emission are fulfilled. Laser radiation should be emitted from this channel's laser.
#f - if laser emission is not possible for one of the following reasons:
- interlock circuit is open.
- the front panel key swicth is "off".
- the laser emission push button on the frontpanel is not pressed.
- laser emission is disabled by the software.

laser1:dl:cc:current-set

(REAL parameter, read-write)

Parameter to set the desired laser diode current in mA.
If **laser1:dl:cc:feedforward-enabled** is #t, **laser1:dl:cc:current-set** is determined as follows:
laser1:dl:cc:current-set = **laser1:dl:cc:current-offset** + **laser1:dl:cc:feedforward-factor** * (**laser1:dl:pc:voltage-set** - 69.5 V)
This parameter setting affects the **laser1:dl:cc:current-offset** value.

laser1:dl:cc:current-offset

(REAL parameter, read-write)

Parameter to specify the laser diode current without Feed Forward contribution (in mA).
This parameter setting affects the **laser1:dl:cc:current-set** value.

laser1:dl:cc:current-set-dithering

(BOOLEAN parameter, read-write)

Parameter to enable/disable resolution enhancement for the laser diode current.
#t - resolution enhancement enabled
#f - resolution enhancement disabled

laser1:dl:cc:external-input:

(parameter section)

Parameters to configure the current control by an external, analog voltage input.

laser1:dl:cc:external-input:signal

(INTEGER parameter, read-write)

ID for the input signal to be routed to this laser channel.
For possible values, refer to the "Signal Channel IDs" section in appendix 4.1 on page 189.

laser1:dl:cc:external-input:factor

(REAL parameter, read-write)

Factor to be applied to the input signal.

laser1:dl:cc:external-input:enabled

(BOOLEAN parameter, read-write)

Parameter to enable/disable the control by external analog input.
#t - channel controlled by external analog input specified in **:external-input:signal**
#f - channel control by external analog input disabled

laser1:dl:cc:output-filter:

(parameter section)

Parameters to configure output filters such as slew rate.

laser1:dl:cc:output-filter:slew-rate

(REAL parameter, read-write)

Parameter to configure the maximum rate of change of the output channel in physical unit per second.

laser1:dl:cc:output-filter:slew-rate-enabled

(BOOLEAN parameter, read-write)

Parameter to enable/disable rate of change limit
#t - rate of change limited #f - output not limited

laser1:dl:cc:output-filter:slew-rate-limited

(BOOLEAN parameter, read-only)

Parameter indicating whether the signal change of the output channel is currently limited by the slew rate.
#t - output channel is modulated too fast. Modulation is limited by slew rate filter
#f - no limitation by slew rate filter

laser1:dl:cc:current-act

(REAL parameter, read-only)

Parameter indicating the measured value of the laser diode current in mA. Usually, this is the current flowing through the laser diode. However, if the safety circuitry shorts the current output, this is not true.

laser1:dl:cc:positive-polarity

(BOOLEAN parameter, read-only)

Parameter to specify the laser diode polarity setting
IMPORTANT:
To be specified only for legacy laser heads (without factory settings stored in EEPROM; **:legacy** = #t).
To be modified only if the channel is disabled (**:enabled** = #f).
#t - positive laser diode polarity
#f - negative laser diode polarity

laser1:dl:cc:current-clip

(REAL parameter, read-write)

Parameter to specify the maximum allowed current (in mA) for this channel's laser diode.

laser1:dl:cc:current-clip-limit

(REAL parameter, read-only)

Parameter to specify the maximum value for the **:current-clip** parameter (in mA).
IMPORTANT: To be specified only for legacy laser heads (without factory settings stored in EEPROM; **:legacy** = #t).
.

laser1:dl:cc:voltage-act

(REAL parameter, read-only)

Parameter indicating the measured value of the voltage applied to the laser diode (in V).

laser1:dl:cc:voltage-clip

(REAL parameter, read-only)

Parameter to specify the maximum allowed voltage (in V) for this channel's laser diode. Can be changed only for legacy laser heads (without factory settings stored in EEPROM).

laser1:dl:cc:feedforward-enabled

(BOOLEAN parameter, read-write)

Parameter to enable/disable Feed Forward for this current control channel.
#t - Feed Forward enabled
#f - Feed Forward disabled
If enabled, a current proportional to another channel's output is added to this channel. The other channel is defined by the **laser1:feedforward-master** parameter.

laser1:dl:cc:feedforward-factor

(REAL parameter, read-write)

Parameter to control how much of the piezo channel's output is to be added to the current channel (in mA/V).

laser1:dl:cc:pd

(REAL parameter, read-only)

Parameter indicating the measured monitor diode current in μA.
Please note that not every laser diode features an internal monitor photodiode.

laser1:dl:cc:aux

(REAL parameter, read-only)

Parameter indicating the measured voltage at the AUX input (in V).

laser1:dl:cc:snubber

(BOOLEAN parameter, read-only)

Snubber setting depending on the connected laser head
#t - Mandatory snubber setting if a legacy TOPTICA diode laser head - without EEPROM-stored factory settings - is connected.
#f - Snubber setting indication only if a new TOPTICA diode laser head - with factory settings stored in EEPROM - is connected.

laser1:dl:cc:status

(INTEGER parameter, read-only)

Parameter providing channel status information. Each bit of the integer value provides specific channel status information.

bit 0 - emission
bit 1 - enabled
bit 2 - positive polarity
bit 3 - snubber enabled (frequency low pass)
bit 4 - crowbar enabled (protective short circuit)
bit 5 - DAC enabled
bit 6 - current clip
bit 7 - voltage clip
bit 8 - FPGA communication problem
bit 12 - DAC not initialized
bit 15 - channel not in use

laser1:dl:cc:status-txt

(STRING parameter, read-only)

Parameter providing a brief text version of the **:status** parameter.

laser1:dl:tc:

(parameter section)

This section provides parameters related to the temperature controller for **laser1**.

laser1:dl:tc:path

(STRING parameter, read-only)

Parameter describing the hardware location of the TEC channel.

laser1:dl:tc:enabled

(BOOLEAN parameter, read-write)

Parameter to enable/disable temperature stabilization.
#t - enable temperature stabilization
#f - disable temperature stabilization

laser1:dl:tc:temp-act

(REAL parameter, read-only)

Parameter indicating the temperature of the laser diode in °C.

laser1:dl:tc:temp-set

(REAL parameter, read-write)

Parameter indicating the laser diode target temperature in °C.

laser1:dl:tc:external-input:

(parameter section)

Parameters to configure the temperature control by an external, analog voltage input.

For usage see **laser1:dl:cc:external-input:** on page 41.

laser1:dl:tc:ready

(BOOLEAN parameter, read-only)

Parameter indicating whether the temperature of the laser diode is settled at the target temperature.
#t - laser diode temperature settled at the target temperature
#f - laser diode temperature not settled

laser1:dl:tc:fault

(BOOLEAN parameter, read-only)

Parameter indicating whether the temperature controller reports a problem.
#t - problem reported by the temperature controller
#f - no temperature controller problem report

laser1:dl:tc:status

(INTEGER parameter, read-only)

Parameter providing a flag register with status information. Each bit in the register represents a specific information:

bit 0 - temperature regulation enabled

bit 1 - ready (same as **:ready** parameter)

bit 2 - TEC or heater is cooling (i.e. not heating)

bit 3 - TEC or heater is heating

bit 4 - output driver operating at maximum output

bit 5 - TEC or heater missing (i.e. too high resistance)

bit 6 - TEC or heater short circuit (i.e. too low resistance)

bit 7 - leakage current deteted

bit 8 - output driver overcurrent

bit 9 - output driver overtemperature

bit 10 - output driver missing

bit 11 - temperature probe missing

bit 12 - temperature probe short circuit

bit 13 - regulation timed out

bit 14 - output current operating at minimum or maximum limit

bit 15 - *unused*

bit 16 - measured temperature outside allowed temperate range

bit 17 - timeout, output driver or current were operating at limit for too long

bit 18 - cable detached (i.e. found no probe, no TEC/heater, no EEPROM and no GPIOs)

laser1:dl:tc:status-txt

(STRING parameter, read-only)

Parameter providing a brief description of the status register.

laser1:dl:tc:t-loop:

(parameter section)

Parameters for configuring the temperature controller performance.
Temperature control loop access.

laser1:dl:tc:t-loop:p-gain

(REAL parameter, read-write)

Proportional gain in dB.

laser1:dl:tc:t-loop:i-gain

(REAL parameter, read-write)

Integral gain in dB.

laser1:dl:tc:t-loop:d-gain

(REAL parameter, read-write)

Differential gain in dB.

laser1:dl:tc:t-loop:ok-tolerance

(REAL parameter, read-write)

Temperature tolerance for "ready" status in Kelvin.

laser1:dl:tc:t-loop:ok-time

(REAL parameter, read-write)

Minimum time (in seconds) the temperature must be within the **:ok-tolerance** temperature range before the "ready" status is confirmed.

laser1:dl:tc:limits:

(parameter section)

Parameter handling temperature conditions for monitoring.

laser1:dl:tc:limits:temp-min

(REAL parameter, read-only)

Parameter to specify/indicate the minimum laser diode temperature in °C. You cannot operate the laser if the laser diode temperature is below **:temp-min**.
Note: **:temp-min** can be specified only for legacy laser heads (without factory settings stored in EEPROM; **:legacy** = #t) and the TCs for nonlinear crystals in frequency-converted diode laser systems.

laser1:dl:tc:limits:temp-max

(REAL parameter, read-only)

Parameter to specify/indicate the maximum laser diode temperature. You cannot operate the laser if the laser diode temperature is higher than **:temp-max**.
Note: **:temp-max** can be specified only for legacy laser heads (without factory settings stored in EEPROM; **:legacy** = #t) and the TCs for nonlinear crystals in frequency-converted diode laser systems.

laser1:dl:tc:limits:timeout

(INTEGER parameter, read-write)

Parameter to specify/indicate the time the system accepts the non-settled laser diode temperature (in seconds). If it takes longer than the **:timeout** time for the laser diode temperature to settle, or if the TEC current is at its limit for longer than the **:timeout** time, the laser and TEC are switched off.
Note: **:timeout** can be specified only for legacy laser heads (without factory settings stored in EEPROM; **:legacy** = #t)) and the TCs for nonlinear crystals in frequency-converted diode laser systems.

laser1:dl:tc:limits:timed-out

(BOOLEAN parameter, read-only)

Parameter indicating whether a timeout has occurred.
#t - timeout has occurred
#f - no timeout
To reset the laser after a timeout, switch the temperature control loop (**:t-loop**) off and on.

laser1:dl:tc:limits:out-of-range

(BOOLEAN parameter, read-only)

Parameter indicating whether the laser diode temperature is out of range.
#t - laser diode temperature out of range
#t - laser diode temperature within range

laser1:dl:tc:current-set

(REAL parameter, read-only)

Parameter to read the TEC current (in mA). In open loop operation, you can use the parameter to manually set a specific current.

laser1:dl:tc:current-act

(REAL parameter, read-only)

Parameter to read the TEC current (in mA).

laser1:dl:tc:temp-set-min

(REAL parameter, read-only)

Parameter to specify the minimum limit for the target temperature (in °C).

laser1:dl:tc:temp-set-max

(REAL parameter, read-only)

Parameter to specify the maximum limit for the target temperature (in °C).

laser1:dl:tc:temp-roc-enabled

(BOOLEAN parameter, read-only)

Parameter to enabled/disable the rate-of-change limitation.

laser1:dl:tc:temp-roc-limit

(REAL parameter, read-only)

Parameter to limit the temperature rate of change (in °C per second).
IMPORTANT: To be specified only for legacy laser heads (without factory settings stored in EEPROM; **:legacy** = #t) and the TCs for nonlinear crystals in frequency-converted diode laser systems.

laser1:dl:pc:

(parameter section)

Piezo driver for laser 1

laser1:dl:pc:path

(STRING parameter, read-only)

Parameter indicating the hardware location of the piezo channel.

laser1:dl:pc:enabled

(BOOLEAN parameter, read-write)

Parameter to enable/disable piezo HV output:
#t - enable HV output
#f - disable HV output

laser1:dl:pc:voltage-set

(REAL parameter, read-write)

Parameter to set the desired piezo voltage in V.

laser1:dl:pc:voltage-min

(REAL parameter, read-only)

Parameter to specify the minimum piezo voltage in V.

laser1:dl:pc:voltage-max

(REAL parameter, read-only)

Parameter to specify the maximum piezo voltage in V.

laser1:dl:pc:voltage-set-dithering

(BOOLEAN parameter, read-write)

Parameter to enable/disable resolution enhancement for the piezo voltage
#t - resolution enhancement enabled
#f - resolution enhancement disabled

laser1:dl:pc:external-input:

(parameter section)

Parameters to configure the piezo voltage control by an external, analog voltage input.

For usage see **laser1:dl:cc:external-input:** on page 41.

laser1:dl:pc:output-filter:

(parameter section)

Parameters to configure output filters such as slew rate.

For usage see **laser1:dl:cc:output-filter:** on page 41.

laser1:dl:pc:voltage-act

(REAL parameter, read-only)

Parameter indicating the measured voltage of **:channel1** in V.

laser1:dl:pc:feedforward-enabled

(BOOLEAN parameter, read-write)

Parameter to enable/disable Feed Forward for this channel
#t - enable Feed Forward
#f - disable Feed Forward
If Feed Forward is enabled, a voltage proportional to another channel's output is added to this channel's piezo voltage. The other channel is defined by the **laser1:feedforward-master** parameter.

laser1:dl:pc:feedforward-factor

(REAL parameter, read-write)

Parameter to control how much of the **laser1:feedforward-master** channel's output is to be added to this channel's piezo voltage (in V/X, where X is the unit of ther feedforward master channel).

laser1:dl:pc:heatsink-temp

(REAL parameter, read-only)

Parameter indicating the PC-channel's heat sink temperature in °C.

laser1:dl:pc:status

(INTEGER parameter, read-only)

Parameter indicating channel status information. Each bit of the integer value provides specific channel status information.

bit 0 - enabled
bit 3 - HV fault
bit 4 - current fault
bit 5 - current limit
bit 7 - voltage at lower limit
bit 15 - voltage at upper limit

laser1:dl:pc:status-txt

(STRING parameter, read-only)

Parameter indicating a brief text version of the **:status** parameter.

laser1:dl:lock:

(parameter section)

Access to the DLCpro's lock module. The lock module provides the following features:

- two PID regulators for controlling two independent output channels.
- Lock-In detection
- automatic ReLock and reset.
- easy-to-use click-and-lock functionality

Access to the lock module is available only if the TOPTICA Lock License option is installed.

laser1:dl:lock:type

(INTEGER parameter, read-write)

Parameter to determine the lock type:
1 - "Top of Fringe" - lock to an extremum; requires a reasonable Lock-In parameter configuration.
2 - "Side of Fringe" - lock to an edge (slope).
3 - "Top of Fringe PDH" - lock to an edge (slope) with PDH module.

laser1:dl:lock:lock-without-lockpoint

(BOOLEAN parameter, read-write)

Parameter to specify the mode for activating the lock.
#t - lockpoint and lockpoint candidates are not used. When the lock gets activated, the scan will stop in its center (at scan-offset) and the PIDs get enabled. Use the PIDs **:sign** parameter to select which slope of the Signal is to be used.
#f - the lock can only be enabled if a lockpoint is selected. If the lock gets activated, the scan will stop and PIDs will be enabled when the lockpoints X and Y conditions are met. The PIDs **:sign** parameter should be set to #t and the slope is configured automatically.

laser1:dl:lock:state

(INTEGER parameter, read-only)

Parameter indicating the current operational mode of the lock module. Possible values are:

0 - "Idle": no scan, no lock

1 - "Scanning": scan controller enabled

2 - "Selecting": "Scanning" plus an additional evaluating signal to find the lockpoint candidates

3 - "Selected": "selecting" plus one lockpoint candidate selected as actual lockpoint

4 - "Locking": start of locking procedure; scanning to the lockpoint and activating the PID controller(s).
The scope engine is paused for a moment to show the start process of the lock. The background-data contains the last trace before the start of the lock.

5 - "Locked": scan controller deactivated and PID lock(s) closed

6 - "On Hold": PIDs on hold, waiting for being activated again

7 - "Resetting": PIDs are being reset

8 - "Reset": PIDs reset and on hold, waiting for being actived again

9 - "Relocking": relock engine is scanning, trying to relock the PIDs

laser1:dl:lock:state-txt

(STRING parameter, read-only)

Parameter indicating the current operational mode of the lock module as a short text. Possible values are: "Idle", "Scanning", "Selecting", "Selected", "Locking", "Locked", "On Hold", "Resetting", "Reset", and "Relocking".

laser1:dl:lock:lock-enabled

(BOOLEAN parameter, read-write)

Parameter to specify the lock module's operational mode (**:state**).
Read mode:
#t - operational mode is "Locking", "Locked", "On Hold", "Resetting", "Reset" or "Relocking".
#f - operational mode is "Idle", "Scanning", "Selecting" or "Selected".
Write mode:
#t - same effect as submitting the **:close** command.
#f - same effect as submitting the **:open** command.

laser1:dl:lock:hold

(BOOLEAN parameter, read-write)

Parameter for pausing the PID controller(s).
#t - pause the PID controller(s)
#f - do not pause the PID controller(s)

laser1:dl:lock:spectrum-input-channel

(INTEGER parameter, read-write)

Parameter to select the channel of the lock input signal.
For possible values, see the "Signal Channel IDs" section in appendix 4.1 on page 189.
This parameter will automatically set:
the input channels for the PIDs
the input channel for Lock-In demodulation
the first channel for the scope engine

laser1:dl:lock:pid-selection

(INTEGER parameter, read-write)

Parameter to select the PID controllers to be used by the lock engine:
0 - no PID controller
1 - PID1
2 - PID2
3 - PID1 and PID2

laser1:dl:lock:setpoint

(REAL parameter, read-write)

Parameter indicating the setpoint for the PID controllers. Typically, the **:setpoint** is automatically set by the **laser1:dl:lock:select-lockpoint** command, depending on the settings of **:lock:type**, **:lock:candidate-filter**, and so on.

laser1:dl:lock:relock:

(parameter section)

Settings for automatic ReLock.

laser1:dl:lock:relock:enabled

(BOOLEAN parameter, read-write)

Set this parameter to #t to enable the ReLock engine.

laser1:dl:lock:relock:output-channel

(INTEGER parameter, read-write)

Parameter to select the output channel for the ReLock scan to return to the in-lock state (described by the **:lock:window** parameters).
For possible values, refer to the "Signal Channel IDs" section in appendix 4.1 on page 189.

laser1:dl:lock:relock:frequency

(REAL parameter, read-write)

Parameter to control the frequency of the ReLock scan (in Hz).

laser1:dl:lock:relock:amplitude

(REAL parameter, read-write)

Parameter to control the amplitude of the ReLock waveform (in V).

laser1:dl:lock:relock:delay

(REAL parameter, read-write)

Parameter to determine the waiting time before the ReLock procedure starts after the out-of-lock condition is signaled by **:lock:window**.

laser1:dl:lock:reset:

(parameter section)

Settings for automatic PID reset.

laser1:dl:lock:reset:enabled

(BOOLEAN parameter, read-write)

Parameter to enable/disable the PID reset engine
#t - PID reset engine enabled
#f - PID reset engine disabled.

laser1:dl:lock:window:

(parameter section)

Settings for out-of-lock detection for ReLock and triggering the PID controller reset.

laser1:dl:lock:window:enabled

(BOOLEAN parameter, read-write)

Set this parameter to #t to enable the ReLock window supervision engine.

laser1:dl:lock:window:input-channel

(INTEGER parameter, read-write)

Parameter to select the signal that monitors the ReLock window.
For possible values, refer to the "Signal Channel IDs" section in appendix 4.1 on page 189.

laser1:dl:lock:window:level-high

(REAL parameter, read-write)

Parameter to determine the upper limit of the outer ReLock window (in V).

laser1:dl:lock:window:level-low

(REAL parameter, read-write)

Parameter to determine the lower limit of the outer ReLock window (in V).

laser1:dl:lock:window:level-hysteresis

(REAL parameter, read-write)

Parameter to determine the inner ReLock window by a voltage difference to the outer ReLock window limits (in V).

laser1:dl:lock:pid1:

(parameter section)

Parameters for the PID1 controller.

laser1:dl:lock:pid1:enabled

(BOOLEAN parameter, read-write)

Parameter to enable/disable the PID controller.
#t - PID controller enabled
#f - PID controller disabled

laser1:dl:lock:pid1:gain:

(parameter section)

Gain parameters for PID controller(s).

laser1:dl:lock:pid1:gain:all

(REAL parameter, read-write)

Parameter to control the overall gain. This parameter has no physical unit.

laser1:dl:lock:pid1:gain:p

(REAL parameter, read-write)

Parameter to control the proportional gain.
The unit of **:gain:p** is A/B.

A - unit of the **laser1:dl:lock:pid1:output-channel** parameter

B - unit of the **laser1:dl:lock:spectrum-input-channel** parameter

Example: The unit of the **:gain:p** parameter for a typical lock of the laser current to the *Fine In 1* input is mA/V.

laser1:dl:lock:pid1:gain:i

(REAL parameter, read-write)

Parameter to control the integral gain.
The unit of **:gain:i** is $\frac{A}{B \cdot ms}$.

A - unit of the **laser1:dl:lock:pid1:output-channel** parameter

B - unit of the **laser1:dl:lock:spectrum-input-channel** parameter

Example: The unit of the **:gain:i** parameter for a typical lock of the laser current to the *Fine In 1* input is $\frac{mA}{V \cdot ms}$.

laser1:dl:lock:pid1:gain:d

(REAL parameter, read-write)

Parameter to control the differential gain.
The unit of **:gain:d** is $\frac{A \cdot \mu s}{B}$.

A - unit of the **laser1:dl:lock:pid1:output-channel** parameter

B - unit of the **laser1:dl:lock:spectrum-input-channel** parameter

Example: The unit of the **:gain:d** parameter for a typical lock of the laser current to the *Fine In 1* input is $\frac{mA \cdot \mu s}{V}$.

laser1:dl:lock:pid1:gain:i-cutoff

(REAL parameter, read-write)

Parameter to determine the frequency limit (*I-cutoff*) for the integral PID gain (in Hz).

laser1:dl:lock:pid1:gain:i-cutoff-enabled

(BOOLEAN parameter, read-write)

Parameter to enable/disable a frequency limit (*I-cutoff*) for the integral PID gain (**:lock:pid1:gain:i-cutoff**).
#t - I-cutoff enabled
#f - I-cutoff disabled

laser1:dl:lock:pid1:gain:fc-ip

(REAL parameter, read-only)

Parameter indicating the transition frequency where the integral behavior of a PID controller changes to proportional behavior for lower frequencies (in Hz).

laser1:dl:lock:pid1:gain:fc-pd

(REAL parameter, read-only)

Parameter indicating the transition frequency where the proportional behavior of a PID controller changes to differential behavior (in Hz).

laser1:dl:lock:pid1:sign

(BOOLEAN parameter, read-write)

Sign of PID controller action. Usually set automatically when using the **laser1:dl:lock:select-lockpoint** command.

laser1:dl:lock:pid1:slope

(BOOLEAN parameter, read-write)

Slope of the signal to lock to. Usually set automatically when using the **laser1:dl:lock:select-lockpoint** command.

laser1:dl:lock:pid1:output-channel

(INTEGER parameter, read-write)

Parameter to select the signal channel to be controlled by the PID controller.
For possible values, refer to the "Signal Channel IDs" section in appendix 4.1 on page 189.

laser1:dl:lock:pid1:outputlimit:

(parameter section)

Parameters to specify limits for the PID output.

laser1:dl:lock:pid1:outputlimit:enabled

(BOOLEAN parameter, read-write)

Parameter to enable/disable PID output limits
#t - PID output limits enabled
#f - PID output limits disabled

laser1:dl:lock:pid1:outputlimit:max

(REAL parameter, read-write)

Parameter to control the maximum PID output value,
in units of the selected PID output channel (**laser1:dl:lock:pid[1/2]:output-channel**).
The output limit is symmetrical, ie, the PID output is limited to a range $-max \ldots + max$.

laser1:dl:lock:pid1:hold

(BOOLEAN parameter, read-write)

Parameter for pausing/holding the PID controller(s).
#t - hold the PID controller(s)
#f - do not hold the PID controller(s)

laser1:dl:lock:pid1:lock-state

(BOOLEAN parameter, read-only)

Parameter indicating whether the PID controller is in In-Lock state.
#t - The PID controller is enabled and the selected window signal is within the specified range.
#f - The PID controller is enabled and the selected window signal is out of the specified range.
Note: The parameter is set to *#f* if the PID controller is disabled.

laser1:dl:lock:pid1:hold-state

(BOOLEAN parameter, read-only)

Parameter indicating whether the PID controller is on hold.
#t - The PID controller is enabled but is set on hold. The PID controller can be set on hold via a software parameter or via the corresponding hardware line.
#f - The PID controller is enabled and no hold criterion (software parameter or hardware line) is set.
Note: The parameter is set to *#f* if the PID controller is disabled.

laser1:dl:lock:pid1:regulating-state

(BOOLEAN parameter, read-only)

Parameter indicating whether the PID controller is actually regulating.
#t - The PID controller algorithm is currently executed (**:lock-state**=#t; **:hold-state**=#f).
#f - The PID controller algorithm is not executed.
Note: The parameter is set to *#f* if the PID controller is disabled.

laser1:dl:lock:pid2:

(parameter section)

Parameters for the PID2 controller.

For usage see **laser1:dl:lock:pid1:** on page 54.

laser1:dl:lock:lockin:

(parameter section)

Parameters for the Lock-In detection engine.

laser1:dl:lock:lockin:modulation-enabled

(BOOLEAN parameter, read-write)

Parameter to enable/disable modulation of the output channel signal (**:output-channel**).
#t - apply modulation to the channel selected by **:output-channel**
#f - no modulation of the output channel signal

laser1:dl:lock:lockin:modulation-output-channel

(INTEGER parameter, read-write)

Parameter to specify the output channel the modulation is applied to.
For possible values, see the "Signal Channel IDs" section in appendix 4.1 on page 189.

laser1:dl:lock:lockin:frequency

(REAL parameter, read-write)

Parameter to control the modulation/demodulation frequency (in Hz).

laser1:dl:lock:lockin:amplitude

(REAL parameter, read-write)

Parameter to control the modulation amplitude.
Unit according to the **:modulation-output-channel** setting

laser1:dl:lock:lockin:phase-shift

(REAL parameter, read-write)

Parameter to control the phase difference between modulation and demodulation (in °). Used to optimize the demodulated Lock-In signal.

laser1:dl:lock:lockin:lock-level

(REAL parameter, read-write)

Parameter to control the setpoint level for top-of-fringe locks to compensate for an eventual DC offset in lock-in output signal.

laser1:dl:lock:lockin:auto-lir:

(parameter section)

Parameters for the automatic adjustment of the LIR phase-shift.

laser1:dl:lock:lockin:auto-lir:progress

(INTEGER parameter, read-only)

Parameter indicating the auto-lir progress in %.

laser1:dl:lock:lockin:auto-lir:auto-lir

(command, no arguments, returns empty tuple)

Command to automatically set the phase difference between the modulation and the error signal for the master lock-in.

laser1:dl:lock:lockpoint:

(parameter section)

Parameter indicating the selected lock point.

laser1:dl:lock:lockpoint:position

(COORDINATE parameter, read-only)
Type COORDINATE is defined as a tuple (x y) of types (REAL REAL).

Parameter indicating the X/Y position of the currently selected lock point.
X value: unit of the scan output channel (**:scan:output-channel**).
Y value: unit of the lock input channel (**:lock:spectrum-input-channel**).

laser1:dl:lock:lockpoint:type

(STRING parameter, read-only)

Parameter indicating the lock point position on the lock input signal:

none - no lock point selected

top - selected lock point is a peak

bottom - selected lock point is a trough

positive-edge - selected lock point is on a rising edge

negative-edge - selected lock point is on a falling edge

laser1:dl:lock:candidate-filter:

(parameter section)

Filter settings for searching for lock point candidates. The settings are changed automatically if the **:lock:type** setting is changed.

laser1:dl:lock:candidate-filter:top

(BOOLEAN parameter, read-write)

#t - Search for lock point candidates shall find peaks.

laser1:dl:lock:candidate-filter:bottom

(BOOLEAN parameter, read-write)

#t - Search for lock point candidates shall find troughs.

laser1:dl:lock:candidate-filter:positive-edge

(BOOLEAN parameter, read-write)

#t - search for lock point candidates shall find rising edges.

laser1:dl:lock:candidate-filter:negative-edge

(BOOLEAN parameter, read-write)

#t - search for lock point candidates shall find falling edges.

laser1:dl:lock:candidate-filter:edge-level

(REAL parameter, read-write)

Parameter to specify the level for edge detection.
Value range according to the lock input channel (**:lock:spectrum-input-channel**) in V.

laser1:dl:lock:candidate-filter:peak-noise-tolerance

(REAL parameter, read-write)

Parameter to control the noise tolerance for peak detection.
Specify the maximimum expected signal modulation caused by noise in the lock input signal (in V).
Lock input signal modulation below the **:peak-noise-tolerance** threshold is ignored for peak detection.
0 - enables automatic noise detection.

laser1:dl:lock:candidate-filter:edge-min-distance

(INTEGER parameter, read-write)

Parameter to specify the minimum distance of adjacent signal cross-overs of the lock input signal and the edge detection level.
Signal cross-overs within the **:edge-min-distance** are considered a single lockpoint.
Unit: number of signal sampling points

laser1:dl:lock:candidates

(BINARY parameter, read-only)

Parameter indicating lock point candidate data for display in the DLCpro GUI (in binary format).
The parameter value is provided in the format decribed in Appendix 4.2. It contains data blocks with IDs *'s'*, *'l'*, *'c'* and *'t'*.

laser1:dl:lock:locking-delay

(INTEGER parameter, read-write)

Parameter to set the locking delay time (in ms). After a **:lock:close** command, the lock module stays in the LOCKING state for the specified time. During the locking delay time, the scope engine is paused and shows the signal trace at the locking time.

laser1:dl:lock:background-trace

(BINARY parameter, read-only)

Parameter indicating the X/Y coordinate data for the background trace in the DLCpro GUIs. The parameter provides the last scan trace before the lock was closed. The parameter value is provided in the format decribed in Appendix 4.2. It contains data blocks with IDs *'x'* and *'y'*.
If the lock is not closed, **:background-trace** is empty.

laser1:dl:lock:lock-tracking

(COORDINATE parameter, read-only)
Type COORDINATE is defined as a tuple (x y) of types (REAL REAL).

Parameter indicating the X/Y position of the center-of-mass of the acquired X and Y trace.
X value: unit of the scan output channel (**:scan:output-channel**).
Y value: unit of the lock input channel (**:lock:spectrum-input-channel**).
The center-of-mass is only available while the lock is closed and while the scope is working in XY mode. In all other cases this parameter returns (0 0).

laser1:dl:lock:show-candidates

(command, no arguments, returns INTEGER)

Command to print a list of lock point candidates to the console and display the number of lock point candidates.

laser1:dl:lock:find-candidates

(command, no arguments, returns empty tuple)

Command to put the autolock module into *Selecting* mode. For each scan, the lock point candidates are determined according to the settings in **:lock:candidate-filter**.

laser1:dl:lock:select-lockpoint

(command, 3 arguments, returns empty tuple)

Arguments:

1. *x* of type REAL
2. *y* of type REAL
3. *type* of type INTEGER

Command to put the lock module into *Selected* mode. The given x/y coordinates and the given lock type are set as lock point settings.
The x-coordinate is in units of the signal selected by **laser1:scan:output-channel**.
The y-coordinate is in units of the signal selected by **laser1:dl:lock:spectrum-input-channel**.
The lock type must comply with the lock mode selected in **laser1:dl:lock:type**.
For the "Top of Fringe" lock mode, the following lock types can be specified:

0 - candidate (set lockpoint to the closest extremum, according to candidate filter)

1 - top (set lockpoint to the closest peak)

2 - bottom (set lockpoint to the closest trough)

For the "Side of-Fringe" lock mode, the following lock types can be specified:

0 - candidate (set lockpoint to the closest edge, according to candidate filter)

3 - positive-edge (set lockpoint to the closest rising edge)

4 - negative-edge (set lockpoint to the closest falling edge)

The point of the specified lock type, that is closest to the given x-coordinate in the spectrum input trace, is selected as lockpoint.
For "Side of Fringe" lockpoints, the y-coordinate provides the new setpoint for the PID controllers and the new **:edge-level** for the candidate filter.
For "Top of Fringe" lockpoints, the y-coordinate is ignored.

laser1:dl:lock:close

(command, no arguments, returns empty tuple)

Command to close the lock. The command can be successfully executed only if one of the following conditions is fullfilled:
1. **:lock-without-lockpoint** is #f and the lock module is in *Selected* state.
2. **:lock-without-lockpoint** is #t and the lock module is in *Scanning* state.

If :lock-without-lockpoint is #f, the command initiates the following steps:

1. The PID controllers are configured (slope, setpoint) according to the currently selected lockpoint.
2. A trace of the spectrum input signal is acquired and stored as **:background-trace** for the signal display.
3. A trigger mechanism is configured: When the scan reaches the lockpoint position (scan generator and input signal) during the next scan period, the PID controllers are automatically enabled.
4. The lock module is set to the *"Locking"* state.
5. The trigger is activated and shortly later, the PID controllers lock to the desired lockpoint. The scan is disabled automatically.
6. Another trace of the spectrum input signal is acquired, showing how the scan module scans up to the desired lockpoint and how the PID controllers subsequently lock the laser.
7. The command finishes.

If **:lock-without-lockpoint** is #t, PID setpoint and sign must have been configured reasonably before. The **:close** command initiates the following steps:

1. If the scope is in XY mode, a trace of the spectrum input signal is acquired and stored as **:background-trace** for the signal display.
2. A trigger mechanism is configured: When the scan generator reaches the center position (**laser1:scan:offset**) during the next scan period, the PID controllers are automatically enabled.
3. The lock module is set to the *"Locking"* state.
4. The trigger is activated and shortly later, the PID controllers are enabled and the scan is disabled automatically.

5. Another trace of the spectrum input signal is acquired, showing how the scan module scans up to the scan center and how the PID controllers subsequently lock the laser.
6. The command finishes.

To better visualize the brief interval when the lock is closed, the scope engine is paused and the last trace is returned in **laser1:scope:data** for a time period specified in **laser1:dl:lock:locking-delay**. After the locking delay time has expired, the lock module is automatically set to the *"Locked"* state.

laser1:dl:lock:open

(command, no arguments, returns empty tuple)

Command to open the lock. The command is ignored if the lock module is not in *locked* state.
Otherwise, the command disables the PID controllerss and sets the lock module back to the state before the **:close** command was executed.
Also, the command re-enables the scan generator.

laser1:dl:pressure-compensation:

(parameter section)

Linear air pressure compensation.
The pressure compensation allows to adapt the geometrical ECDL cavity length to changes in the laser wavelength, resulting from pressure change induced variation of the refractive index of the air. For this the voltage of the cavity piezo is changed (dU) linearly with air pressure changes (dp) according to $dU = \frac{dU}{dp} \cdot dp$. The factor $\frac{dU}{dp}$ must be given by the parameter **laser1:dl:pressure-compensation:factor**.

laser1:dl:pressure-compensation:enabled

(BOOLEAN parameter, read-write)

Parameter to enabled/disable automatic pressure compensation.
#t - enable pressure compensation
#f - disable pressure compensation.

laser1:dl:pressure-compensation:air-pressure

(REAL parameter, read-only)

Parameter indicating the averaged air pressure measured by the pressure sensor (in hPa).

laser1:dl:pressure-compensation:factor

(REAL parameter, read-write)

Parameter to specify the factor for linear air pressure compensation in units of $\frac{V}{hPa}$.

laser1:dl:pressure-compensation:compensation-voltage

(REAL parameter, read-only)

Parameter indicating the overall voltage difference in V applied to the PC channel by the pressure compensation.

laser1:dl:pd:

(parameter section)

Access to the calibration of the internal master laser power. (Only available for certain laser heads.)

laser1:dl:pd:power

(REAL parameter, read-only)

Parameter indicating the power level in mW.

laser1:dl:pd:cal-offset

(REAL parameter, read-only)

Parameter to specify the calibration offset for the photodiode in V.

laser1:dl:pd:cal-factor

(REAL parameter, read-only)

Parameter to specify the calibration factor for the photodiode in mW/V.

laser1:dl:factory-settings:

(parameter section)

Factory settings for the most important laser parameters.
These settings are only available for non-legacy laser heads with an EEPROM (**laser1:dl:legacy** = #f)

laser1:dl:factory-settings:wavelength

(REAL parameter, read-only)

Parameter indicating the specified laser wavelength (in nanometer).

laser1:dl:factory-settings:threshold-current

(REAL parameter, read-only)

Parameter indicating the threshold current as determined during production (in mA).

laser1:dl:factory-settings:power

(REAL parameter, read-only)

Parameter indicating the output power measured under factory settings during production (in mW).

laser1:dl:factory-settings:cc:

(parameter section)

Factory settings for the current controller (CC).

laser1:dl:factory-settings:cc:feedforward-factor

(REAL parameter, read-only)

Parameter indicating the setting for parameter **laser1:dl:cc:feedforward-factor** used for measurements during production.

laser1:dl:factory-settings:cc:current-set

(REAL parameter, read-only)

Parameter indicating the setting for parameter **laser1:dl:cc:current-set** used for measurements during production.

laser1:dl:factory-settings:cc:current-clip

(REAL parameter, read-only)

Parameter indicating the factory setting for the parameters **laser1:dl:cc:current-clip** and **laser1:dl:cc:current-clip-limit**.

laser1:dl:factory-settings:cc:voltage-clip

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **laser1:dl:cc:voltage-clip**.

laser1:dl:factory-settings:cc:positive-polarity

(BOOLEAN parameter, read-only)

Parameter indicating the factory setting for parameter **laser1:dl:cc:positive-polarity**.

laser1:dl:factory-settings:cc:snubber

(BOOLEAN parameter, read-only)

Parameter indicating the factory setting for parameter **laser1:dl:cc:snubber**.

laser1:dl:factory-settings:tc:

(parameter section)

Factory settings for the temperature controller (TC).

laser1:dl:factory-settings:tc:temp-min

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **tc:temp-set-min**.
The parameter **tc:limits:temp-min** is set to 2K below this value if this result is below 15°C. Otherwise **tc:limits:temp-min** is set to 15°C.

laser1:dl:factory-settings:tc:temp-max

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **tc:temp-set-max**.
The parameter **tc:limits:temp-max** is set to 2K above this value if this result is above 30°C.Otherwise **tc:limits:temp-max** is set to 30°C.

laser1:dl:factory-settings:tc:temp-set

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **tc:temp-set**.

laser1:dl:factory-settings:tc:temp-roc-enabled

(BOOLEAN parameter, read-only)

Parameter indicating the factory setting for parameter **tc:temp-roc-enabled**.

laser1:dl:factory-settings:tc:temp-roc-limit

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **tc:temp-roc-limit**.

laser1:dl:factory-settings:tc:current-max

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **tc:current-set-max**.

laser1:dl:factory-settings:tc:current-min

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **tc:current-set-min**.

laser1:dl:factory-settings:tc:p-gain

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **tc:t-loop:p-gain**.

laser1:dl:factory-settings:tc:i-gain

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **tc:t-loop:i-gain**.

laser1:dl:factory-settings:tc:d-gain

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **tc:t-loop:d-gain**.

laser1:dl:factory-settings:tc:c-gain

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **tc:c-loop:i-gain**.

laser1:dl:factory-settings:tc:ok-tolerance

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **tc:t-loop:ok-tolerance**.

laser1:dl:factory-settings:tc:ok-time

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **tc:t-loop:ok-time**.

laser1:dl:factory-settings:tc:timeout

(INTEGER parameter, read-only)

Parameter indicating the factory setting for parameter **tc:limits:timeout**.

laser1:dl:factory-settings:tc:power-source

(INTEGER parameter, read-only)

Parameter indicating the factory setting for parameter **tc:power-source**.

laser1:dl:factory-settings:tc:ntc-series-resistance

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **tc:ntc-series-resistance**.

laser1:dl:factory-settings:tc:ntc-parallel-resistance

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **tc:ntc-parallel-resistance**.

laser1:dl:factory-settings:pc:

(parameter section)

Factory settings for the piezo controller (PC).

laser1:dl:factory-settings:pc:voltage-min

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **laser1:dl:pc:voltage-min**.

laser1:dl:factory-settings:pc:voltage-max

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **laser1:dl:pc:voltage-max**.

laser1:dl:factory-settings:pc:feedforward-enabled

(BOOLEAN parameter, read-only)

Factory setting for **laser1:dl:pc:feedforward-enabled**.

laser1:dl:factory-settings:pc:feedforward-factor

(REAL parameter, read-only)

Factory setting for **laser1:dl:pc:feedforward-factor**.

laser1:dl:factory-settings:pc:capacitance

(REAL parameter, read-only)

Parameter indicating the piezo capacitance, measured during production (in μF).

laser1:dl:factory-settings:pc:scan-offset

(REAL parameter, read-only)

Parameter indicating the setting for parameter **laser1:scan:offset** used for measurements during production.

laser1:dl:factory-settings:pc:scan-amplitude

(REAL parameter, read-only)

Parameter indicating the setting for parameter **laser1:scan:amplitude** used for measurements during production.

laser1:dl:factory-settings:pc:slew-rate

(REAL parameter, read-only)

Parameter indicating the setting for parameter **laser1:dl:pc:output-filter:slew-rate** recommended by TOPTICA.

laser1:dl:factory-settings:pc:slew-rate-enabled

(BOOLEAN parameter, read-only)

Parameter indicating the setting for parameter **laser1:dl:pc:output-filter:slew-rate-enabled**.

laser1:dl:factory-settings:pc:pressure-compensation-factor

(REAL parameter, read-only)

Parameter indicating the setting for parameter **laser1:dl:pressure-compensation:factor**.

laser1:dl:factory-settings:pd:

(parameter section)

Factory settings for the laser power calibration. (Only available for certain laser heads)

laser1:dl:factory-settings:pd:cal-offset

(REAL parameter, read-only)

Parameter to specify the factory setting for the photodiode's calibration offset in V.

laser1:dl:factory-settings:pd:cal-factor

(REAL parameter, read-only)

Parameter to specify the factory setting for the photodiode's calibration factor in mW/V.

laser1:dl:factory-settings:apply

(command, no arguments, returns empty tuple)

This command applies to all factory settings for the respecive CC, PC, TC channels etc.

laser1:ctl:

(parameter section)

Parameters of the CTL head.

laser1:ctl:fpga-fw-ver

(INTEGER parameter, read-only)

Parameter indicating the firmware version of the CTL head FPGA.

laser1:ctl:wavelength-set

(REAL parameter, read-write)

Parameter to set the desired wavelength in nm.
Changing the value of this parameter will start the motor. The motor will then move with maximum velocity to the posititon attributed to the desired wavelength, according to the internal calibration.

laser1:ctl:wavelength-act

(REAL parameter, read-only)

Parameter indicating the actual wavelength in nm.
The value indicated here is calculated from the motor position, according to the internal calibration.

laser1:ctl:wavelength-min

(REAL parameter, read-only)

Parameter indicating the minimum wavelength in nm.

laser1:ctl:wavelength-max

(REAL parameter, read-only)

Parameter indicating the maximum wavelength in nm.

laser1:ctl:tuning-current-min

(REAL parameter, read-only)

Parameter indicating the minimum current in mA, required for proper mode-hope free operation of the CTL.
The value is only informative. It's still possible to choose lower laser currents.

laser1:ctl:tuning-power-min

(REAL parameter, read-only)

Parameter indicating the minimum power in mW, required for proper mode-hope free operation of the CTL. It is also the lower limit for the setvalue of the power stabilization.

laser1:ctl:state

(INTEGER parameter, read-only)

Parameter indicating the current state of the CTL scan engine:

-100 - ERROR
-90 - Standby
-8 - Motor referencing and FLOW initialization in progress
-7 - FLOW initialization in progress
-6 - Motor not referenced, yet
-5 - Motor referencing in progress
-4 - Motor referenced
-3 - Drift compensation in progress
-2 - FLOW optimization in progress
-1 - SMILE optimization in progress
0 - Idle/Stopped
1 - Target set wavelength is about to be reached
2 - Starting motor scan
3 - Scan in progress
4 - Restarting scan
5 - Paused
6 - Remotely controlled

laser1:ctl:state-txt

(STRING parameter, read-only)

Parameter indicating the state of the CTL scan engine as a text.

laser1:ctl:head-temperature

(REAL parameter, read-only)

Parameter indicating the temperature inside the CTL laser head in $°C$.

laser1:ctl:optimization:

(parameter section)

CTL SMILE (Single Mode Intelligent Loop Engine) and FLOW (Feedback Light Optimization Wizard) optimization control.

laser1:ctl:optimization:progress

(INTEGER parameter, read-only)

Parameter indicating the progress of the SMILE or FLOW optimization in percent.

laser1:ctl:optimization:smile

(command, no arguments, returns empty tuple)

Command to start optimization of SMILE parameters. Updates CTL state in **:ctl:state**. Abort with **:ctl:optimization:abort**.

laser1:ctl:optimization:flow

(command, no arguments, returns empty tuple)

Command to start FLOW optimization followed by an optimization of SMILE parameters. Updates CTL state in **:ctl:state**. Abort with **:ctl:optimization:abort**.

laser1:ctl:optimization:abort

(command, no arguments, returns empty tuple)

Command to abort currently running SMILE or FLOW optimization procedure.

laser1:ctl:remote-control:

(parameter section)

Parameter to configure CTL analog remote control.
With analog remote control it's possible to control the wavelength of the laser with a voltage applied to one of the DLC pro's frontpanel inputs.

laser1:ctl:remote-control:signal

(INTEGER parameter, read-write)

Parameter to specify the input signal to be used for CTL analog remote control.
For possible values, refer to the "Signal Channel IDs" section in appendix 4.1 on page 189.

laser1:ctl:remote-control:factor

(REAL parameter, read-write)

Parameter specifying the factor to be applied to the input signal in nm/V.
NOTE: Remote control by a voltage is not linear in wavelengths, but in motor positions. The factor specified with parameter is only valid around the currently set wavelength.

laser1:ctl:remote-control:enabled

(BOOLEAN parameter, read-write)

Parameter to enabled/disabled analog remote control.

laser1:ctl:mode-control:

(parameter section)

Parameters and commands related to SMILE.

laser1:ctl:mode-control:loop-enabled

(BOOLEAN parameter, read-write)

Parameter to enable/disable SMILE.

laser1:ctl:motor:

(parameter section)

CTL motor control parameters.

laser1:ctl:motor:position-accuracy-fullstep

(INTEGER parameter, read-only)

Parameter for setting the motor position accuracy (in arbitrary units) for full-step operation. Default value is 8. When approaching its set wavelength, the motor stops when the measured position differs from the set position by less than the accuracy in arbitrary units. If this value is too small, the motor might jump back and forth between two positions instead of stopping.

laser1:ctl:motor:position-hysteresis-fullstep

(INTEGER parameter, read-only)

Parameter for setting the motor position hysteresis (in arbitrary units)for full-step operation. Once the motor stopped, it will not start moving again before the measured position differs from the set position by more than position-accuracy+position-hysteresis. In unsteady environment, the laser might show small drifts. This is compensated by changing the motor position until the configured accuracy is again reached. By increasing this value, unwanted motor steps can be prevented.

laser1:ctl:motor:position-accuracy-microstep

(INTEGER parameter, read-only)

Parameter for setting the motor position accuracy (in arbitrary units) for micro-step operation. Default value is 2. See **:position-accuracy-fullstep** for details.

laser1:ctl:motor:position-hysteresis-microstep

(INTEGER parameter, read-only)

Parameter for setting the motor position hysteresis (in arbitrary units) for micro-step operation. See **:position-hysteresis-fullstep** for details.

laser1:ctl:motor:microsteps

(BOOLEAN parameter, read-write)

Paramter to specify whether microstepping should be used when possible.
Microstepping leads to smoother scans for low scan speeds. If this parameter is set to #t, microstepping will be used for speeds up to about 50% of the maximum speed specified by **:speed-max**. If this parameter is set to #f microstepping will not be used.

laser1:ctl:motor:power-save-disabled

(BOOLEAN parameter, read-only)

Parameter for enabling/disabling a "dead zone" around the target position inside which the motor is automatically disabled to save power and avoid heat generation.
#t - dead zone is deactivated, motor is always on
#f - dead zone is activated, motor is switched off after having reached the target position
Note: When **:power-save-disabled** is set to #f motor microsteps are disabled automatically and can not be activated unless power-save-disabled is set to #t.

laser1:ctl:power:

(parameter section)

Parameters related to the output power level of the CTL as measured by an CTL head internal photodiode.

laser1:ctl:power:power-act

(REAL parameter, read-only)

Parameter indicating the approximate output power level of the CTL in mW.

laser1:ctl:factory-settings:

(parameter section)

Factory settings for CTL operation.

laser1:ctl:factory-settings:wavelength-min

(REAL parameter, read-only)

Parameter indicating the setting for parameter **laser1:ctl:wavelength-min**.

laser1:ctl:factory-settings:wavelength-max

(REAL parameter, read-only)

Parameter indicating the setting for parameter **laser1:ctl:wavelength-max**.

laser1:ctl:factory-settings:tuning-current-min

(REAL parameter, read-only)

Parameter indicating the setting for parameter **laser1:ctl:tuning-current-min**.

laser1:ctl:factory-settings:tuning-power-min

(REAL parameter, read-only)

Parameter indicating the setting for parameter **laser1:ctl:tuning-power-min**.

laser1:ctl:factory-settings:apply

(command, no arguments, returns empty tuple)

Command to apply factory settings (originally read from EEPROM) to active CTL parameters in DLC pro.

laser1:amp:

(parameter section)

Parameters of the laser power amplifier stage.

laser1:amp:legacy

(BOOLEAN parameter, read-only)

Parameter indicating whether a legacy laser head - without factory settings stored in EEPROM - is connected to the DLCpro.
#t - legacy laser head connected; factory settings cannot be identified
#f - TOPTICA laser head factory settings stored in EEPROM

laser1:amp:type

(STRING parameter, read-only)

Parameter indicating the type of amplifier head, e.g. "TApro".
For a legacy laser head - without factory settings stored in EEPROM - this parameter returns *"legacy amplifier"*. Possible values are:
- TApro/amplifier
- DFB-TApro/amplifier

- TA-SHGpro/amplifier
- DFB-TA-SHGpro/amplifier
- TA-FHGpro/amplifier
- DFB-TA-FHGpro/amplifier
- legacy amplifier

laser1:amp:version

(STRING parameter, read-only)

Parameter indicating the version of the laser head hardware, e.g. "3V1".
For a legacy laser head - without factory settings stored in EEPROM - this parameter returns *"unknown"*.

laser1:amp:serial-number

(STRING parameter, read-only)

Parameter indicating the serial number of the laser head, e.g. "020000".
For a legacy laser head - without factory settings stored in EEPROM - this parameter returns *"unknown"*.

laser1:amp:fru-serial-number

(STRING parameter, read-only)

Parameter indicating the serial number of the laser-diode unit.

laser1:amp:ontime

(INTEGER parameter, read-only)

Parameter indicating the accumulated time (in seconds) the laser has been emitting.
For a legacy laser head - without factory settings stored in EEPROM - this parameter returns *0*.

laser1:amp:ontime-txt

(STRING parameter, read-only)

Formatted string for the accumulated laser emission time:
hours:minutes:seconds
For a legacy laser head - without factory settings stored in EEPROM - this parameter returns *"0:00:00"*.

laser1:amp:cc:

(parameter section)

Current control channel of power amplifier.

laser1:amp:cc:path

(STRING parameter, read-only)

Parameter describing the hardware location of the current control (CC-5000) channel. Example: "ampcc1:channel1" indicates the current channel of the first 5A current controller.

laser1:amp:cc:variant

(STRING parameter, read-only)

Parameter describing the hardware variant of the current control (CC-5000) channel. For example, "5000 mA" or "10000 mA"

laser1:amp:cc:enabled

(BOOLEAN parameter, read-write)

Parameter to switch the amplifier on/off:
#t - laser emission on
#f - laser emission off

laser1:amp:cc:emission

(BOOLEAN parameter, read-only)

Parameter indicating the amplifier emission status.
#t - all criteria for laser emission are fulfilled. Laser radiation should be emitted from this channel's amplifier.
#f - if laser emission is not possible for one of the following reasons:
- interlock circuit is open.
- the front panel key swicth is "off".
- the laser emission push button on the frontpanel is not pressed.
- laser emission is disabled by the software.

laser1:amp:cc:current-set

(REAL parameter, read-write)

Parameter to set the desired amplifier chip current in mA.
If **laser1:amp:cc:feedforward-enabled** is #t, **laser1:amp:cc:current-set** is determined as follows:

laser1:amp:cc:current-set = **laser1:amp:cc:current-offset** + **laser1:amp:cc:feedforward-factor** * (**laser1:dl:pc:voltage-set** - 69.5 V)
This parameter setting affects the **laser1:amp:cc:current-offset** value.

laser1:amp:cc:current-offset

(REAL parameter, read-write)

Parameter to specify the amplifier chip current without Feed Forward contribution (in mA).
This parameter setting affects the **laser1:amp:cc:current-set** value.

laser1:amp:cc:output-filter:

(parameter section)

Parameters to configure output filters such as slew rate.

For usage see **laser1:dl:cc:output-filter:** on page 41.

laser1:amp:cc:current-act

(REAL parameter, read-only)

Parameter indicating the measured value of the amplifier chip current in mA. Usually, this is the current flowing through the amplifier chip. However, if the safety circuitry shorts the current output, this is not true.

laser1:amp:cc:current-clip

(REAL parameter, read-write)

Parameter to specify the maximum allowed current (in mA) for this channel's amplifier chip.

laser1:amp:cc:current-clip-limit

(REAL parameter, read-only)

Parameter to specify the maximum value for the **:current-clip** parameter (in mA). IMPORTANT: To be specified only for legacy laser heads (without factory settings stored in EEPROM; **:legacy** = #t).
.

laser1:amp:cc:voltage-act

(REAL parameter, read-only)

Parameter indicating the measured value of the voltage applied to the amplifier chip (in V).

laser1:amp:cc:voltage-out

(REAL parameter, read-only)

Parameter indicating the measured value of the voltage at the voltage fuse (in V).

laser1:amp:cc:voltage-clip

(REAL parameter, read-only)

Parameter to specify the maximum allowed voltage (in V) for this channel's amplifier chip.
Can be changed only for legacy laser heads (without factory settings stored in EEPROM).

laser1:amp:cc:feedforward-enabled

(BOOLEAN parameter, read-write)

Parameter to enable/disable Feed Forward for this current control channel.
#t - Feed Forward enabled
#f - Feed Forward disabled
If enabled, a current proportional to another channel's output is added to this channel. The other channel is defined by the **laser1:feedforward-master** parameter.

laser1:amp:cc:feedforward-factor

(REAL parameter, read-write)

Parameter to control how much of the piezo channel's output is to be added to the current channel (in mA/V).

laser1:amp:cc:aux

(REAL parameter, read-only)

Parameter indicating the measured voltage in V at the AUX input.

laser1:amp:cc:status

(INTEGER parameter, read-only)

Parameter providing channel status information. Each bit of the integer value provides specific channel status information.

bit 0 - emission
bit 1 - enabled
bit 2 - inverter in constant-current mode
bit 3 - inverter dummyload enabled
bit 4 - crowbar enabled (protective short circuit)
bit 5 - DAC enabled
bit 6 - current clip
bit 7 - voltage clip
bit 12 - DAC not initialized
bit 11 - shortcircuit detected
bit 12 - channel forced to be off bei health monitoring

laser1:amp:cc:status-txt

(STRING parameter, read-only)

Parameter providing a brief text version of the **:status** parameter.

laser1:amp:tc:

(parameter section)

The **laser1:tec** section provides parameters related to the temperature controller for laser 1's power amplifier.

For usage see **laser1:dl:tc:** on page 44.

laser1:amp:pd:

(parameter section)

Amplifier monitoring photodiodes.

laser1:amp:pd:seed:

(parameter section)

Access to the calibration of the amplifier's seed power monitoring photodiode (only available for certain laser heads.)

For usage see **laser1:dl:pd:** on page 65.

laser1:amp:pd:amp:

(parameter section)

Access to the calibration of the amplifier's output power monitoring photodiode (only available for certain laser heads.)

For usage see **laser1:dl:pd:** on page 65.

laser1:amp:seed-limits:

(parameter section)

The amplifier's seed power is measured with a photodiode inside the TApro and the ADC of the CC-500 SMB input ch1. The seed power must be within a certain range of power levels to ensure proper operation and long lifetime for the amplifier.

laser1:amp:seed-limits:power

(REAL parameter, read-only)

Parameter indicateing the power level in mW.

laser1:amp:seed-limits:power-min

(REAL parameter, read-only)

Parameter to specify the minimum required seed power in mW.

laser1:amp:seed-limits:power-min-warning-delay

(REAL parameter, read-only)

Parameter to specify the time in seconds, the seed power is tolerated to be below **:power-min** before a warning message is issued.

laser1:amp:seed-limits:power-min-shutdown-delay

(REAL parameter, read-only)

Parameter to specify the time in seconds, the seed power is tolerated to be below **:power-min** before a warning the amplifier is switched off.

laser1:amp:seed-limits:power-max

(REAL parameter, read-only)

Parameter to specify the minimum required power in mW.

laser1:amp:seed-limits:power-max-warning-delay

(REAL parameter, read-only)

Parameter to specify the time in seconds, the seed power is tolerated to be above **:power-max** before a warning message is issued.

laser1:amp:seed-limits:power-max-shutdown-delay

(REAL parameter, read-only)

Parameter to specify the time in seconds, the seed power is tolerated to be above **:power-max** before a warning the amplifier is switched off.

laser1:amp:seed-limits:status

(INTEGER parameter, read-only)

Parameter indicating status information about the power monitoring. Each bit provides specific information.

bit 0 - actual power below minimum

bit 1 - minimum power warning

bit 2 - minimum power shutdown

bit 3 - actual power exceeds maximum

bit 4 - maximum power warning

bit 5 - maximum power shutdown

bit 6 - photodiode detached

laser1:amp:seed-limits:status-txt

(STRING parameter, read-only)

Parameter providing a brief text version of the **:status** parameter.

laser1:amp:output-limits:

(parameter section)

The amplifier's output power is measured with a photodiode inside the TApro and the ADC of the CC-5000 SMB input ch1. The output power must be within a certain range of power levels to ensure proper operation and long lifetime for the amplifier.

For usage see **laser1:amp:seed-limits:** on page 80.

laser1:amp:seedonly-check:

(parameter section)

The amplifier must not be seeded while it is switched off (*seed without pump*). The parameters in this section configure when the seed is switched off in such a case.

laser1:amp:seedonly-check:warning-delay

(REAL parameter, read-only)

Parameter to specify the time in seconds, the seed laser is tolerated to be on with the amplifier being off before a warning message is issued.

laser1:amp:seedonly-check:shutdown-delay

(REAL parameter, read-only)

Parameter to specify the time in seconds, the seed laser is tolerated to be on with the amplifier being off before a warning the seed laser is switched off.

laser1:amp:seedonly-check:status

(INTEGER parameter, read-only)

Parameter indicating status information about the power monitoring. Each bit provides specific information.

bit 0 - emission conflict

bit 1 - emission conflict warning

bit 2 - emission conflict shutdown

laser1:amp:seedonly-check:status-txt

(STRING parameter, read-only)

Parameter providing a brief text version of the **:status** parameter.

laser1:amp:factory-settings:

(parameter section)

Factory settings for the most important amplifier parameters.
These settings are only available for non-legacy amplifier heads with an EEPROM (**laser1:amp:legacy** = #f)

laser1:amp:factory-settings:wavelength

(REAL parameter, read-only)

Parameter indicating the specified laser wavelength of the amplifier (in nanometer).

laser1:amp:factory-settings:power

(REAL parameter, read-only)

Parameter indicating the amplifier output power measured under factory settings during production (in mW).

laser1:amp:factory-settings:cc:

(parameter section)

Factory settings for the amplifier current controller (CC).

laser1:amp:factory-settings:cc:feedforward-factor

(REAL parameter, read-only)

Parameter indicating the setting for parameter **laser1:amp:cc:feedforward-factor** used for measurements during production.

laser1:amp:factory-settings:cc:current-set

(REAL parameter, read-only)

Parameter indicating the setting for parameter **laser1:amp:cc:current-set** used for measurements during production.

laser1:amp:factory-settings:cc:current-clip

(REAL parameter, read-only)

Parameter indicating the factory setting for the parameters **laser1:amp:cc:current-clip** and **laser1:amp:cc:current-clip-limit**.

laser1:amp:factory-settings:cc:voltage-clip

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **laser1:amp:cc:voltage-clip**.

laser1:amp:factory-settings:tc:

(parameter section)

Factory settings for the amplifier temperature controller (TC).

For usage see **laser1:dl:factory-settings:tc:** on page 66.

laser1:amp:factory-settings:pd:

(parameter section)

Factory settings for the Amplifier monitoring photodiodes.

laser1:amp:factory-settings:pd:seed:

(parameter section)

Factory settings for the calibration of the amplifier's seed power monitoring photodiode (only available for certain laser heads.)

For usage see **laser1:dl:factory-settings:pd:** on page 69.

laser1:amp:factory-settings:pd:amp:

(parameter section)

Factory settings for the calibration of the amplifier's output power monitoring photodiode (only available for certain laser heads.)

For usage see **laser1:dl:factory-settings:pd:** on page 69.

laser1:amp:factory-settings:seed-limits:

(parameter section)

Factory settings for the seed laser power monitoring.

laser1:amp:factory-settings:seed-limits:power-min

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **laser1:amp:seed-limits:power-min**.

laser1:amp:factory-settings:seed-limits:power-min-warning-delay

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **laser1:amp:seed-limits:power-min-warning-delay**.

laser1:amp:factory-settings:seed-limits:power-min-shutdown-delay

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **laser1:amp:seed-limits:power-min-shutdown-delay**.

laser1:amp:factory-settings:seed-limits:power-max

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **laser1:amp:seed-limits:power-max**.

laser1:amp:factory-settings:seed-limits:power-max-warning-delay

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **laser1:amp:seed-limits:power-max-warning-delay**.

laser1:amp:factory-settings:seed-limits:power-max-shutdown-delay

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **laser1:amp:seed-limits:power-max-shutdown-delay**.

laser1:amp:factory-settings:output-limits:

(parameter section)

Factory settings for the amplifier output power monitoring.

For usage see **laser1:amp:factory-settings:seed-limits:** on page 84.

laser1:amp:factory-settings:seedonly-check:

(parameter section)

Factory settings for the amplifier *seed-without-pump* check.

laser1:amp:factory-settings:seedonly-check:warning-delay

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **laser1:amp:seedonly-check:warning-delay**.

laser1:amp:factory-settings:seedonly-check:shutdown-delay

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **laser1:amp:seedonly-check:shutdown-delay**.

laser1:amp:factory-settings:apply

(command, no arguments, returns empty tuple)

Command to apply all factory settings for the respective CC, PC, TC channels etc.

laser1:dpss:

(parameter section)

Parameters for the diode-pumped solid state (DPSS) laser.

laser1:dpss:enabled

(BOOLEAN parameter, read-write)

Parameter to specify the DPSS laser on/off state.

laser1:dpss:status

(INTEGER parameter, read-only)

Parameter indicating the DPSS laser status.

laser1:dpss:status-txt

(STRING parameter, read-only)

Parameter indicating the Cobolt LED status in a textual form.

laser1:dpss:tc-status

(INTEGER parameter, read-only)

Parameter indicating the status of the DPSS' TECs.

1 - TECs have reached the set temperature
0 - TECs are regulating and have reached the set temperature yet
-1 - Temperature error

laser1:dpss:tc-status-txt

(STRING parameter, read-only)

Parameter indicating the status of the DPSS' TECs in a textual form.

laser1:dpss:error-code

(INTEGER parameter, read-only)

Parameter indicating the DPSS laser fault status.

laser1:dpss:error-txt

(STRING parameter, read-only)

Parameter indicating the DPSS laser fault status in a textual form.

laser1:dpss:operation-time

(REAL parameter, read-only)

Parameter indicating the DPSS laser operation time (in hours).

laser1:dpss:power-set

(REAL parameter, read-write)

Parameter to specify the output power of the DPSS laser (in mW).

laser1:dpss:power-act

(REAL parameter, read-only)

Parameter indicating the actual output power of the DPSS laser (in mW).

laser1:dpss:power-max

(REAL parameter, read-only)

Parameter indicating the maximum power output of the DPSS laser (in mW).

laser1:dpss:power-margin

(REAL parameter, read-only)

Parameter indicating the fractional power-margin for the DPSS laser.

laser1:dpss:current-act

(REAL parameter, read-only)

Parameter indicating the actual drive current of the DPSS laser (in mA).

laser1:dpss:current-max

(REAL parameter, read-only)

Parameter indicating the maximal drive current of the DPSS laser (in mA).

laser1:scan:

(parameter section)

Access to the DLCpro's scan signal generator.

laser1:scan:enabled

(BOOLEAN parameter, read-write)

Parameter to enable/disable the signal generator
#t - signal generator enabled
#f - signal generator disabled

laser1:scan:hold

(BOOLEAN parameter, read-write)

Parameter to hold the signal generator
#t - signal generator held
#f - signal generator not held

laser1:scan:signal-type

(INTEGER parameter, read-write)

Parameter to specify the waveform of the scan signal.
0: sine
1: triangle
2: triangle rounded

laser1:scan:frequency

(REAL parameter, read-write)

Parameter to control the scan frequency (in Hz).

laser1:scan:output-channel

(INTEGER parameter, read-write)

This parameter controls the output channel for applying the modulation. For possible values, see the "Signal Channel IDs" section in appendix 4.1 on page 189.

laser1:scan:unit

(STRING parameter, read-only)

Parameter indicating the physical unit for **:offset** and **:amplitude**.
Please note that string values might contain UTF-8 encoded characters like the small circle in $°C$.

laser1:scan:amplitude

(REAL parameter, read-write)

Parameter to control the peak-to-peak amplitude of the scan. Provided in physical units of the signal selected by the **:output-channel**.

laser1:scan:offset

(REAL parameter, read-write)

Parameter to control the offset/center of the scan. Provided in physical units of the signal selected by the **:output-channel**.

laser1:scan:start

(REAL parameter, read-write)

Parameter to control the start value of the scan period. Provided in physical units of the signal selected by the **:output-channel**.

laser1:scan:end

(REAL parameter, read-write)

Parameter to control the end value of the scan. Provided in physical units of the signal selected by the **:output-channel**.

laser1:wide-scan:

(parameter section)

Access to the single-shot wide-scan.

laser1:wide-scan:state

(INTEGER parameter, read-only)

Parameter indicating the current state of the wide-scan:

0 - disabled

1 - waiting for start condition to be reached

2 - scan active

3 - waiting for stop condition to be reached

laser1:wide-scan:state-txt

(STRING parameter, read-only)

Parameter indicating the current state of the wide-scan as string.

laser1:wide-scan:output-channel

(INTEGER parameter, read-write)

Parameter to specify the output channel for the scan. For possible values, refer to the "Signal Channel IDs" section in appendix 4.1 on page 189.

laser1:wide-scan:scan-begin

(REAL parameter, read-write)

Parameter to specify the start value for the scan in $°C$.

laser1:wide-scan:scan-end

(REAL parameter, read-write)

Parameter to specify the stop value for the scan in $°C$.

laser1:wide-scan:continuous-mode

(BOOLEAN parameter, read-write)

Parameter to enable/disable wide-scan repeat mode.
#t - repeat mode on, scan runs continuously until **:stop** command is executed.
#f - repeat mode off, scan stops when **:scan-end** is reached.

laser1:wide-scan:shape

(INTEGER parameter, read-write)

Parameter defining the scan type.
0 = Sawtooth, 1 = Triangle

laser1:wide-scan:offset

(REAL parameter, read-write)

Parameter to specify the center value of the scan in $°C$.

laser1:wide-scan:amplitude

(REAL parameter, read-write)

Parameter to specify the peak-to-peak amplitude of the scan in $°C$.

laser1:wide-scan:speed

(REAL parameter, read-write)

Parameter to specify the scan speed in K/s.

laser1:wide-scan:speed-min

(REAL parameter, read-only)

Parameter indicating the minimum possible scan speed in K/s.

laser1:wide-scan:speed-max

(REAL parameter, read-only)

Parameter indicating the maximum possible scan speed in K/s.

laser1:wide-scan:duration

(REAL parameter, read-write)

Parameter to specify the scan duration in s.

laser1:wide-scan:value-set

(REAL parameter, read-write)

Parameter to specify the value of the parameter for the wide-scan x-axis.

laser1:wide-scan:value-act

(REAL parameter, read-only)

Parameter indicating the value of the parameter for the wide-scan x-axis.

laser1:wide-scan:value-unit

(STRING parameter, read-only)

Parameter indicating the unit of the parameter for the wide-scan x-axis.

laser1:wide-scan:recorder-stepsize-set

(REAL parameter, read-write)

Parameter to specify step size for x-axis.

laser1:wide-scan:recorder-stepsize

(REAL parameter, read-only)

Parameter indicating the next possible step size for x-axis.

laser1:wide-scan:progress

(INTEGER parameter, read-only)

Parameter indicating the wide-scan progress in %.

laser1:wide-scan:remaining-time

(INTEGER parameter, read-only)

Parameter indicating the approximate remaining time of the wide-scan in s.

laser1:wide-scan:trigger:

(parameter section)

Parameters to configure the wide-scan's input and output trigger.

laser1:wide-scan:trigger:input-enabled

(BOOLEAN parameter, read-write)

Parameter to enable/disable the wide-scan input trigger. Use **:input-channel** for input channel configuration.

laser1:wide-scan:trigger:input-channel

(INTEGER parameter, read-write)

Parameter to specify the wide-scan trigger input channel on the Digital I/O Connector:

2 - Digital Input 2

3 - Digital Input 3

laser1:wide-scan:trigger:output-enabled

(BOOLEAN parameter, read-write)

Parameter to enable/disable the wide-scan output triggers on the digital I/O connector selected by **:output-channel** Set **:output-threshold** for trigger condition and choose the correct mode (2) for **io:digital-outX:mode**.

laser1:wide-scan:trigger:output-channel

(INTEGER parameter, read-write)

Parameter to specify the wide-scan trigger output channel on the Digital I/O Connector:

1 - Digital Output 1

3 - Digital Output 3

Make sure to set the respective digital output into mode 2 with **io:digital-outX:mode**.

laser1:wide-scan:trigger:output-threshold

(REAL parameter, read-write)

Parameter to specify the trigger threshold in physical units of the selected output-channel. Trigger output level on the selected Digital Output pin is high if the actual value of the output channel is higher than this parameter and low otherwise.

laser1:wide-scan:start

(command, no arguments, returns empty tuple)

Command to start the wide scan. It has an effect only if **laser1:scan:enabled** is #f.

laser1:wide-scan:stop

(command, no arguments, returns empty tuple)

Command to stop the wide scan.

laser1:wide-scan:set-output-to-zoom-offset

(command, no arguments, returns empty tuple)

Command to set the value for the x-axis-parameter to the center of the zoom window.

laser1:wide-scan:set-scan-range-to-zoom-range

(command, no arguments, returns empty tuple)

Command to set the range for the next scan to the current zoom range.

laser1:wide-scan:set-zoom-range-to-scan-range

(command, no arguments, returns empty tuple)

Command to set the zoom range to the full scan range.

laser1:scope:

(parameter section)

Access to the data traces for the DLCpro diagram.

laser1:scope:variant

(INTEGER parameter, read-write)

Parameter to control which kind of data is exported to the **:data** parameter:

0 - *xy* - This variant is typically used to find the lock point. The input signals are shown as function of the scan output-channel. Use the **:scope:channelx:xy-signal** parameter to define the signal for the x-axis.
The acquisition time for the scope engine is automatically set to half the scan period.

1 - *scope* - This variant shows the input signals as function of the time.
Use the **:scope:channelx:scope-timescale** parameter to define the total acquisition time for the traces (in ms). The acquisition time for the scope engine is set to the **:scope:channelx:scope-timescale** value.

2 - *spectrum* - This variant shows a Fast Fourier Transform of the signals as function of the frequency.
Use the **:scope:channelx:spectrum-range** parameter to define the maximum frequency you want to resolve.
The acquisition time for the scope engine is set to the $500/f_{max}$, with f_{max} = **:channelx:spectrum-range**.

laser1:scope:update-rate

(INTEGER parameter, read-write)

Sets the diagram update rate (in Hz).
Please note that, the trace acquisition time may influence the real diagram update-rate.

laser1:scope:channel1:

(parameter section)

Settings for channel1 of the scope engine. For most lock applications, this channel's **:input-signal** is set to [100], that is, to the **:lock:spectrum-input-channel**.

laser1:scope:channel1:signal

(INTEGER parameter, read-write)

Parameter to specify the signal channel to be acquired by the scope engine.
For possible values, refer to the "Signal Channel IDs" section in appendix 4.1 on page 189.

laser1:scope:channel1:unit

(STRING parameter, read-only)

Parameter indicating the physical unit of the selected signal.
Please note that string values might contain UTF-8 encoded characters like the small circle in $°C$.

laser1:scope:channel1:name

(STRING parameter, read-only)

Parameter indicating the name of the signal.

laser1:scope:channel2:

(parameter section)

Settings for channel2 of the scope engine. You can freely configure this channel.

For usage see **laser1:scope:channel1:** on page 93.

laser1:scope:channelx:

(parameter section)

Settings for the x-axis of the scope engine.
The x-axis is treated differently, depending on the **:scope:variant** setting.

laser1:scope:channelx:xy-signal

(INTEGER parameter, read-write)

Parameter to define the signal channel to be acquired for the x-axis values.
Applied if the **:scope:variant** parameter is set to "0" (xy) .
In most cases, this parameter is set to "101" - the scope acquiring signals from the **:scan:output-channel** channel.

laser1:scope:channelx:scope-timescale

(REAL parameter, read-write)

Parameter to define the timescale (in ms).
Applied if the **:scope:variant** parameter is set to "1" (scope).

laser1:scope:channelx:spectrum-range

(REAL parameter, read-write)

Parameter to define the full frequency range (in kHz).
Applied if the **:scope:variant** parameter is set to "2" (spectrum).

laser1:scope:channelx:spectrum-omit-dc

(BOOLEAN parameter, read-write)

To help with autoscaling in the diagrams, the DC-components of the Fast Fourier Transform traces can be omitted.
Applied if the **:scope:variant** parameter is set to "2" (spectrum).
#t - the DC-components of the Fast Fourier Transform traces (that is, the 3 lowermost frequency components) are omitted.
#f - The DC-components of the Fast Fourier Transform traces can be seen.

laser1:scope:channelx:unit

(STRING parameter, read-only)

Parameter indicating the physical unit of the signal.
"scope": ms
"spectrum": kHz
"xy": unit of the signal defined by **:channelx:xy-signal**
Please note that string values might contain UTF-8 encoded characters like the small circle in $°C$.

laser1:scope:channelx:name

(STRING parameter, read-only)

Parameter indicating the name of the signal.

laser1:scope:timescale

(REAL parameter, read-only)

Parameter indicating the data trace acquisition time in ms.

laser1:scope:data

(BINARY parameter, read-only)

Parameter indicating trace data for all enabled channels. The parameter value is provided in the format decribed in Appendix 4.2.
It always contains a block of IDs *'x'* and, depending on which scope channels are enabled, contains IDs *'y'* and/or *'Y'*.

laser1:recorder:

(parameter section)

Access to the single-shot data acquisition.

laser1:recorder:state

(INTEGER parameter, read-only)

Parameter indicating the current state of the single-shot data acquisition:

0 - disabled

1 - armed, waiting for trigger

2 - recording

laser1:recorder:state-txt

(STRING parameter, read-only)

Parameter indicating the current state of the single-shot data acquisition as string.

laser1:recorder:inputs:

(parameter section)

Parameters to configure the channels to be recorded.

laser1:recorder:inputs:channel1:

(parameter section)

Parameter to configure the signal for channel1.

laser1:recorder:inputs:channel1:signal

(INTEGER parameter, read-write)

Parameter to specify the signal channel to be acquired for this channel of the single-shot scope engine.
For possible values, refer to the "Signal Channel IDs" section in appendix 4.1 on page 189.

laser1:recorder:inputs:channel1:low-pass-filter:

(parameter section)

Parameter to configure the input low-pass filter for this channel.

laser1:recorder:inputs:channel1:low-pass-filter:enabled

(BOOLEAN parameter, read-write)

Parameter to enable/disable the low-pass filter for this signal.

laser1:recorder:inputs:channel1:low-pass-filter:cut-off-frequency

(REAL parameter, read-write)

Parameter to specify the cut off frequency for the low-pass filter in Hz.

laser1:recorder:inputs:channel2:

(parameter section)

Parameter to configure the signal for channel2.

For usage see **laser1:recorder:inputs:channel1:** on page 96.

laser1:recorder:inputs:channelx:

(parameter section)

Parameter to configure the signal for channelx.

laser1:recorder:inputs:channelx:signal

(INTEGER parameter, read-write)

Parameter to specify the signal channel to be acquired for this channel of the single-shot scope engine.
For possible values, refer to the "Signal Channel IDs" section in appendix 4.1 on page 189.

laser1:recorder:recording-mode

(INTEGER parameter, read-write)

Parameter to specify the recording mode:

0 - reset: resets all data on start.

1 - overwrite: overwrites old data.

2 - continuus: overwrites old data periodically.

laser1:recorder:recording-time

(REAL parameter, read-write)

Parameter to specify the recording time in ms.

laser1:recorder:sample-count-set

(INTEGER parameter, read-write)

Parameter to specify the desired, minimum total number of samples to be recorded. From this value and the given **:recording-time**, the required sampling interval is calculated. This calculated interval has to be rounded to the next smaller possible value, supported by the digital sampling electronics. If this supported sampling interval is smaller than the original one, more sampling points are needed to cover the specified **recording-time**. If there is no supported smaller sampling interval, the targeted sample count cannot be reached. The number of actually required sampling points is returned by the **:sample-count** parameter.

laser1:recorder:sample-count

(INTEGER parameter, read-only)

Parameter indicating the total number of samples to be recorded.
See **:sample-count-set** for a description.
When recording is started this number will be used to allocate internal memory for the data to be recorded.

laser1:recorder:sampling-interval

(REAL parameter, read-only)

Parameter indicating the sampling interval in ms.

laser1:recorder:sampling-rate

(REAL parameter, read-only)

Parameter indicating the sampling rate in Hz.

laser1:recorder:memory-size

(INTEGER parameter, read-only)

Parameter indicating the memory size in bytes needed to record all enabled channels.

laser1:recorder:data:

(parameter section)

Parameters to retrieve the recorded data.

laser1:recorder:data:channel1:

(parameter section)

Properties of channel1 of the recorded data.

laser1:recorder:data:channel1:signal

(INTEGER parameter, read-only)

Parameter indicating the signal channel acquired by the single-shot scope engine.
For possible values, refer to the "Signal Channel IDs" section in appendix 4.1 on page 189.

laser1:recorder:data:channel1:unit

(STRING parameter, read-only)

Parameter indicating the physical unit of the selected signal.
Please note that string values might contain UTF-8 encoded characters like the small circle in $°C$.

laser1:recorder:data:channel1:name

(STRING parameter, read-only)

Parameter indicating the name of the signal.

laser1:recorder:data:channel2:

(parameter section)

Properties of channel2 of the recorded data.

For usage see **laser1:recorder:data:channel1:** on page 98.

laser1:recorder:data:channelx:

(parameter section)

Properties of the x channel of the recorded data.

For usage see **laser1:recorder:data:channel1:** on page 98.

laser1:recorder:data:zoom-data

(BINARY parameter, read-only)

Parameter indicating trace data for all enabled channels. The parameter value is provided in the format described in appendix 4.2.
It always contains a block of IDs *'x'* and, depending on which scope channels are enabled, additionally *'a'* and *'A'* and/or *'b'* and *'B'*.

laser1:recorder:data:zoom-offset

(REAL parameter, read-write)

Parameter to specify the center of the data range to be zoomed into, in units of the x-axis signal.

laser1:recorder:data:zoom-amplitude

(REAL parameter, read-write)

Parameter to specify the full length of the data range to be zoomed into, in units of the x-axis signal. The amplitude must be positive.

laser1:recorder:data:recorded-sampling-interval

(REAL parameter, read-only)

Parameter indicating the sampling interval in the traces for being retrieved with the `:get-data` and `:show-data` commands.

laser1:recorder:data:recorded-sample-count

(INTEGER parameter, read-only)

Parameter indicating the number of recorded samples per channel, i.e. the number of samples available in the traces for being retrieved with the `:get-data` and `:show-data` commands.

laser1:recorder:data:last-recorded-sample

(INTEGER parameter, read-only)

Parameter indicating the last recorded sample count.
This is usefull when using the **:recording-mode** contiuous or overwrite. All samples beyond last-recorded-samples are recorded at the previous scan.

laser1:recorder:data:last-valid-sample

(INTEGER parameter, read-only)

Parameter indicating if data acquisition was corrupted, eg, due to too high sampling rate.
If no corruption was detected this parameter returns **:recorded-sample-count** - 1. If data corruption was detected this parameter returns index of the last sample that has been recorded before the first corruption was detected.
Please note that sometimes data corruption may occure without being detected.

laser1:recorder:data:zoom-out

(command, no arguments, returns empty tuple)

Command to adjust **:zoom-offset** and **:zoom-amplitude** to the full width of the x-axis data range.

laser1:recorder:data:get-data

(command, 2 arguments, returns BINARY)

Arguments:

1. *start-index* of type INTEGER
2. *count* of type INTEGER

Command to get part of the recorded data.
Argument *start-index* specifies the index of the first sampling point to be returned. Argument *count* specifies the number of sampling points to be returned. If *start-index* is greater than or equal to **:recorded-sample-count**, no sampling points will be returned. If *count* is greater than 1024 it will be clipped to 1024. If *start-index*+*count* is greater than **:recorded-sample-count** only **:recorded-sample-count** − *start-index* samples will be returned.
The binary return value is provided in the format described in Appendix 4.2.
It always contains a block of ID *i*, consisting of two 32bit integer values. The first integer value is the value of *start-index* and the second one is the number of sampling points returned (may be less than specified by *count*). Depending on which recorder channels are enabled, the data furthermore contains IDs *'x'*, *'y'* and/or *'Y'* with arrays of floating point values.

laser1:recorder:data:show-data

(command, 2 arguments, returns empty tuple)

Arguments:

1. *start-index* of type INTEGER
2. *count* of type INTEGER

Command to print of the recorded data to the console.
Argument *start-index* specifies the index of the first sampling point to be returned. Argument *count* specifies the number of sampling points to be returned. If *start-index* is greater than or equal to **:recorded-sample-count**, no sampling points will be returned. If *count* is greater than 1024 it will be clipped to 1024. If *start-index*+ *count* is greater than **:recorder-sample-count** only **:recorder-sample-count**−*start-index* samples will be returned.
The data will be printed to the console as comma separated table of decimal numbers. The table always has 4 columns: *index*, *channel-x value*, *channel 1 value* and *channel 2 value*.

laser1:nlo:

(parameter section)

Parameters relevant for the operation of frequency-converted diode laser systems.

laser1:nlo:servo:

(parameter section)

Parameters of the servo motors in frequency-converted diode laser systems.

laser1:nlo:servo:ta1-hor:

(parameter section)

Parameters of the first mirror/horizontal axis servo of the amplifier stage.

laser1:nlo:servo:ta1-hor:display-name

(STRING parameter, read-only)

Parameter indicating the name of the servo motor, used in error messages.

laser1:nlo:servo:ta1-hor:enabled

(BOOLEAN parameter, read-write)

Parameter to enable/disable the servo motor.

laser1:nlo:servo:ta1-hor:value

(INTEGER parameter, read-write)

Parameter indicating the position of the servo motor.

laser1:nlo:servo:ta1-vert:

(parameter section)

Parameters of the first mirror/vertical axis servo of the amplifier stage.

For usage see **laser1:nlo:servo:ta1-hor:** on page 101.

laser1:nlo:servo:ta2-hor:

(parameter section)

Parameters of the second mirror/horizontal axis servo of the amplifier stage.

For usage see **laser1:nlo:servo:ta1-hor:** on page 101.

laser1:nlo:servo:ta2-vert:

(parameter section)

Parameters of the second mirror/vertical axis servo of the amplifier stage.

For usage see **laser1:nlo:servo:ta1-hor:** on page 101.

laser1:nlo:servo:shg1-hor:

(parameter section)

Parameters of the first mirror/horizontal axis servo of the SHG stage.

For usage see **laser1:nlo:servo:ta1-hor:** on page 101.

laser1:nlo:servo:shg1-vert:

(parameter section)

Parameters of the first mirror/vertical axis servo of the SHG stage.

For usage see **laser1:nlo:servo:ta1-hor:** on page 101.

laser1:nlo:servo:shg2-hor:

(parameter section)

Parameters of the second mirror/horizontal axis servo of the SHG stage.

For usage see **laser1:nlo:servo:ta1-hor:** on page 101.

laser1:nlo:servo:shg2-vert:

(parameter section)

Parameters of the second mirror/vertical axis servo of the SHG stage.

For usage see **laser1:nlo:servo:ta1-hor:** on page 101.

laser1:nlo:servo:fhg1-hor:

(parameter section)

Parameters of the first mirror/horizontal axis servo of the FHG stage.

For usage see **laser1:nlo:servo:ta1-hor:** on page 101.

laser1:nlo:servo:fhg1-vert:

(parameter section)

Parameters of the first mirror/vertical axis servo of the FHG stage.

For usage see **laser1:nlo:servo:ta1-hor:** on page 101.

laser1:nlo:servo:fhg2-hor:

(parameter section)

Parameters of the second mirror/horizontal axis servo of the FHG stage.

For usage see **laser1:nlo:servo:ta1-hor:** on page 101.

laser1:nlo:servo:fhg2-vert:

(parameter section)

Parameters of the second mirror/vertical axis servo of the FHG stage.

For usage see **laser1:nlo:servo:ta1-hor:** on page 101.

laser1:nlo:servo:fiber1-hor:

(parameter section)

Parameters of the first mirror/horizontal axis servo of the fiber stage.

For usage see **laser1:nlo:servo:ta1-hor:** on page 101.

laser1:nlo:servo:fiber1-vert:

(parameter section)

Parameters of the first mirror/vertical axis servo of the fiber stage.

For usage see **laser1:nlo:servo:ta1-hor:** on page 101.

laser1:nlo:servo:fiber2-hor:

(parameter section)

Parameters of the second mirror/horizontal axis servo of the fiber stage.

For usage see **laser1:nlo:servo:ta1-hor:** on page 101.

laser1:nlo:servo:fiber2-vert:

(parameter section)

Parameters of the second mirror/vertical axis servo of the fiber stage.

For usage see **laser1:nlo:servo:ta1-hor:** on page 101.

laser1:nlo:servo:uv-outcpl:

(parameter section)

Parameters of the servo of the UV cavity.

For usage see **laser1:nlo:servo:ta1-hor:** on page 101.

laser1:nlo:servo:uv-cryst:

(parameter section)

Parameters of the servo of the UV cavity.

For usage see **laser1:nlo:servo:ta1-hor:** on page 101.

laser1:nlo:pd:

(parameter section)

Parameters for values and calibration of the photo diodes within frequency-converted diode laser systems.

laser1:nlo:pd:dl:

(parameter section)

Parameters for value and calibration of the seed photo diode within frequency-converted diode laser systems.

laser1:nlo:pd:dl:power

(REAL parameter, read-only)

Parameter indicating the power level in mW.

laser1:nlo:pd:dl:cal-offset

(REAL parameter, read-only)

Parameter to specify the calibration offset for the photodiode in mW.

laser1:nlo:pd:dl:cal-factor

(REAL parameter, read-only)

Parameter to specify the calibration factor for the photodiode in mW/V.

laser1:nlo:pd:amp:

(parameter section)

Parameters for value and calibration of the amplifier photo diode within frequency-converted diode laser systems.

For usage see **laser1:nlo:pd:dl:** on page 104.

laser1:nlo:pd:fiber:

(parameter section)

Parameters for value and calibration of the fiber photo diode within frequency-converted diode laser systems (use with FiberMon option only).

For usage see **laser1:nlo:pd:dl:** on page 104.

laser1:nlo:pd:shg:

(parameter section)

Parameters for value and calibration of the SHG photo diode within frequency-converted diode laser systems.

For usage see **laser1:nlo:pd:dl:** on page 104.

laser1:nlo:pd:shg-input:

(parameter section)

Parameters for value and calibration of the SHG input photo diode within frequency-converted diode laser systems.

For usage see **laser1:dl:pd:** on page 65.

laser1:nlo:pd:shg-int:

(parameter section)

Parameters for value and calibration of the SHG intra-cavity photo diode within frequency-converted diode laser systems.

laser1:nlo:pd:shg-int:photodiode

(REAL parameter, read-only)

Parameter indicating the photo diode voltage in V.

laser1:nlo:pd:shg-int:cal-offset

(REAL parameter, read-only)

Parameter to specify the calibration offset for the photodiode in V.

laser1:nlo:pd:shg-pdh-dc:

(parameter section)

Parameters for value and calibration of the SHG cavity-rejection photo diode within frequency-converted diode laser systems.

For usage see **laser1:nlo:pd:shg-int:** on page 105.

laser1:nlo:pd:shg-pdh-rf:

(parameter section)

Parameters for value and gain of the SHG PDH photo diode within frequency-converted diode laser systems.

laser1:nlo:pd:shg-pdh-rf:photodiode

(REAL parameter, read-only)

Parameter indicating the photo diode voltage in V.

laser1:nlo:pd:shg-pdh-rf:gain

(REAL parameter, read-write)

Parameter to specify the gain factor for the photodiode in V/V.

laser1:nlo:pd:fhg:

(parameter section)

Parameters for value and calibration of the SHG photo diode within frequency-converted diode laser systems.

For usage see **laser1:nlo:pd:dl:** on page 104.

laser1:nlo:pd:fhg-int:

(parameter section)

Parameters for value and calibration of the FHG intra-cavity photo diode within frequency-converted diode laser systems.

For usage see **laser1:nlo:pd:shg-int:** on page 105.

laser1:nlo:pd:fhg-pdh-dc:

(parameter section)

Parameters for value and calibration of the FHG cavity-rejection photo diode within frequency-converted diode laser systems.

For usage see **laser1:nlo:pd:shg-int:** on page 105.

laser1:nlo:pd:fhg-pdh-rf:

(parameter section)

Parameters for value and gain of the FHG PDH photo diode within frequency-converted diode laser systems.

For usage see **laser1:nlo:pd:shg-pdh-rf:** on page 105.

laser1:nlo:power-optimization:

(parameter section)

Parameters for the power optimization routine of frequency-converted diode laser systems (use with AutoAlign option only).

laser1:nlo:power-optimization:ongoing

(BOOLEAN parameter, read-only)

Parameter indicating the status of the power optimization routine:
#t: An optimization routine is in progress.
#f: No optimization routine is in progress.

laser1:nlo:power-optimization:progress

(INTEGER parameter, read-only)

Parameter indicating the overall progress of the power optimization routines depending on the selected stages:

0 : Optimization routine is starting.

1 : Optimization routine has finished.

laser1:nlo:power-optimization:status

(INTEGER parameter, read-only)

Status of the optimization for internal purposes.

laser1:nlo:power-optimization:status-string

(STRING parameter, read-only)

Parameter indicating the status of the power optimization routine as a status string as displayed in the TOPAS DLC PC-GUI.

laser1:nlo:power-optimization:shg-advanced

(BOOLEAN parameter, read-write)

Parameter to select the Advanced mode of the power optimization routine for the SHG stage:
#t: Advanced mode selected.
#f: Advanced mode deselected.

laser1:nlo:power-optimization:stage1:

(parameter section)

Parameters for the amplifier power optimization routine of frequency-converted diode laser systems (use with amplifier only).

laser1:nlo:power-optimization:stage1:input:

(parameter section)

Parameters for the photo diode input of the power optimization routine.

laser1:nlo:power-optimization:stage1:input:value-calibrated

(REAL parameter, read-only)

Parameter indicating the calibrated photo diode voltage used in the amplifier power optimization routine.

laser1:nlo:power-optimization:stage1:progress

(INTEGER parameter, read-only)

Parameter indicating the progress of the power optimization routine:

0 : Optimization routine is starting.

1 : Optimization routine has finished.

laser1:nlo:power-optimization:stage1:optimization-in-progress

(BOOLEAN parameter, read-only)

Parameter indicating the status of the power optimization routine:
#t: The optimization routine is in progress.
#f: The optimization routine is not in progress.

laser1:nlo:power-optimization:stage1:restore-on-abort

(BOOLEAN parameter, read-write)

Parameter to enable/disable the return of the servo motors to their previous positions after the power optimization routine is aborted.

laser1:nlo:power-optimization:stage1:restore-on-regress

(BOOLEAN parameter, read-write)

Parameter to enable/disable the return of the servo motors to their previous positions after the power optimization routine has decreased the stage power. This may happen for an already optimized system.

laser1:nlo:power-optimization:stage1:regress-tolerance

(INTEGER parameter, read-write)

Parameter to specify the failure margin that is tolerated if the power optimization routine leads to a power decrease. This may happen for an already optimized system.

laser1:nlo:power-optimization:stage1:start-optimization

(command, no arguments, returns INTEGER)

Command to start the power optimization routine of the stage.

laser1:nlo:power-optimization:stage2:

(parameter section)

Parameters for the SHG power optimization routine of frequency-converted diode laser systems.

For usage see **laser1:nlo:power-optimization:stage1:** on page 107.

laser1:nlo:power-optimization:stage3:

(parameter section)

Parameters for the SHG power optimization routine of frequency-converted diode laser systems using the amplifier servo motors (use with amplifier only).

For usage see **laser1:nlo:power-optimization:stage1:** on page 107.

laser1:nlo:power-optimization:stage4:

(parameter section)

Parameters for the fiber power optimization routine of frequency-converted diode laser systems.

For usage see **laser1:nlo:power-optimization:stage1:** on page 107.

laser1:nlo:power-optimization:stage5:

(parameter section)

Parameters for the FHG power optimization routine of frequency-converted diode laser systems.

For usage see **laser1:nlo:power-optimization:stage1:** on page 107.

laser1:nlo:power-optimization:progress-data-amp

(BINARY parameter, read-only)

Parameter array indicating the amplifier power after the various iteration steps of the amplifier power optimization routine, as displayed in the TOPAS DLC PC-GUI Power Optimization Monitor (use with amplifier only). The values are represented as a BASE64-encoded sequence of 4-byte long floating point numbers in *little endian* byte order.

laser1:nlo:power-optimization:progress-data-shg

(BINARY parameter, read-only)

Parameter array indicating the SHG power after the various iteration steps of the SHG power optimization routine, as displayed in the TOPAS DLC PC-GUI Power Optimization Monitor. The values are represented as a BASE64-encoded sequence of 4-byte long floating point numbers in *little endian* byte order.

laser1:nlo:power-optimization:progress-data-fiber

(BINARY parameter, read-only)

Parameter array indicating the fiber monitor power after the various iteration steps of the fiber power optimization routine, as displayed in the TOPAS DLC PC-GUI Power Optimization Monitor (use with FiberMon option only). The values are represented as a BASE64-encoded sequence of 4-byte long floating point numbers in *little endian* byte order.

laser1:nlo:power-optimization:progress-data-fhg

(BINARY parameter, read-only)

Parameter array indicating the FHG power after the various iteration steps of the FHG power optimization routine, as displayed in the TOPAS DLC PC-GUI Power Optimization Monitor. The values are represented as a BASE64-encoded sequence of 4-byte long floating point numbers in *little endian* byte order.

laser1:nlo:power-optimization:abort

(BOOLEAN parameter, read-write)

Parameter specifying whether to abort the power optimization routine.

laser1:nlo:power-optimization:start-optimization-all

(command, no arguments, returns INTEGER)

Command to start the power optimization routine for all stages. This command returns 0 if the power optimization routine could be successfully started or a negative error code otherwise.

laser1:nlo:power-optimization:start-optimization-amp

(command, no arguments, returns INTEGER)

Command to start the power optimization routine of the amplifier stage. This command returns 0 if the power optimization routine could be successfully started or a negative error code otherwise.

laser1:nlo:power-optimization:start-optimization-shg

(command, no arguments, returns INTEGER)

Command to start the power optimization routine of the SHG stage. This command returns 0 if the power optimization routine could be successfully started or a negative error code otherwise.

laser1:nlo:power-optimization:start-optimization-fiber

(command, no arguments, returns INTEGER)

Command to start the power optimization routine of the fiber stage (use with FiberMon option only). This command returns 0 if the power optimization routine could be successfully started or a negative error code otherwise.

laser1:nlo:power-optimization:start-optimization-fhg

(command, no arguments, returns INTEGER)

Command to start the power optimization routine of the FHG stage. This command returns 0 if the power optimization routine could be successfully started or a negative error code otherwise.

laser1:nlo:auto-nlo:

(parameter section)

Parameters for controlling the AutoNLO feature of frequency-converted diode laser systems.

laser1:nlo:auto-nlo:automatic-mode

(BOOLEAN parameter, read-only)

Parameter to enable the Auto-Pilot feature.

laser1:nlo:auto-nlo:laser-on

(BOOLEAN parameter, read-write)

Parameter to enable the NLO laser head.

laser1:nlo:auto-nlo:emission

(BOOLEAN parameter, read-only)

Parameter indicating the emission status for the NLO laser head.
#t - laser emits light
#f - laser emission is switched off

laser1:nlo:auto-nlo:operation-time-master

(REAL parameter, read-only)

Parameter indicating the operation time of the master laser in hours.

laser1:nlo:auto-nlo:operation-time-amplifier

(REAL parameter, read-only)

Parameter indicating the operation time of the amplifier in hours.

laser1:nlo:auto-nlo:operation-time-cavity

(REAL parameter, read-only)

Parameter indicating the operation time of the NLO resonator in hours.

laser1:nlo:auto-nlo:amplifier-current-margin

(REAL parameter, read-only)

Parameter indicating the fractional current-margin for the amplifier.

laser1:nlo:auto-nlo:perform-single-mode-optimization

(command, no arguments, returns empty tuple)

Command to optimize the single-mode performance of the NLO system.

laser1:nlo:auto-nlo:perform-auto-align

(command, no arguments, returns empty tuple)

Command to start the AutoAlign optimization routine.

laser1:nlo:shg:

(parameter section)

Parameters for the control of the SHG cavity.

laser1:nlo:shg:tc:

(parameter section)

The **laser1:nlo:shg:tc** section provides parameters related to the temperature controller for the nonlinear crystals in frequency-converted diode laser systems.

For usage see **laser1:dl:tc:** on page 44.

laser1:nlo:shg:pc:

(parameter section)

Parameters the Temperature Control (TC) board.

For usage see **laser1:dl:pc:** on page 48.

laser1:nlo:shg:scan:

(parameter section)

This section provides access to the SHG cavity scan signal generator.

laser1:nlo:shg:scan:enabled

(BOOLEAN parameter, read-write)

Parameter to enable/disable the SHG cavity signal generator
#t - signal generator enabled
#f - signal generator disabled

laser1:nlo:shg:scan:frequency

(REAL parameter, read-write)

Parameter to control the SHG cavity scan frequency (in Hz).

laser1:nlo:shg:scan:amplitude

(REAL parameter, read-write)

Parameter to control the peak-to-peak amplitude of the SHG cavity scan generator (in Vpp).

laser1:nlo:shg:scan:offset

(REAL parameter, read-write)

Parameter to control the offset/center of the SHG cavity scan generator (in V).

laser1:nlo:shg:scope:

(parameter section)

This section provides access to the data traces for the SHG signal display.

laser1:nlo:shg:scope:variant

(INTEGER parameter, read-write)

This parameter controls which kind of data should be exported in the **:data** parameter:

0 - *xy* - This variant will typically be used for finding the lock point. The input signals are then shown as a function of the scan output-channel. Use the **:scope:channelx:xy-signal** to define the signal for the x-axis. The acuisition time for the scope engine is automatically set to half the scan period.

1 - *scope* - This variant shows the signals as a function of time.
Use the **:scope:channelx:scope-timescale** parameter to define the total acquisition time for the traces in ms. The acquisition time for the scope engine is set to the **:scope:channelx:scope-timescale** value.

2 - *spectrum* - This variant shows a Fast Fourier Transform of the signals as a function of frequency.
Use the **:scope:channelx:spectrum-range** parameter to define the maximum frequency you want to resolve. The acquisition time for the scope engine is set to the $500/f_{max}$, with f_{max} = **:channelx:spectrum-range**.

laser1:nlo:shg:scope:update-rate

(INTEGER parameter, read-write)

Sets the diagram update-rate (in Hz).
Please note that, the trace acquisition time may influence the real diagram update-rate.

laser1:nlo:shg:scope:channel1:

(parameter section)

Settings for channel1 of the scope engine. For most lock applications you may want to set this channel's **:input-signal** to 100, meaning the **:lock:spectrum-input-channel**.

laser1:nlo:shg:scope:channel1:signal

(INTEGER parameter, read-write)

Use this parameter to set the signal channel you want to be acquired by the scope engine.

laser1:nlo:shg:scope:channel1:unit

(STRING parameter, read-only)

Returns the physical unit of the selected signal.

laser1:nlo:shg:scope:channel1:name

(STRING parameter, read-only)

Returns the name of the signal.

laser1:nlo:shg:scope:channel2:

(parameter section)

Settings for channel2 of the scope engine. You can freely configure this channel.

For usage see **laser1:nlo:shg:scope:channel1:** on page 113.

laser1:nlo:shg:scope:channelx:

(parameter section)

Settings for the x-axis of the scope engine. Depending on the **:scope:variant** setting the x-axis is treated differently and different parameters of this sections apply.

laser1:nlo:shg:scope:channelx:xy-signal

(INTEGER parameter, read-write)

This parameter is only used if the **:scope:variant** is set to "XY mode". It then defines the signal channel to be acquired for the x-axis values. In most cases this parameter should be set to 101 will make the scope acquiring the signals from the channel defined as **:scan:output-channel**.

laser1:nlo:shg:scope:channelx:scope-timescale

(REAL parameter, read-write)

This paramter is only used if the **:scope:variant** is set to "scope". It then defines the timescale (in ms).

laser1:nlo:shg:scope:channelx:spectrum-range

(REAL parameter, read-write)

This paramter is only used if the **:scope:variant** is set to "spectrum". It then defines the full frequency range (in kHz).

laser1:nlo:shg:scope:channelx:spectrum-omit-dc

(BOOLEAN parameter, read-write)

If this parameter is set to #t, the lowest 3 frequency components (i.e. the DC components) of the Fast Fourier Transform traces will be omitted. This is intended to help with autoscaling in the diagrams. Set this parameter to #f if you need to see the DC components.

laser1:nlo:shg:scope:channelx:unit

(STRING parameter, read-only)

Returns the physical unit of the signal. For the "scope" case it will return "ms", for the spectrum case "kHz" and for the "xy" case it will return the unit of the signal defined by **:channelx:xy-signal**.

laser1:nlo:shg:scope:channelx:name

(STRING parameter, read-only)

Returns the name of the signal.

laser1:nlo:shg:scope:timescale

(REAL parameter, read-only)

Returns the data trace acquisition time (in ms).

laser1:nlo:shg:scope:data

(BINARY parameter, read-only)

Returns trace data for all enabled channels. The data format is described in the appendix (to be done).

laser1:nlo:shg:lock:

(parameter section)

This section provides access to the SHG cavity's lock engine. It has two PID regulators for controlling two independed output channels. Furthermore it provides modules for lock-in detection, automatic relock or reset, as well as for easy to use click-and-lock functionality.

laser1:nlo:shg:lock:state

(INTEGER parameter, read-only)

Parameter indicating the current operational mode of the lock module. Possible values are:
0 - lock off
1 - locking
2 - locked

laser1:nlo:shg:lock:state-txt

(STRING parameter, read-only)

Parameter indicating the current operational mode of the lock module as a short text. Possible values are: "idle", "locking" and "locked".

laser1:nlo:shg:lock:lock-enabled

(BOOLEAN parameter, read-write)

This parameter returns #t if the lock engine's **:state** is "locking" or "locked".
Setting this parameter to #t has the same effect as submitting the command **:close** and setting this parameter to #f has the same effect as submitting the command **:open**.

laser1:nlo:shg:lock:pid-selection

(INTEGER parameter, read-write)

Parameter to select the PID controllers to be used by the SHG cavity lock engine:
0 - no PID controller active.
1 - "PID Slow" (PID2) on, "PID Fast" (PID1) off, analog PID off.
2 - "PID Slow" (PID2) on, "PID Fast" (PID1) off, analog PID on.
3 - "PID Slow" (PID2) on, "PID Fast" (PID1) on, analog PID off.
4 - All PID controllers on.

laser1:nlo:shg:lock:setpoint

(REAL parameter, read-write)

Parameter to specify the setpoint for the PID Slow controller (in V).

laser1:nlo:shg:lock:relock:

(parameter section)

Settings for automatic SHG cavity ReLock.

laser1:nlo:shg:lock:relock:enabled

(BOOLEAN parameter, read-write)

Set this parameter to #t to enable the ReLock engine.

laser1:nlo:shg:lock:relock:frequency

(REAL parameter, read-write)

Parameter to control the frequency of the ReLock scan (in Hz).

laser1:nlo:shg:lock:relock:amplitude

(REAL parameter, read-write)

Parameter to control the amplitude of the ReLock waveform (in V).

laser1:nlo:shg:lock:relock:delay

(REAL parameter, read-write)

Parameter to determine the waiting time before the ReLock procedure starts after the out-of-lock condition is signaled by **:lock:window**.

laser1:nlo:shg:lock:window:

(parameter section)

Settings for out-of-lock detection for SHG cavity ReLock and triggering the PID controller reset.

laser1:nlo:shg:lock:window:input-channel

(INTEGER parameter, read-write)

Parameter to select the input signal for the lock detection window.
For possible values, refer to the "Signal Channel IDs" section in appendix 4.1 on page 189.

laser1:nlo:shg:lock:window:threshold

(REAL parameter, read-write)

Parameter to determine the threshold of the ReLock window (in V).

laser1:nlo:shg:lock:window:level-hysteresis

(REAL parameter, read-write)

Parameter to determine the inner ReLock window by a voltage difference to the outer ReLock window limits (in V or mW).

laser1:nlo:shg:lock:window:calibration:

(parameter section)

Parameters for the automatic calibration of the lock supervision window

laser1:nlo:shg:lock:pid1:

(parameter section)

Parameters for the PID Fast controller.

laser1:nlo:shg:lock:pid1:gain:

(parameter section)

Gain parameters for the PID controller.

laser1:nlo:shg:lock:pid1:gain:all

(REAL parameter, read-write)

Parameter to control the overall gain. This parameter has no physical unit.

laser1:nlo:shg:lock:pid1:gain:p

(REAL parameter, read-write)

Parameter to control the proportional gain (in V/V).

laser1:nlo:shg:lock:pid1:gain:i

(REAL parameter, read-write)

Parameter to control the integral gain (in V/V/ms).

laser1:nlo:shg:lock:pid1:gain:d

(REAL parameter, read-write)

Parameter to control the differential gain (in V/V*μs).

laser1:nlo:shg:lock:pid1:gain:i-cutoff

(REAL parameter, read-write)

Parameter to determine the frequency limit (I-cutoff) for the integral PID gain (in Hz).

laser1:nlo:shg:lock:pid1:gain:i-cutoff-enabled

(BOOLEAN parameter, read-write)

Parameter to enable/disable a frequency limit (I-cutoff) for the integral PID Fast gain (**:lock:pid1:gain:i-cutoff**). Possible values are:
#t - I-cutoff enabled
#f - I-cutoff disabled

laser1:nlo:shg:lock:pid2:

(parameter section)

Parameters for the PID Slow controller.

For usage see **laser1:nlo:shg:lock:pid1:** on page 117.

laser1:nlo:shg:lock:analog-dl-gain:

(parameter section)

Access to the parameters of the analog lock path.

laser1:nlo:shg:lock:analog-dl-gain:p-gain

(REAL parameter, read-write)

Parameter to specify the proportional gain of the analog lock path (in V/V).

laser1:nlo:shg:lock:local-oscillator:

(parameter section)

Access to the parameters of the local oscillator for the SHG cavity lock.

laser1:nlo:shg:lock:local-oscillator:enabled

(BOOLEAN parameter, read-write)

Parameter to enable/disable the local oscillator for the SHG cavity lock.
#t - Local oscillator is enabled.
#f - Local oscillator is disabled.

laser1:nlo:shg:lock:local-oscillator:use-external-oscillator

(BOOLEAN parameter, read-write)

Parameter to specify if the internal local oscillator tries to phase-lock onto an external signal at the "extLO" plug.
#t - Phase-lock to external signal is enabled.
#f - Phase-lock to external signal is disabled.
This parameter is necessary in the context of PDH locks of the master oscillator to an external reference. For details, see the TA/DL-SHG pro manual.

laser1:nlo:shg:lock:local-oscillator:amplitude

(REAL parameter, read-write)

Parameter to specify the peak-to-peak local oscillator amplitude for the cavity lock (in V). Only discrete values are possible, and the user is recommended to set the local oscillator amplitude via the parameter **laser1:nlo:shg:lock:local-oscillator:attentuation-raw**.

laser1:nlo:shg:lock:local-oscillator:attenuation-raw

(INTEGER parameter, read-write)

Parameter to select the peak-to-peak amplitude of the cavity local oscillator. Possible values are:
0 - 0.65 Vpp
2 - 0.58 Vpp
4 - 0.52 Vpp
6 - 0.46 Vpp
9 - 0.39 Vpp
12 - 0.33 Vpp
16 - 0.26 Vpp
21 - 0.19 Vpp
28 - 0.13 Vpp
40 - 0.065 Vpp
63 - 0.017 Vpp

laser1:nlo:shg:lock:local-oscillator:phase-shift

(REAL parameter, read-write)

Parameter to select the phase difference between the local oscillator for the cavity lock and the PDH RF photo diode signal of the SHG cavity (in °).

laser1:nlo:shg:lock:local-oscillator:auto-pdh

(command, no arguments, returns empty tuple)

Command to automatically set the phase difference between the local oscillator for the cavity lock and the PDH RF photo diode signal of the SHG cavity for an optimized SHG cavity error signal.

laser1:nlo:shg:lock:cavity-fast-pzt-voltage

(REAL parameter, read-write)

Alias for single-value-main-out.

laser1:nlo:shg:lock:cavity-slow-pzt-voltage

(REAL parameter, read-write)

Alias for single-value-aux-out.

laser1:nlo:shg:lock:background-trace

(BINARY parameter, read-only)

Parameter indicating the X/Y coordinate data for the background trace in the DLCpro GUIs. The parameter provides the last scan trace before the lock was closed. The parameter value is provided in the format decribed in Appendix 4.2. It contains data blocks with IDs *'x'* and *'y'*.
If the lock is not closed, **:background-trace** is empty.

laser1:nlo:shg:factory-settings:

(parameter section)

Factory settings for the most important parameters related to the SHG cavity and power optimization.

laser1:nlo:shg:factory-settings:tc:

(parameter section)

Factory settings for the temperature controller (TC) of the SHG nonlinear crystal.

laser1:nlo:shg:factory-settings:tc:temp-min

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **tc:limits:temp-min**.

laser1:nlo:shg:factory-settings:tc:temp-max

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **tc:limits:temp-max**.

laser1:nlo:shg:factory-settings:tc:temp-set

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **tc:temp-set**.

laser1:nlo:shg:factory-settings:tc:temp-roc-limit

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **tc:temp-roc-limit**.

laser1:nlo:shg:factory-settings:tc:temp-roc-enabled

(BOOLEAN parameter, read-only)

Parameter indicating the factory setting for parameter **tc:temp-roc-enabled**.

laser1:nlo:shg:factory-settings:tc:current-max

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **tc:current-set-max**.

laser1:nlo:shg:factory-settings:tc:current-min

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **tc:current-set-min**.

laser1:nlo:shg:factory-settings:tc:p-gain

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **tc:t-loop:p-gain**.

laser1:nlo:shg:factory-settings:tc:i-gain

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **tc:t-loop:i-gain**.

laser1:nlo:shg:factory-settings:tc:d-gain

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **tc:t-loop:d-gain**.

laser1:nlo:shg:factory-settings:tc:c-gain

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **tc:c-loop:i-gain**.

laser1:nlo:shg:factory-settings:tc:ok-tolerance

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **tc:t-loop:ok-tolerance**.

laser1:nlo:shg:factory-settings:tc:ok-time

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **tc:t-loop:ok-time**.

laser1:nlo:shg:factory-settings:tc:timeout

(INTEGER parameter, read-only)

Parameter indicating the factory setting for parameter **tc:limits:timeout**.

laser1:nlo:shg:factory-settings:tc:power-source

(INTEGER parameter, read-only)

Parameter indicating the factory setting for parameter **tc:power-source**.

laser1:nlo:shg:factory-settings:tc:ntc-series-resistance

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **tc:ntc-series-resistance**.

laser1:nlo:shg:factory-settings:pc:

(parameter section)

Factory settings for the piezo controller (PC) of the slow SHG cavity piezo element.

laser1:nlo:shg:factory-settings:pc:voltage-min

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **laser1:nlo:shg:pc:voltage-min**.

laser1:nlo:shg:factory-settings:pc:voltage-max

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **laser1:nlo:shg:pc:voltage-max**.

laser1:nlo:shg:factory-settings:pc:feedforward-enabled

(BOOLEAN parameter, read-only)

Parameter indicating the factory setting for parameter **laser1:nlo:shg:pc:feedforward-enabled**.

laser1:nlo:shg:factory-settings:pc:feedforward-factor

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **laser1:nlo:shg:pc:feedforward-factor**.

laser1:nlo:shg:factory-settings:pc:capacitance

(REAL parameter, read-only)

Parameter indicating the piezo capacitance, measured during production (in μF).

laser1:nlo:shg:factory-settings:pc:scan-offset

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **laser1:scan:offset** used for measurements during production.

laser1:nlo:shg:factory-settings:pc:scan-amplitude

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **laser1:scan:amplitude** used for measurements during production.

laser1:nlo:shg:factory-settings:pc:scan-frequency

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **laser1:scan:frequency** used for measurements during production.

laser1:nlo:shg:factory-settings:pd:

(parameter section)

Factory settings for the SHG photodiodes.

laser1:nlo:shg:factory-settings:pd:shg:

(parameter section)

Factory settings for the SHG photo diode.

laser1:nlo:shg:factory-settings:pd:shg:cal-offset

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **laser1:nlo:pd:dl:cal-offset**.

laser1:nlo:shg:factory-settings:pd:shg:cal-factor

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **laser1:nlo:pd:dl:cal-factor**.

laser1:nlo:shg:factory-settings:pd:shg-input:

(parameter section)

Factory settings for the SHG input photo diode.

For usage see **laser1:nlo:shg:factory-settings:pd:shg:** on page 123.

laser1:nlo:shg:factory-settings:pd:fiber:

(parameter section)

Factory settings for the fiber monitor photo diode.

For usage see **laser1:nlo:shg:factory-settings:pd:shg:** on page 123.

laser1:nlo:shg:factory-settings:pd:int:

(parameter section)

Factory settings for the SHG's intra-cavity photo diode.

laser1:nlo:shg:factory-settings:pd:int:cal-offset

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **laser1:nlo:pd:int:cal-offset**.

laser1:nlo:shg:factory-settings:pd:pdh-dc:

(parameter section)

Factory settings for the SHG cavity-rejection photo diode.

For usage see **laser1:nlo:shg:factory-settings:pd:int:** on page 124.

laser1:nlo:shg:factory-settings:pd:pdh-rf:

(parameter section)

Factory settings for the SHG PDH photo diode.

laser1:nlo:shg:factory-settings:pd:pdh-rf:gain

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **laser1:nlo:pd:shg-pdh-rf:gain**.

laser1:nlo:shg:factory-settings:lock:

(parameter section)

Factory settings for the lock engine.

laser1:nlo:shg:factory-settings:lock:pid-selection

(INTEGER parameter, read-only)

Parameter indicating the factory setting for parameter **laser1:nlo:shg:lock:pid-selection**.

laser1:nlo:shg:factory-settings:lock:setpoint

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **laser1:nlo:shg:lock:setpoint**.

laser1:nlo:shg:factory-settings:lock:relock:

(parameter section)

Factory settings for the automatic SHG cavity ReLock.

laser1:nlo:shg:factory-settings:lock:relock:enabled

(BOOLEAN parameter, read-only)

Parameter indicating the factory setting for parameter **laser1:nlo:shg:lock:relock:enabled**.

laser1:nlo:shg:factory-settings:lock:relock:frequency

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **laser1:nlo:shg:lock:relock:frequency**.

laser1:nlo:shg:factory-settings:lock:relock:amplitude

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **laser1:nlo:shg:lock:relock:amplitude**.

laser1:nlo:shg:factory-settings:lock:relock:delay

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **laser1:nlo:shg:lock:relock:delay**.

laser1:nlo:shg:factory-settings:lock:window:

(parameter section)

Factory settings for out-of-lock detection for SHG cavity ReLock and triggering the PID controller reset.

laser1:nlo:shg:factory-settings:lock:window:input-channel

(INTEGER parameter, read-only)

Parameter indicating the factory setting for parameter **laser1:nlo:shg:lock:window:input-channel**.

laser1:nlo:shg:factory-settings:lock:window:threshold

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **laser1:nlo:shg:lock:window:threshold**.

laser1:nlo:shg:factory-settings:lock:window:level-hysteresis

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **laser1:nlo:shg:lock:window:level-hysteresis**.

laser1:nlo:shg:factory-settings:lock:pid1-gain:

(parameter section)

Factory Settings for the PID Fast controller.

laser1:nlo:shg:factory-settings:lock:pid1-gain:all

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **laser1:nlo:shg:lock:pid1:gain:all**.

laser1:nlo:shg:factory-settings:lock:pid1-gain:p

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **laser1:nlo:shg:lock:pid1:gain:p**.

laser1:nlo:shg:factory-settings:lock:pid1-gain:i

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **laser1:nlo:shg:lock:pid1:gain:i**.

laser1:nlo:shg:factory-settings:lock:pid1-gain:d

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **laser1:nlo:shg:lock:pid1:gain:d**.

laser1:nlo:shg:factory-settings:lock:pid1-gain:i-cutoff

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **laser1:nlo:shg:lock:pid1:gain:i-cutoff**.

laser1:nlo:shg:factory-settings:lock:pid1-gain:i-cutoff-enabled

(BOOLEAN parameter, read-only)

Parameter indicating the factory setting for parameter **laser1:nlo:shg:lock:pid1:gain:i-cutoff**.

laser1:nlo:shg:factory-settings:lock:pid2-gain:

(parameter section)

Factory Settings for the PID Slow controller.

For usage see **laser1:nlo:shg:factory-settings:lock:pid1-gain:** on page 126.

laser1:nlo:shg:factory-settings:lock:analog-p-gain

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **laser1:nlo:shg:lock:analog-dl-gain:p-gain**.

laser1:nlo:shg:factory-settings:lock:local-oscillator:

(parameter section)

Factory settings for the local oscillator of the cavity lock.

laser1:nlo:shg:factory-settings:lock:local-oscillator:enabled

(BOOLEAN parameter, read-only)

Parameter indicating the factory setting for parameter **laser1:nlo:shg:lock:local-oscillator:enabled**.

laser1:nlo:shg:factory-settings:lock:local-oscillator:attenuation-shg-raw

(INTEGER parameter, read-only)

Parameter indicating the factory setting for parameter **laser1:nlo:shg:lock:local-oscillator:attenuation-raw**.

laser1:nlo:shg:factory-settings:lock:local-oscillator:attenuation-fhg-raw

(INTEGER parameter, read-only)

Parameter indicating the factory setting for parameter **laser1:nlo:shg:lock:local-oscillator:attenuation-raw**.

laser1:nlo:shg:factory-settings:lock:local-oscillator:phase-shift-shg

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **laser1:nlo:shg:lock:local-oscillator:phase-shift**.

laser1:nlo:shg:factory-settings:lock:local-oscillator:phase-shift-fhg

(REAL parameter, read-only)

Parameter indicating the factory setting for parameter **laser1:nlo:shg:lock:local-oscillator:phase-shift**.

laser1:nlo:shg:factory-settings:apply

(command, no arguments, returns empty tuple)

This command applies all factory settings for the SHG cavity and power optimization.

laser1:nlo:fhg:

(parameter section)

Parameters for the control of the FHG cavity.

laser1:nlo:fhg:tc:

(parameter section)

The **laser1:nlo:fhg:tc** section provides parameters related to the temperature controller for the nonlinear crystals in frequency-converted diode laser systems.

For usage see **laser1:dl:tc:** on page 44.

laser1:nlo:fhg:pc:

(parameter section)

Parameters the Temperature Control (TC) board.

For usage see **laser1:dl:pc:** on page 48.

laser1:nlo:fhg:scan:

(parameter section)

This section provides access to the scan signal generator.

For usage see **laser1:nlo:shg:scan:** on page 112.

laser1:nlo:fhg:scope:

(parameter section)

This section provides access to the data traces for the DLCpro diagram.

For usage see **laser1:nlo:shg:scope:** on page 112.

laser1:nlo:fhg:lock:

(parameter section)

This section provides access to the DLCpro's lock engine. It has two PID regulators for controlling two independed output channels. Furthermore it provides modules for lock-in detection, automatic relock or reset, as well as for easy to use click-and-lock functionality.

laser1:nlo:fhg:lock:state

(INTEGER parameter, read-only)

Parameter indicating the current operational mode of the lock module. Possible values are:
0 - lock off
1 - locking
2 - locked

laser1:nlo:fhg:lock:state-txt

(STRING parameter, read-only)

Parameter indicating the current operational mode of the lock module as a short text. Possible values are: "idle", "locking" and "locked".

laser1:nlo:fhg:lock:lock-enabled

(BOOLEAN parameter, read-write)

This parameter returns #t if the lock engine's **:state** is "locking" or "locked".
Setting this parameter to #t has the same effect as submitting the command **:close** and setting this parameter to #f has the same effect as submitting the command **:open**.

laser1:nlo:fhg:lock:pid-selection

(INTEGER parameter, read-write)

Parameter to select the PID controllers to be used by the FHG cavity lock engine:
0 - no PID controller active.
1 - "PID Slow" (PID2) on, "PID Fast" (PID1) off, analog PID off.
2 - "PID Slow" (PID2) on, "PID Fast" (PID1) off, analog PID on.
3 - "PID Slow" (PID2) on, "PID Fast" (PID1) on, analog PID off.
4 - All PID controllers on.

laser1:nlo:fhg:lock:setpoint

(REAL parameter, read-write)

Parameter to specify the setpoint for the PID Slow controller (in V).

laser1:nlo:fhg:lock:relock:

(parameter section)

Settings for automatic FHG cavity ReLock.

For usage see **laser1:nlo:shg:lock:relock:** on page 116.

laser1:nlo:fhg:lock:window:

(parameter section)

Settings for out-of-lock detection for FHG cavity ReLock and triggering the PID controller reset.

For usage see **laser1:nlo:shg:lock:window:** on page 117.

laser1:nlo:fhg:lock:pid1:

(parameter section)

Parameters for the PID Fast controller.

For usage see **laser1:nlo:shg:lock:pid1:** on page 117.

laser1:nlo:fhg:lock:pid2:

(parameter section)

Parameters for the PID Slow controller.

For usage see **laser1:nlo:shg:lock:pid1:** on page 117.

laser1:nlo:fhg:lock:local-oscillator:

(parameter section)

Access to the parameters of the local oscillator for the FHG cavity lock.

laser1:nlo:fhg:lock:local-oscillator:enabled

(BOOLEAN parameter, read-write)

Parameter to enable/disable the local oscillator for the FHG cavity lock.
#t - Local oscillator is enabled.
#f - Local oscillator is disabled.

laser1:nlo:fhg:lock:local-oscillator:amplitude

(REAL parameter, read-write)

Parameter to specify the peak-to-peak local oscillator amplitude for the cavity lock (in V). Only discrete values are possible, and the user is recommended to set the local oscillator amplitude via the parameter **laser1:nlo:fhg:lock:local-oscillator:attenuation-raw**.

laser1:nlo:fhg:lock:local-oscillator:attenuation-raw

(INTEGER parameter, read-write)

Parameter to select the peak-to-peak amplitude of the cavity local oscillator. Possible values are:
0 - 0.65 Vpp
2 - 0.58 Vpp
4 - 0.52 Vpp
6 - 0.46 Vpp
9 - 0.39 Vpp
12 - 0.33 Vpp
16 - 0.26 Vpp
21 - 0.19 Vpp
28 - 0.13 Vpp
40 - 0.065 Vpp
63 - 0.017 Vpp

laser1:nlo:fhg:lock:local-oscillator:phase-shift

(REAL parameter, read-write)

Parameter to select the phase difference between the local oscillator for the cavity lock and the PDH RF photo diode signal of the FHG cavity (in °).

laser1:nlo:fhg:lock:local-oscillator:auto-pdh

(command, no arguments, returns empty tuple)

Command to automatically set the phase difference between the local oscillator for the cavity lock and the PDH RF photo diode signal of the FHG cavity for an optimized FHG cavity error signal.

laser1:nlo:fhg:lock:cavity-fast-pzt-voltage

(REAL parameter, read-write)

Alias for single-value-main-out.

laser1:nlo:fhg:lock:cavity-slow-pzt-voltage

(REAL parameter, read-write)

Alias for single-value-aux-out.

laser1:nlo:fhg:lock:background-trace

(BINARY parameter, read-only)

Parameter indicating the X/Y coordinate data for the background trace in the DLCpro GUIs. The parameter provides the last scan trace before the lock was closed. The parameter value is provided in the format decribed in Appendix 4.2. It contains data blocks with IDs *'x'* and *'y'*.
If the lock is not closed, **:background-trace** is empty.

laser1:nlo:fhg:factory-settings:

(parameter section)

Factory settings for the most important parameters related to the FHG cavity, power optimization.

laser1:nlo:fhg:factory-settings:tc:

(parameter section)

Factory settings for the temperature controller (TC) of the FHG nonlinear crystal.

For usage see **laser1:nlo:shg:factory-settings:tc:** on page 120.

laser1:nlo:fhg:factory-settings:pc:

(parameter section)

Factory settings for the piezo controller (PC) of the slow FHG cavity piezo element.

For usage see **laser1:nlo:shg:factory-settings:pc:** on page 122.

laser1:nlo:fhg:factory-settings:pd:

(parameter section)

Factory settings for the FHG photodiodes.

laser1:nlo:fhg:factory-settings:pd:fhg:

(parameter section)

Factory settings for the FHG photo diode.

For usage see **laser1:nlo:shg:factory-settings:pd:shg:** on page 123.

laser1:nlo:fhg:factory-settings:pd:int:

(parameter section)

Factory settings for the FHG's intra-cavity photo diode.

For usage see **laser1:nlo:shg:factory-settings:pd:int:** on page 124.

laser1:nlo:fhg:factory-settings:pd:pdh-dc:

(parameter section)

Factory settings for the FHG cavity-rejection photo diode.

For usage see **laser1:nlo:shg:factory-settings:pd:int:** on page 124.

laser1:nlo:fhg:factory-settings:pd:pdh-rf:

(parameter section)

Factory settings for the FHG PDH photo diode.

For usage see **laser1:nlo:shg:factory-settings:pd:pdh-rf:** on page 124.

laser1:nlo:fhg:factory-settings:lock:

(parameter section)

Factory settings for the lock engine.

For usage see **laser1:nlo:shg:factory-settings:lock:** on page 124.

laser1:nlo:fhg:factory-settings:apply

(command, no arguments, returns empty tuple)

This command applies all factory settings for the FHG cavity.

laser1:nlo:ssw-ver

(STRING parameter, read-only)

Parameter indicating the version of the currently installed SHG system software.

laser1:uv:

(parameter section)

Parameters relevant for the operation of UV frequency-converted diode laser systems.

laser1:uv:pump:

(parameter section)

Parameters for the diode-pumped solid state (DPSS) laser.

For usage see **laser1:dpss:** on page 85.

laser1:uv:eom:

(parameter section)

Parameters concerning the electro-optic modulator in UV-SHG systems.

laser1:uv:eom:tc:

(parameter section)

The **laser1:uv:eom:tc** section provides parameters related to the temperature controller for the EOM in frequency-converted diode laser systems.

For usage see **laser1:dl:tc:** on page 44.

laser1:uv:cavity:

(parameter section)

Parameters describing the doubling cavity in UV-SHG systems.

laser1:uv:cavity:tc:

(parameter section)

The **laser1:uv:cavity:tc** section provides parameters related to the temperature controller for the doubling cavity in frequency-converted diode laser systems.

For usage see **laser1:dl:tc:** on page 44.

laser1:uv:cavity:pc:

(parameter section)

Parameters for the Piezo Control (PC) board in the doubling cavity in frequency-converted diode laser systems.

For usage see **laser1:dl:pc:** on page 48.

laser1:uv:crystal:

(parameter section)

Parameters describing the NLO-crystal in UV-SHG systems.

laser1:uv:crystal:tc:

(parameter section)

The **laser1:uv:cavity:tc** section provides parameters related to the temperature controller for the doubling cavity in frequency-converted diode laser systems.

For usage see **laser1:dl:tc:** on page 44.

laser1:uv:crystal:optics-shifters:

(parameter section)

Parameter describing for the crystal spots an UV-SHG system.

laser1:uv:crystal:optics-shifters:current-spot

(INTEGER parameter, read-only)

Parameter indicating the current spot position, beginning at 1.

laser1:uv:crystal:optics-shifters:remaining-spots

(INTEGER parameter, read-only)

Parameter indicating the number of remaining spot positions.

laser1:uv:servo:

(parameter section)

This section provides access to the servo motors in UV-SHG systems.

laser1:uv:servo:shg1-hor:

(parameter section)

Parameters of the first mirror/horizontal axis servo of the SHG stage.

For usage see **laser1:nlo:servo:ta1-hor:** on page 101.

laser1:uv:servo:shg1-vert:

(parameter section)

Parameters of the first mirror/vertical axis servo of the SHG stage.

For usage see **laser1:nlo:servo:ta1-hor:** on page 101.

laser1:uv:servo:shg2-hor:

(parameter section)

Parameters of the second mirror/horizontal axis servo of the SHG stage.

For usage see **laser1:nlo:servo:ta1-hor:** on page 101.

laser1:uv:servo:shg2-vert:

(parameter section)

Parameters of the second mirror/vertical axis servo of the SHG stage.

For usage see **laser1:nlo:servo:ta1-hor:** on page 101.

laser1:uv:servo:hwp:

(parameter section)

Parameters of the servo of the half-wave plate.

For usage see **laser1:nlo:servo:ta1-hor:** on page 101.

laser1:uv:servo:lens:

(parameter section)

Parameters of the servo of the beamforming lens.

For usage see **laser1:nlo:servo:ta1-hor:** on page 101.

laser1:uv:servo:outcpl:

(parameter section)

Parameters of the servo of the out-coupler in the UV cavity.

For usage see **laser1:nlo:servo:ta1-hor:** on page 101.

laser1:uv:servo:cryst:

(parameter section)

Parameters of the servo of the crystal in the UV cavity.

For usage see **laser1:nlo:servo:ta1-hor:** on page 101.

laser1:uv:servo:comp-hor:

(parameter section)

Parameters of the horizontal compensation servo of the SHG stage.

For usage see **laser1:nlo:servo:ta1-hor:** on page 101.

laser1:uv:servo:comp-vert:

(parameter section)

Parameters of the vertical compensation servo of the SHG stage.

For usage see **laser1:nlo:servo:ta1-hor:** on page 101.

laser1:uv:pd:

(parameter section)

This section provides access to the photodiodes in UV-SHG systems.

laser1:uv:pd:shg:

(parameter section)

Parameters for value and calibration of the SHG photo diode in an UV-SHG system.

For usage see **laser1:nlo:pd:dl:** on page 104.

laser1:uv:pd:pdh-rf:

(parameter section)

Parameters for value and gain of the SHG PDH photo diode in an UV-SHG system.

For usage see **laser1:nlo:pd:shg-pdh-rf:** on page 105.

laser1:uv:pd:pdh-dc:

(parameter section)

Parameters for value and calibration of the SHG cavity-rejection photo diode in an UV-SHG system.

For usage see **laser1:nlo:pd:shg-int:** on page 105.

laser1:uv:power-optimization:

(parameter section)

This section provides access to the power optimization routine in UV-SHG systems.

laser1:uv:power-optimization:ongoing

(BOOLEAN parameter, read-only)

Parameter indicating the status of the power optimization routine:
#t: An optimization routine is in progress.
#f: No optimization routine is in progress.

laser1:uv:power-optimization:status

(INTEGER parameter, read-only)

Parameter indicating the status of the optimization for internal purposes.

laser1:uv:power-optimization:status-string

(STRING parameter, read-only)

Parameter indicating the status of the power optimization routine in textual form.

laser1:uv:power-optimization:cavity:

(parameter section)

Parameters for the SHG power optimization routine of frequency-converted diode laser systems.

For usage see **laser1:nlo:power-optimization:stage1:** on page 107.

laser1:uv:power-optimization:progress-data

(BINARY parameter, read-only)

Parameter array indicating the SHG power after the various iteration steps of the SHG power optimization routine. The values are represented as a BASE64-encoded sequence of 4-byte long floating point numbers in *little endian* byte order.

laser1:uv:power-optimization:abort

(BOOLEAN parameter, read-only)

Parameter specifying whether to abort the power optimization routine.

laser1:uv:power-stabilization:

(parameter section)

This section provides access to the power stabilization routine in UV-SHG systems.

laser1:uv:power-stabilization:enabled

(BOOLEAN parameter, read-only)

Parameter to enable/disable the power stabilization.

laser1:uv:power-stabilization:gain:

(parameter section)

Gain parameters for the power stabilization.

laser1:uv:power-stabilization:gain:all

(REAL parameter, read-only)

Parameter to control the overall gain. This parameter has no physical unit.

laser1:uv:power-stabilization:gain:p

(REAL parameter, read-only)

Parameter to control the proportional gain.
The unit of **:gain:p** is mA/mW.

laser1:uv:power-stabilization:gain:i

(REAL parameter, read-only)

Parameter to control the integral gain.
The unit of **:gain:i** is $\frac{mA}{mW \cdot ms}$.

laser1:uv:power-stabilization:gain:d

(REAL parameter, read-only)

Parameter to control the differential gain.
The unit of **:gain:d** is $\frac{mA \cdot \mu s}{mW}$.

laser1:uv:power-stabilization:power-set

(REAL parameter, read-only)

Parameter to specify the target power in mW.

laser1:uv:power-stabilization:power-act

(REAL parameter, read-only)

Parameter indicating the current power level (in mW).

laser1:uv:power-stabilization:power-min

(REAL parameter, read-only)

Parameter to specify the minimal target power in mW.

laser1:uv:power-stabilization:power-max

(REAL parameter, read-only)

Parameter to specify the maximum target power in mW.

laser1:uv:power-stabilization:state

(INTEGER parameter, read-only)

Parameter indicating the state of the power stabilization PID controller.

0: off
1: in lock
2: on hold
3: suspended

laser1:uv:power-stabilization:update-strategy

(INTEGER parameter, read-only)

Parameter to specify the strategy used for updating the output power during power-stabilization:

0 - change the pump laser power output only.
1 - change the position of the half-wave plate only.
2 - change both the pump laser power output and the position of the half-wave plate as necessary.

laser1:uv:scan:

(parameter section)

This section provides access to the UV-SHG cavity scan signal generator.

For usage see **laser1:nlo:shg:scan:** on page 112.

laser1:uv:scope:

(parameter section)

This section provides access to the data traces for the UV-SHG signal display.

For usage see **laser1:nlo:shg:scope:** on page 112.

laser1:uv:lock:

(parameter section)

This section provides access to the UV-SHG cavity's lock engine. It has two PID regulators for controlling two independed output channels. Furthermore it provides modules for lock-in detection, automatic relock or reset, as well as for easy to use click-and-lock functionality.

For usage see **laser1:nlo:shg:lock:** on page 115.

laser1:uv:factory-settings:

(parameter section)

Factory settings for UV-SHG systems.

laser1:uv:factory-settings:eom-tc:

(parameter section)

Factory settings for the EOM temperature controller (TC).

For usage see **laser1:nlo:shg:factory-settings:tc:** on page 120.

laser1:uv:factory-settings:crystal-tc:

(parameter section)

Factory settings for the crystal temperature controller (TC).

For usage see **laser1:nlo:shg:factory-settings:tc:** on page 120.

laser1:uv:factory-settings:cavity-tc:

(parameter section)

Factory settings for the cavity temperature controller (TC).

For usage see **laser1:nlo:shg:factory-settings:tc:** on page 120.

laser1:uv:factory-settings:pc:

(parameter section)

Factory settings for the piezo controller (PC) of the slow SHG cavity piezo element.

For usage see **laser1:nlo:shg:factory-settings:pc:** on page 122.

laser1:uv:factory-settings:pd:

(parameter section)

Factory settings for the SHG photodiodes.

laser1:uv:factory-settings:pd:shg:

(parameter section)

Factory settings for the SHG photo diode.

For usage see **laser1:nlo:shg:factory-settings:pd:shg:** on page 123.

laser1:uv:factory-settings:pd:pdh-rf:

(parameter section)

Factory settings for the SHG PDH photo diode.

For usage see **laser1:nlo:shg:factory-settings:pd:pdh-rf:** on page 124.

laser1:uv:factory-settings:pd:pdh-dc:

(parameter section)

Factory settings for the SHG cavity-rejection photo diode.

For usage see **laser1:nlo:shg:factory-settings:pd:int:** on page 124.

laser1:uv:factory-settings:lock:

(parameter section)

Factory settings for the lock engine.

For usage see **laser1:nlo:shg:factory-settings:lock:** on page 124.

laser1:uv:factory-settings:apply

(command, no arguments, returns empty tuple)

Command to apply all factory settings.

laser1:uv:status-parameters:

(parameter section)

Parameters for configuring the UV-SHG state machine.

laser1:uv:status-parameters:baseplate-temperature-limit

(REAL parameter, read-only)

Parameter to specify the limit for temperature of the baseplate (in degree Celsius) on an UV-SHG system before reporting an error.

laser1:uv:status-parameters:temperature-settle-time

(INTEGER parameter, read-only)

Parameter to specify the time limit (in seconds) for which the temperature loop is allowed to be out of lock.

laser1:uv:status-parameters:pump-lock-settle-time

(INTEGER parameter, read-only)

Parameter to specify the time limit (in seconds) for which the pump laser is allowed to be out of lock.

laser1:uv:status-parameters:settle-down-delay

(INTEGER parameter, read-only)

Parameter to specify a delay (in seconds) to allow the system to settle down after an optimization.

laser1:uv:status-parameters:power-margin-tolerance-time

(INTEGER parameter, read-only)

Parameter to specify the time limit (in seconds) for which the power margin is allowed to be under the threshold.

laser1:uv:status-parameters:power-margin-threshold

(REAL parameter, read-only)

Parameter to specify the minimum recommended value of the power-margin for the pump laser.

laser1:uv:status-parameters:cavity-lock-settle-time

(INTEGER parameter, read-only)

Parameter to specify the time limit (in seconds) for the cavity lock-in mechanism to get into a locked state.

laser1:uv:status-parameters:cavity-lock-tolerance-factor

(INTEGER parameter, read-only)

Parameter to specify the time limit for which the cavity is allowed to be out of lock, as multiple of **lock:relock:delay**.

laser1:uv:status-parameters:power-lock-settle-time

(INTEGER parameter, read-only)

Parameter to specify the time limit (in seconds) for which the power-stabilization is allowed to be out of lock.

laser1:uv:status-parameters:cavity-scan-duration

(INTEGER parameter, read-only)

Parameter to specify the duration of the cavity scan (in seconds) before attempting a lock in case of power-warning.

laser1:uv:status-parameters:power-stabilization-strategy

(INTEGER parameter, read-only)

Parameter to specify the strategy used for updating the output power during power-stabilization:

0 - change the pump laser power output only.

1 - change the position of the half-wave plate only.

2 - change both the pump laser power output and the position of the half-wave plate as necessary.

laser1:uv:status-parameters:power-stabilization-level-low-factor

(REAL parameter, read-only)

Parameter to specify the power-stabilization level threshold, as a multiple of **laser1:uv:power-stabilization:power-min**.

laser1:uv:status-parameters:power-output-relative-error-max

(REAL parameter, read-only)

Parameter to specify the maximum tolerated error for the power output relative to its set value.

laser1:uv:status-parameters:power-output-relative-deviation-max

(REAL parameter, read-only)

Parameter to specify the maximum tolerated value for the standard deviation of the power output relative to its set value.

laser1:uv:status-parameters:operational-pump-power

(REAL parameter, read-only)

Parameter to specify the value for pump power used for the power-stabilization.

laser1:uv:status-parameters:degradation-detection-slope-threshold

(REAL parameter, read-only)

Parameter to specify the limit for a variation in pump power indicating optics degradation (in mW/h).

laser1:uv:status-parameters:degradation-detection-measurement-interval

(INTEGER parameter, read-only)

Parameter to specify the delay between measurements of the pump power to detect optics degradation (in seconds).

laser1:uv:status-parameters:degradation-detection-number-of-measurements

(INTEGER parameter, read-only)

Parameter to specify the number of measurements of the pump power to detect optics degradation.

laser1:uv:power-margin

(REAL parameter, read-only)

Parameter indicating the overall fractional power-margin for the pump laser/HWP system.

laser1:uv:hwp-transmittance

(REAL parameter, read-only)

Parameter indicating the transmittance of the half-wave plate.

laser1:uv:status

(INTEGER parameter, read-only)

Parameter indicating the status of the UV-SHG system corresponding to the following states:

0 - *power off*
10 - *preparing*
20 - *standby*
30 - *pre-emission*
35 - *idle*
40 - *ready*
50 - *power warning*
60 - *optimizing*
-1 - *error*
99 - *service mode*

laser1:uv:status-txt

(STRING parameter, read-only)

Parameter indicating the status of the UV-SHG system in textual form.

laser1:uv:specs-fulfilled

(BOOLEAN parameter, read-only)

Parameter indicating whether the laser specifications are currently met.

laser1:uv:error

(INTEGER parameter, read-only)

Parameter indicating the error status of the UV-SHG system.

laser1:uv:error-txt

(STRING parameter, read-only)

Parameter indicating the error status of the UV-SHG system.

laser1:uv:operation-time

(REAL parameter, read-only)

Parameter indicating the operation time of the UV-SHG system in hours.

laser1:uv:remaining-optics-spots

(INTEGER parameter, read-only)

Parameter indicating the number of remaining optics spot positions.

laser1:uv:baseplate-temperature

(REAL parameter, read-only)

Parameter indicating the current temperature of the baseplate on an UV-SHG system.

laser1:uv:ssw-ver

(STRING parameter, read-only)

Parameter indicating the version of the currently installed SHG system software.

laser1:uv:perform-optimization

(command, no arguments, returns empty tuple)

Command to optimize the power level of the UV-SHG system.

laser1:uv:perform-optics-shift

(command, no arguments, returns empty tuple)

Command to shift the optics of the UV-SHG system to the next spot position.

laser1:uv:clear-errors

(command, no arguments, returns empty tuple)

Command to reset all error flags.

laser1:pd-ext:

(parameter section)

Parameters for using an external photodiode at one of the BNC inputs as user-calibrated power meter.

laser1:pd-ext:input-channel

(INTEGER parameter, read-write)

Parameter to specify the input channel, the photodiode is connected to. Allowed values are 0, 1, 2, 4.

laser1:pd-ext:photodiode

(REAL parameter, read-only)

Parameter showing the voltage measured at the input specified by **:input-channel**.

laser1:pd-ext:power

(REAL parameter, read-only)

Parameter for reading the laser power. The signal measured at the input specified by **:input-channel** in Volts is converted into power by use of the calibration parameters **:cal-offset** and **:cal-factor**.

laser1:pd-ext:cal-offset

(REAL parameter, read-write)

Parameter to specify the calibration offset for the photodiode in V.

laser1:pd-ext:cal-factor

(REAL parameter, read-write)

Parameter to specify the calibration factor for the photodiode in mW/V.

laser1:power-stabilization:

(parameter section)

Power Stabilization

laser1:power-stabilization:enabled

(BOOLEAN parameter, read-write)

Parameter to enable/disable the power stabilization.

laser1:power-stabilization:gain:

(parameter section)

Gain parameters for the power stabilization.

For usage see **laser1:uv:power-stabilization:gain:** on page 137.

laser1:power-stabilization:sign

(BOOLEAN parameter, read-write)

Sign of the power stabilization action. Typically this parameter should be #f.
#f - to increase the power level the output current needs to be increased
#t - to increase the power level the output current needs to be decreased.

laser1:power-stabilization:input-channel

(INTEGER parameter, read-write)

Parameter to select the signal channel to be stabilized.
Depending on the laser head connected, different choices are possible here. The possible values are a subset of the signals listed in the "Signal Channel IDs" section in appendix 4.1 on page 189.

laser1:power-stabilization:setpoint

(REAL parameter, read-write)

Parameter to specify the target power in mW.

laser1:power-stabilization:window:

(parameter section)

Parameters for power supervision.

laser1:power-stabilization:window:enabled

(BOOLEAN parameter, read-write)

Set this parameter to #t to enable the power supervision engine.

laser1:power-stabilization:window:level-low

(REAL parameter, read-write)

Parameter to specify a lower limit (in mW) for power stabilization.
If the power level drops below this limit, the power stabilization loop with be set to hold state, waiting for the power level to return to higher levels.

laser1:power-stabilization:window:level-hysteresis

(REAL parameter, read-write)

Parameter to specify the hysteresis (in mW) for the supervision engine.
If the power stabilization was set to hold state because the power level dropped below **:level-low**, the requirement for the stabilization loop to continue is that the power level returns to values higher than **:level-low + :level-hysteresis**.

laser1:power-stabilization:hold-output-on-unlock

(BOOLEAN parameter, read-write)

Parameter to determine the behaviour when power stabilization is disabled.
#t - upon disabling the power stabilization the, the PID output is transferred to the current set-value, keeping the current power level.
#f - upon disabling the power stabilization the, the PID output is reset to zero. The current will return to the value it had before enabling power stabilization.

laser1:power-stabilization:output-channel

(INTEGER parameter, read-only)

Parameter indicating the PID output channel for the power-stabilization. For amplified laser heads (TA pro and alike) this will be the amplifier current (63). For all other lasers it will be the laser diode current (51). (See the "Signal Channel IDs" section in appendix 4.1 on page 189.)

laser1:power-stabilization:input-channel-value-act

(REAL parameter, read-only)

Parameter indicating the current power level (in mW) as measured by the input specified with **:input-channel**.

laser1:power-stabilization:state

(INTEGER parameter, read-only)

Parameter indicating the state of the power stabilization PID controller.

0: off

1: in lock

2: on hold

3: suspended

4: limited

laser1:power-stabilization:feedforward-enabled

(BOOLEAN parameter, read-write)

Only for CTL laser heads: Parameter for enabling/disabling the feedforward for the cavity piezo. The feedforward is used to compensating current change induced wavelength changes by adapting the cavity.

laser1:power-stabilization:feedforward-factor

(REAL parameter, read-write)

Only for CTL laser heads: Parameter to specify the feedforward factor between piezo voltage and laser current (in V/mA).

laser1:config:

(parameter section)

Parameters and commands to load, save, modify and inspect a configurations file.

Up to four configurations can be stored on the controller, addressed by the labels "dlc:config1" through "dlc:config4". More configurations can be stored on an attached USB stick. They are stored in a folder named "toptica", get the file extensions ".laserconf" and are addressed by the labels "usb:*filename*". Furthermore, configurations can be imported from and exported to a remote PC via command line.

Working with a configuration always consists of two steps: First, the content of the configuration must be set with one of the commands **:retrieve**, **:load** or **:import**. Then, second, the content can be either applied to the laser parameters or stored into a file or transferred to a remote PC with the commands **:apply**, **:save** or **:export**, respectively.

Examples:

Activate configuration #4, stored on the device
First execute `(exec 'laser1:config:load "dlc:config4")` to load the content of the configuration file into memory. Then execute `(exec 'laser1:config:apply)` to set all laser parameters according to the configuration values.

Copy configuration #1 from the device to a file on a remote PC
First execute `(exec 'laser1:config:load "dlc:config1")` to load the content of the configuration file into memory. Then execute `(exec 'laser1:config:export)` to read out the configuration content in BASE64 format. Decode the data and store the result in a file on the PC.

Save current parameter values to configuration file "laser-settings.laserconf" on the USB stick
First execute `(exec 'laser1:config:retrieve)` to get a snapshot of the current parameter values. If desired use `(param-set! 'laser1:config:caption "...")` to add a descriptive text to the configuration. Then execute `(exec 'laser1:config:save "usb:laser-settings.laserconf")` to store the values onto the USB stick.

Replace configuration #3 on the device by a file from a remote PC
First encode your file content to BASE64 format. Then start the command `(exec`

`'laser1:config:import)`. When prompted for data transfer, send the BASE64 data, followed by a '#' character. Now the file content is in memory. Execute `(exec 'laser1:config:save "dlc:config3")` to write the content into configuration #3.

laser1:config:source

(STRING parameter, read-only)

Parameter indicating the source of the configuration.
The label has the form "dlc:configX" for configurations stored on the controller, "usb:filename" for configurations stored on an USB-stick, "imported" for contents imported from remote or "retrieved" for values retrieved from the current parameters.

laser1:config:product-name

(STRING parameter, read-only)

Parameter indicating type and serial number of the laser head, the configuration was generated for.
This value is automatically set when the **:retrieve** command is used.
Note: The configuration can only be applied to a laser head with the exactly same product name.

laser1:config:date

(STRING parameter, read-only)

Parameter indicating date and time when the configuration was generated.
This value is automatically set when the **:retrieve** command is used.

laser1:config:caption

(STRING parameter, read-write)

Parameter to specify a short description of the purpose of the configuration.

laser1:config:pristine

(BOOLEAN parameter, read-only)

Parameter indicating whether the configuration is in an 'original' state, i.e. whether it was not manually modified outside the device.

laser1:config:load

(command, 1 argument, returns empty tuple)

Arguments:
1. *source* of type STRING

Command to load the content of the configuration file specified by the *source* argument.
The *source* argument accepts values "dlc:config1" to "dlc:config4" for configurations stored inside the controller or "usb:filename" for a configuration stored on a USB-Stick.

laser1:config:save

(command, 1 argument, returns empty tuple)

Arguments:
1. *destination* of type STRING

Command to save the configuration content to a configuration file specified by the *destination* argument.
The *destination* argument accepts the same values as the *source* argument of the **:load** command. If the USB stick is used as destination, the file will be stored in a folder named "toptica". If the folder does not exist it will be created.

laser1:config:import

(command, no arguments, returns empty tuple)

Command to import a configuration content via command line.
Start the command with `(exec 'laser1:config:import)`.
The device then prompts for the content file:
`waiting for input (send # for end-of-file) ...`
Send the entire configuration content BASE64 encoded. The end-of-file signal (# character) tells the firmware to process the data which then gets acknowledge by `transfer complete.`.

laser1:config:export

(command, no arguments, returns empty tuple)

Command to export the content of the configuration via command line.
The content gets printed to the command line in BASE64 format.

laser1:config:retrieve

(command, no arguments, returns empty tuple)

Command to retrieve the configuration content from the current parameter values.
The parameter **:date** will automatically be set to the current system-time and the parameter **:product-name** will be set to the product name of the laser head. The parameter **:caption** will be set to an empty string.

laser1:config:apply

(command, no arguments, returns BOOLEAN)

Command to apply the content of the configuration to the parameters. Note: Only parameters accessible in the current userlevel will be applied. If all parameters from the configuration are used, the command returns #t. If, due to userlevel restrictions, parameter values need to be omitted, the return value is #f. If the product name of the laser head **laser1:product-name** differs from that in the **laser1:config:product-name** parameter, the command refuses to apply the parameters and exits with an error message.

laser1:config:show

(command, no arguments, returns empty tuple)

Command to print the content of the configuration to the console.

laser1:config:list

(command, no arguments, returns STRING)

Command to list the configuration files available on the device and the attached USB stick.
The return value consists of a multi-line string, listing informations for one file per line. Each line contains the configuration name in the format needed for the **:load** and **:save** commands, the product-name, the date when the configuration was saved and the optional caption, separated by semicolons. Files on the USB stick are listed if their file extension is ".laserconf" and if they reside in a folder named "toptica".

laser1:save

(command, no arguments, returns empty tuple)

Command to save laser parameters to the DLC pro flash memory.
This includes all relevant parameters related of **:dl:cc**, **:dl:pc**, **:dl:tc**, **:dl:scan**, **:scope**, **:dl:lock**, **:amp:cc**, and **:amp:tc**.

laser1:load

(command, no arguments, returns empty tuple)

Command to load laser parameters from the DLC pro flash memory.

laser1:load-head

(command, no arguments, returns empty tuple)

Command to load laser head parameters from the DLC pro flash memory.

laser2:

(parameter section)

This section provides controls for the second laser head attached to the DLC pro controller.

For usage see **laser1:** on page 36.

laser-common:

(parameter section)

Parmeters and commands related to more than one laser.

laser-common:scan:

(parameter section)

Parameters and command to synchronize the scan generators of multiple lasers.

laser-common:scan:sync-laser1

(BOOLEAN parameter, read-write)

Parameter to specify if the **laser1:scan** should be considered when the command **:sync** is executed.

laser-common:scan:sync-laser2

(BOOLEAN parameter, read-write)

Parameter to specify if **laser2:scan** should be considered when the command **:sync** is executed.

laser-common:scan:frequency

(REAL parameter, read-write)

Parameter to specify the common frequency the scan generators should use when they get synchronized with the **:sync** command.

laser-common:scan:sync

(command, no arguments, returns empty tuple)

Command to synchronize the scan generators of all connected lasers.
When the command is executed, the scan generators of all configured lasers get set to the same frequency **:frequency**. They then get restarted simultaneously and will continue to oscillate synchronously with zero relative phase-shift.
Note: During the process of synchronization the digital output 3 will be toggled.

laser-common:scan:save

(command, no arguments, returns empty tuple)

Command to save scan-synchronization settings.

laser-common:scan:load

(command, no arguments, returns empty tuple)

Command to load scan-synchronization settings.

laser-common:save-all

(command, no arguments, returns empty tuple)

Command to save all user-settings, including global settings and settings of all connected lasers.

laser-common:load-all

(command, no arguments, returns empty tuple)

Command to load all user-settings, including global settings and settings of all connected lasers.

laser-common:store-all

(command, no arguments, returns empty tuple)

Command to store all laser-settings, including global settings and settings of all connected lasers.

laser-common:restore-all

(command, no arguments, returns empty tuple)

Command to restore all laser-settings, including global settings and settings of all connected lasers.

laser-common:apply-all

(command, no arguments, returns empty tuple)

Command to apply all factory-settings, including global settings and settings of all connected lasers.

laser-common:retrieve-all

(command, no arguments, returns empty tuple)

Command to retrieve all factory-settings, including global settings and settings of all connected lasers.

uv:

(parameter section)

This section provides controls for a UV-SHG laser head attached to the DLC pro controller.

uv:laser-on

(BOOLEAN parameter, read-write)

Parameter to enable the UV-SHG laser head.

uv:emission

(BOOLEAN parameter, read-only)

Parameter indicating the emission status for the UV-SHG laser head.
#t - laser emits light
#f - laser emission is switched off

uv:status

(INTEGER parameter, read-only)

Parameter indicating the status of the UV-SHG system corresponding to the following states:

0 - *power off*
10 - *preparing*
20 - *standby*
30 - *pre-emission*
35 - *idle*
40 - *ready*
50 - *power warning*
60 - *optimizing*
-1 - *error*
99 - *service mode*

uv:status-txt

(STRING parameter, read-only)

Parameter indicating the status of the UV-SHG system in textual form.

uv:specs-fulfilled

(BOOLEAN parameter, read-only)

Parameter indicating whether the laser specifications are currently met.

uv:error

(INTEGER parameter, read-only)

Parameter indicating the error status of the UV-SHG system.

uv:error-txt

(STRING parameter, read-only)

Parameter indicating the error status of the UV-SHG system in textual form.

uv:operation-time-pump

(REAL parameter, read-only)

Parameter indicating the operation time of the pump laser in hours.

uv:operation-time-uv

(REAL parameter, read-only)

Parameter indicating the operation time of the UV-SHG system in hours.

uv:pump-power-margin

(REAL parameter, read-only)

Parameter indicating the fractional power-margin for the pump laser.

uv:remaining-optics-spots

(INTEGER parameter, read-only)

Parameter indicating the number of remaining optics spot positions.

uv:power-set

(REAL parameter, read-write)

Parameter to specify the target power in mW.

uv:power-act

(REAL parameter, read-only)

Parameter indicating the current power level (in mW).

uv:baseplate-temperature

(REAL parameter, read-only)

Parameter indicating the current temperature of the baseplate on an UV-SHG system.

uv:idle-mode

(BOOLEAN parameter, read-write)

Parameter to enable the idle mode in the UV-SHG system.

uv:perform-optimization

(command, no arguments, returns empty tuple)

Command to optimize the power level of the UV-SHG system.

uv:perform-optics-shift

(command, no arguments, returns empty tuple)

Command to shift the optics of the UV-SHG system to the next spot position.

uv:clear-errors

(command, no arguments, returns empty tuple)

Command to optimize the power level of the UV-SHG system.

auto-nlo:

(parameter section)

Parameters for controlling the AutoNLO feature of frequency-converted diode laser systems.

auto-nlo:automatic-mode

(BOOLEAN parameter, read-only)

Parameter to enable the Auto-Pilot feature.

auto-nlo:laser-on

(BOOLEAN parameter, read-write)

Parameter to enable the NLO laser head.

auto-nlo:emission

(BOOLEAN parameter, read-only)

Parameter indicating the emission status for the NLO laser head.
#t - laser emits light
#f - laser emission is switched off

auto-nlo:status

(INTEGER parameter, read-only)

Parameter indicating the status of the NLO system corresponding to the following states:

0 - *power off*
10 - *preparing*
20 - *standby*
30 - *pre-emission*
35 - *idle*
40 - *ready*
50 - *power warning*
60 - *optimizing*
-1 - *error*
99 - *service mode*
999 - *disabled*

auto-nlo:status-txt

(STRING parameter, read-only)

Parameter indicating the status of the NLO system in textual form.

auto-nlo:error

(INTEGER parameter, read-only)

Parameter indicating the error status of the NLO system.

auto-nlo:error-txt

(STRING parameter, read-only)

Parameter indicating the error status of the NLO system in textual form.

auto-nlo:operation-time-master

(REAL parameter, read-only)

Parameter indicating the operation time of the master laser in hours.

auto-nlo:operation-time-amplifier

(REAL parameter, read-only)

Parameter indicating the operation time of the amplifier in hours.

auto-nlo:operation-time-cavity

(REAL parameter, read-only)

Parameter indicating the operation time of the NLO resonator in hours.

auto-nlo:amplifier-current-margin

(REAL parameter, read-only)

Parameter indicating the fractional current-margin for the amplifier.

auto-nlo:power-set

(REAL parameter, read-write)

Parameter to specify the target power in mW.

auto-nlo:power-act

(REAL parameter, read-only)

Parameter indicating the current power level (in mW).

auto-nlo:idle-mode

(BOOLEAN parameter, read-write)

Parameter to enable the idle mode in the NLO system.

auto-nlo:perform-optimization

(command, no arguments, returns empty tuple)

Command to optimize the power level of the NLO system.

auto-nlo:clear-errors

(command, no arguments, returns empty tuple)

Command to reset all the AutoNLO related error flags.

cc1:

(parameter section)

This section provides controls for the first Current Controller (CC) board. CC controls the laser current and provides checks for the laser system's health.

cc1:slot

(STRING parameter, read-only)

Parameter indicating the slot, the CC-board is mounted in.

cc1:serial-number

(STRING parameter, read-only)

Parameter indicating the CC-board's serial number.

cc1:revision

(STRING parameter, read-only)

Parameter indicating the CC-board's hardware revision number.

cc1:fpga-fw-ver

(INTEGER parameter, read-only)

Parameter indicating the firmware version of the FPGA.

cc1:board-temp

(REAL parameter, read-only)

Parameter indicating the CC-board temperature (in °C).

cc1:variant

(STRING parameter, read-only)

Parameter describing the hardware configuration of the CC-channel. For example, "2x 250 mA" or "1x 500 mA"

cc1:parallel-mode

(BOOLEAN parameter, read-only)

Parameter indicating whether both CC channels are combined into a single high-power channel.
#t - both 250mA CC channels are combined into a single 500mA channel.
#f - the two 250mA CC channels are not combined and can be used separately.

cc2:

(parameter section)

This section provides controls for the optional 2nd Current Controller (CC) board.

For usage see **cc1:** on page 158.

ampcc1:

(parameter section)

This section provides controls for the Amplifier Current Controller (CC) board. CC controls the laser current and provides checks for the laser system's health.

ampcc1:slot

(STRING parameter, read-only)

Parameter indicating the slot, the CC-5000 board is mounted in.

ampcc1:serial-number

(STRING parameter, read-only)

Parameter indicating the CC-5000 board's serial number.

ampcc1:revision

(STRING parameter, read-only)

Parameter indicating the CC-5000 board's hardware revision number.

ampcc1:fpga-fw-ver

(INTEGER parameter, read-only)

Parameter indicating the firmware version of the FPGA.

ampcc1:board-temp

(REAL parameter, read-only)

Parameter indicating the CC-board temperature (in °C).

ampcc1:variant

(STRING parameter, read-only)

Parameter describing the hardware configuration of the CC-5000 channel. For example, "1x 5000mA"

ampcc1:parallel-mode

(BOOLEAN parameter, read-only)

Parameter describing the hardware configuration of the CC-5000 channel.
#t - this board's channel is combined with a second CC-5000 board's channels into a single 10000mA channel.
#f - this board is provigin a single 5000mA channel

ampcc1:power-15v

(BOOLEAN parameter, read-only)

Parameter to specify power supply to use for the CC5000 board.
#t - use 15V line
#f - use 5V line.

ampcc1:channel1:

(parameter section)

This section provides controls for the current channel of the current controller (CC-5000) board. The controls include setting the amplifier chip current, configuring the clips of the chip protection circuitry, reading status information, etc.

For usage see **laser1:amp:cc:** on page 76.

ampcc2:

(parameter section)

This section provides controls for an optional 2nd Amplifier Current Controller (CC) board.

For usage see **ampcc1:** on page 159.

pc1:

(parameter section)

This section provides controls for the Piezo Controller (PC) board. The PC controls the piezo voltage applied to the laser head.

pc1:slot

(STRING parameter, read-only)

Parameter indicating the slot, the PC-board is mounted in.

pc1:serial-number

(STRING parameter, read-only)

Parameter indicating the PC-board's serial number.

pc1:revision

(STRING parameter, read-only)

Parameter indicating the PC-board's hardware revision number.

pc1:variant

(STRING parameter, read-only)

Parameter indicating the board variant of the PC module.

pc1:channel-count

(INTEGER parameter, read-only)

Parameter indicating the number of available voltage channels.

pc1:fpga-fw-ver

(INTEGER parameter, read-only)

Parameter indicating the firmware version of the FPGA.

pc2:

(parameter section)

This section gives access to the piezo control board. It provide means for controlling the piezo voltage.

For usage see **pc1:** on page 160.

pc3:

(parameter section)

This section gives access to the piezo control board. It provide means for controlling the piezo voltage.

For usage see **pc1:** on page 160.

tc1:

(parameter section)

This section provides controls for the Temperature Control (TC) board.

tc1:slot

(STRING parameter, read-only)

Parameter indicating the slot, the TC-board is mounted in.

tc1:serial-number

(STRING parameter, read-only)

Parameter indicating the TC-board's serial number.

tc1:revision

(STRING parameter, read-only)

Parameter indicating the TC-board's hardware revision number.

tc1:fpga-fw-ver

(STRING parameter, read-only)

Parameter indicating the firmware version of the FPGA.

tc1:board-temp

(REAL parameter, read-only)

Parameter indicating the TC-board temperature in °C.

tc1:channel1:

(parameter section)

Parameters for controlling the temperature stabilization of the laser diode.

For usage see **laser1:dl:tc:** on page 44.

tc1:channel2:

(parameter section)

Parameters for controlling the temperature stabilization of the laser diode.

For usage see **laser1:dl:tc:** on page 44.

tc2:

(parameter section)

This section provides controls for the Temperature Control (TC) board.

For usage see **tc1:** on page 161.

mc:

(parameter section)

This section provides controls for the Main Controller (MC) board.

mc:serial-number

(STRING parameter, read-only)

Parameter indicating the serial number of the MC-board.

mc:revision

(STRING parameter, read-only)

Parameter indicating the MC-board's hardware revision number.

mc:fpga-fw-ver

(STRING parameter, read-only)

Parameter indicating the firmware version of the FPGA.

mc:board-temp

(REAL parameter, read-only)

Parameter indicating the temperature measured on the MC-board (in °C).

mc:relative-humidity

(REAL parameter, read-only)

Parameter indicating the relative humidity measured by the humidity sensor (in %).

mc:air-pressure

(REAL parameter, read-only)

Parameter indicating the air pressure measured by the pressure sensor (in hPa).

io:

(parameter section)

This section provides controls for the Input/Output (I/O) board.

io:serial-number

(STRING parameter, read-only)

Parameter indicating the serial number of the I/O-board.

io:revision

(STRING parameter, read-only)

Parameter indicating the I/O-board's hardware revision number.

io:fpga-fw-ver

(INTEGER parameter, read-only)

Parameter indicating the firmware version of the FPGA.

io:fine-1:

(parameter section)

Parameters for the Fine 1 analog frontpanel input.

io:fine-1:value-act

(REAL parameter, read-only)

Parameter indicating the voltage in V, measured at the analog input connector.

io:fine-2:

(parameter section)

Parameters for the Fine 2 analog frontpanel input.

For usage see **io:fine-1:** on page 163.

io:fast-3:

(parameter section)

Parameters for the Fast 3 analog frontpanel input.

For usage see **io:fine-1:** on page 163.

io:fast-4:

(parameter section)

Parameters for the Fast 4 analog frontpanel input.

For usage see **io:fine-1:** on page 163.

io:out-a:

(parameter section)

Settings for the Out A analog frontpanel output.

io:out-a:voltage-set

(REAL parameter, read-write)

Parameter to specify the static output voltage in V.
In contrast to the **:voltage-offset** parameter, this value includes the static contribution of the feedforward. With feedforward disabled **:voltage-offset** and **:voltage-set** are identical.

io:out-a:voltage-offset

(REAL parameter, read-write)

Parameter to specify the static output voltage offset in V.

io:out-a:voltage-min

(REAL parameter, read-write)

Parameter to specify the minimum output voltage in V.

io:out-a:voltage-max

(REAL parameter, read-write)

Parameter to specify the maximum output voltage in V.

io:out-a:external-input:

(parameter section)

Parameters to configure the voltage control by an external, analog voltage input.

For usage see **laser1:dl:cc:external-input:** on page 41.

io:out-a:output-filter:

(parameter section)

Parameters to configure output filters such as slew rate.

For usage see **laser1:dl:cc:output-filter:** on page 41.

io:out-a:feedforward-enabled

(BOOLEAN parameter, read-write)

Parameter to enable/disable Feed Forward for this voltage output channel.
#t - Feed Forward enabled
#f - Feed Forward disabled
If enabled, a voltage proportional to another channel's output is added to this channel. The other channel is defined by the **:feedforward-master** parameter.

io:out-a:feedforward-factor

(REAL parameter, read-write)

Parameter to control how much of the master channel's output is to be added to this voltage channel.

io:out-b:

(parameter section)

Settings for the Out B analog frontpanel output.

For usage see **io:out-a:** on page 164.

io:digital-in0:

(parameter section)

Parameters related to the digital input 0.

io:digital-in0:value-act

(BOOLEAN parameter, read-only)

Parameter indicating the electrical state of the digital input pin.
#t - high signal (5V)
#f - low signal (0V)

io:digital-in1:

(parameter section)

Parameters related to the digital input 0.

For usage see **io:digital-in0:** on page 165.

io:digital-in2:

(parameter section)

Parameters related to the digital input 0.

For usage see **io:digital-in0:** on page 165.

io:digital-in3:

(parameter section)

Parameters related to the digital input 0.

For usage see **io:digital-in0:** on page 165.

io:digital-out0:

(parameter section)

Parameters related to the digital output 0.
This output supports the following modes:

0 - trigger output of signal generator **laser1:scan**

1 - unused

2 - unused

3 - software control via parameter **:value-set**

io:digital-out0:value-act

(BOOLEAN parameter, read-only)

Parameter indicating the electrical state of the digital output pin.
#t - high signal (5V)
#f - low signal (0V)

io:digital-out0:value-set

(BOOLEAN parameter, read-write)

Parameter specifying the electrical state of the digital output pin in case of software control.
#t - high signal (5V)
#f - low signal (0V)
If the **:invert** parameter is #t, the signal will be inverted. To use software control set the **:mode** parameter to 3.

io:digital-out0:mode

(INTEGER parameter, read-write)

Parameter to specify the signal source for digital output.
While for all the digital outputs allowed mode values are 0, 1, 2 and 3, the meaning of the value depends on the indivial output. Please read the description of the parameters **io:digital-out0**, **io:digital-out1**, **io:digital-out2** and **io:digital-out3**.

io:digital-out0:invert

(BOOLEAN parameter, read-write)

Parameter to specify if the digital output logic should be inverted.

io:digital-out1:

(parameter section)

Parameters related to the digital output 1.
This output supports the following modes:

0 - unused

1 - *out-of-lock* signal of lock engine **laser1:dl:lock**

2 - possible trigger output of a wide-scan (see **laser1:wide-scan:trigger:output-channel**)

3 - software control via parameter **:value-set**

For usage see **io:digital-out0:** on page 166.

io:digital-out2:

(parameter section)

Parameters related to the digital output 2.
This output supports the following modes:

0 - trigger output of CTL motor scan **laser1:ctl:scan**

1 - *out-of-lock* signal of lock engine **laser2:dl:lock**

2 - unused

3 - software control via parameter **:value-set**

For usage see **io:digital-out0:** on page 166.

io:digital-out3:

(parameter section)

Parameters related to the digital output 3.
This output supports the following modes:

0 - trigger output of signal generator **laser2:scan**

1 - unused

2 - possible trigger output of a wide-scan (see **laser1:wide-scan:trigger:output-channel**)

3 - software control via parameter **:value-set**

For usage see **io:digital-out0:** on page 166.

io:save

(command, no arguments, returns empty tuple)

Command to save user settings for the analog output channels.

io:load

(command, no arguments, returns empty tuple)

Command to load user settings for the analog output channels.

power-supply:

(parameter section)

This section provides information about power supply lines.

power-supply:type

(STRING parameter, read-only)

Parameter indicating the type of power supply installed.

power-supply:serial-number

(STRING parameter, read-only)

Parameter indicating the serial number of the power supply.

power-supply:revision

(STRING parameter, read-only)

Parameter indicating the power supply's hardware revision number.

power-supply:board-temp

(REAL parameter, read-only)

Parameter indicating the temperature of the power filter PCB (in °C).

power-supply:heatsink-temp

(REAL parameter, read-only)

Parameter indicating the temperature of the power supply heatsink (in °C). This parameter is only available if the power supply hardware supports it.

power-supply:current-5V

(REAL parameter, read-only)

Parameter indicating the current on the +5V line (in A).

power-supply:current-15V

(REAL parameter, read-only)

Parameter indicating the current on the +15V line (in A).

power-supply:current-15Vn

(REAL parameter, read-only)

Parameter indicating the current on the -15V line (in A).

power-supply:voltage-5V

(REAL parameter, read-only)

Parameter indicating the voltage of the +5V line (in V).

power-supply:voltage-15V

(REAL parameter, read-only)

Parameter indicating the voltage of the +15V line (in V).

power-supply:voltage-15Vn

(REAL parameter, read-only)

Parameter indicating the voltage of the -15V line (in V).

power-supply:voltage-3V3

(REAL parameter, read-only)

Parameter indicating the voltage of the +3.3V line (in V).

power-supply:load

(REAL parameter, read-only)

Parameter indicating total power consumption of 5V, +15V and -15V line in W.

power-supply:status

(INTEGER parameter, read-only)

Parameter providing status information about the power-supply health. Each bit of the integer value provides specific channel status information.

bit 0 - high temperature (temperature above limit T_1)

bit 1 - critical temperature (temperature above limit T_2)

bit 2 - legacy powersupply without temperature sensor

bit 3 - problem with reading one of the sensors

bit 4 - very high current at DC/DC converter

The temperature limits T_1 and T_2 depend on type and revision of the power-supply installed. At temperatures above T_2 all modules with be switched off.

power-supply:status-txt

(STRING parameter, read-only)

Parameter providing a brief text version of the **:status** parameter.

buzzer:

(parameter section)

Parameters to access the buzzer.

buzzer:welcome

(STRING parameter, read-write)

Parameter to determine the welcome melody that is played by the buzzer at boot time when the firmware is started.
Set an empty string if no melody is to be played.

buzzer:play-welcome

(command, no arguments, returns empty tuple)

Command to play the **:welcome** melody.

buzzer:play

(command, 1 argument, returns empty tuple)

Arguments:
1. *melody* of type STRING

Command to play the melody specified in the command argument.

display:

(parameter section)

Parameters to specify the behaviour of the DLCpro touch screen illumination.

display:brightness

(REAL parameter, read-write)

Parameter to specify the brightness of the touch screen illumination. The minimum value for darkest illumination is 0.5. The maximum value of 100 means maximum brightness. The scale is not linear.

display:auto-dark

(BOOLEAN parameter, read-write)

Parameter to enable/disable *screen save* mode.
#t - If the touchscreen on DLC pro frontpanel is not used for a time specified by the **:idle-timeout**, the display illumination is automatically switched off. It is automatically switched on again as soon as the screen is touched again.
#f - The display stays illuminated.

display:idle-timeout

(INTEGER parameter, read-write)

Parameter specifying the time in seconds after which the display illumination is switched off, if the touchscreen on the frontpanel has not been used.

display:state

(INTEGER parameter, read-only)

Parameter indicating the display state.

0 - display is off

1 - display is about to be turned off (semi dark)

2 - display is on, **:auto-dark** is enabled

3 - display is on, **:auto-dark** just got enabled,

4 - display is on, **:auto-dark** is disabled

display:save

(command, no arguments, returns empty tuple)

Command to save display user-settings.

display:load

(command, no arguments, returns empty tuple)

Command to load display user-settings.

display:update-state

(command, 1 argument, returns empty tuple)

Arguments:
1. *active* of type BOOLEAN

Command for the touch UI to report frontpanel activity to the device control.

standby:

(parameter section)

Parameters to modify the settings of the standby mode. The standby mode is toggled with the power/standby button on the DLCpro frontpanel.

standby:enabled

(BOOLEAN parameter, read-write)

Parameter indicating wheteher the system is in standby mode.
#t - system in standby mode
#f - system not in standby mode

standby:state

(INTEGER parameter, read-only)

Parameter indicating standby state of the system.

0 - standby disabled, system is in *power mode*

1 - standby enabled, system is in *standby mode*

2 - transition from *standby mode* to*power mode*, system is waiting for confirmation

standby:laser1:

(parameter section)

Settings for the standby mode of laser1.

standby:laser1:dl:

(parameter section)

Settings for the standby mode of the laser-head's diode laser.

standby:laser1:dl:disable-pc

(BOOLEAN parameter, read-write)

Parameter to disable the piezo voltage in laser standby mode.
#t - piezo voltage disabled in laser standby mode

standby:laser1:dl:disable-cc

(BOOLEAN parameter, read-write)

Parameter to disable the diode current in laser standby mode.
#t - diode current disabled in laser standby mode

standby:laser1:dl:disable-tc

(BOOLEAN parameter, read-write)

Parameter to disable the temperature control in laser standby mode.
#t - temperature control disabled in laser standby mode

standby:laser1:amp:

(parameter section)

Settings for the standby mode of laser-head's amplifier.

standby:laser1:amp:disable-cc

(BOOLEAN parameter, read-write)

Parameter to disable the amplifier current in laser standby mode.
#t - amplifier current disabled in laser standby mode

standby:laser1:amp:disable-tc

(BOOLEAN parameter, read-write)

Parameter to disable the amplifier temperature control in laser standby mode.
#t - amplififer temperature control disabled in laser standby mode

standby:laser1:ctl:

(parameter section)

Settings for the standby mode of laser-head's CTL.

standby:laser1:ctl:disable

(BOOLEAN parameter, read-write)

Disable the CTL laser-head in standby mode.

standby:laser1:nlo:

(parameter section)

Settings for the SHG (and FHG) standby mode.

standby:laser1:nlo:disable-pc

(BOOLEAN parameter, read-write)

Disable the SHG (and FHG) piezo control in standby mode.

standby:laser1:nlo:disable-tc

(BOOLEAN parameter, read-write)

Disable the temperature control of the SHG-cavity (and of the FHG-cavity) in standby mode.

standby:laser2:

(parameter section)

Settings for the standby mode of laser2.

standby:laser2:dl:

(parameter section)

Settings for the standby mode of the laser-head's diode laser.

For usage see **standby:laser1:dl:** on page 172.

pdh1:

(parameter section)

This section provides controls for the Pound-Drever-Hall (PDH) board.

pdh1:slot

(STRING parameter, read-only)

Parameter indicating the slot, the PDH board is mounted in.

pdh1:serial-number

(STRING parameter, read-only)

Parameter indicating the PDH board's serial number.

pdh1:revision

(STRING parameter, read-only)

Parameter indicating the PDH board's hardware revision number.

pdh1:fpga-fw-ver

(INTEGER parameter, read-only)

Parameter indicating the firmware version of the FPGA.

pdh1:board-temp

(REAL parameter, read-only)

Parameter indicating the PDH board temperature (in °C).

pdh1:channel1:

(parameter section)

Channel1 of PDH board.

pdh1:channel1:modulation-enabled

(BOOLEAN parameter, read-write)

Parameter to enable/disable modulation of the output channel signal (**:output-channel**).
#t - apply modulation to the channel selected by **:output-channel**.
#f - no modulation of the output channel signal.

pdh1:channel1:use-fast-oscillator

(BOOLEAN parameter, read-write)

Parameter to control the modulation/demodulation frequency.
#t - select 25MHz.
#f - select 5MHz.

pdh1:channel1:modulation-amplitude-dbm

(REAL parameter, read-write)

Parameter to control the modulation amplitude in dBm.

pdh1:channel1:modulation-amplitude-vpp

(REAL parameter, read-only)

Parameter to view the modulation amplitude (in V peak to peak).

pdh1:channel1:lo-output-amplitude-dbm

(REAL parameter, read-write)

Parameter to control the lo output amplitude in dBm.

pdh1:channel1:lo-output-amplitude-vpp

(REAL parameter, read-only)

Parameter to view the lo output amplitude in volts.

pdh1:channel1:lo-output-enabled

(BOOLEAN parameter, read-write)

Parameters for enabling the output of the pdh lo signal.

pdh1:channel1:phase-shift

(REAL parameter, read-write)

Parameter to control the phase difference between modulation and demodulation (in °). Used to optimize the demodulated Lock-In signal.

pdh1:channel1:input-level-max

(INTEGER parameter, read-write)

Parameter to specify the maximal input level for the signal.
Possible values:

0: -10dBm

1: 0dBm

2: +10dBm

pdh1:channel1:lock-level

(REAL parameter, read-write)

Parameter to control the setpoint level for top-of-fringe locks to compensate for an eventual DC offset in lock-in output signal.

pdh1:channel2:

(parameter section)

Channel2 of PDH board.

For usage see **pdh1:channel1:** on page 174.

pdh1:save

(command, no arguments, returns empty tuple)

Command to save PDH parameters to the DLC pro flash memory.

pdh1:load

(command, no arguments, returns empty tuple)

Command to load PDH parameters from the DLC pro flash memory.

3.2 Maintenance

Commands and parameters for device maintenance
time

(STRING parameter, read-only)

Parameter indicating the system time of the device.
Format: YYYY-MM-DD hh:mm:ss

tan

(INTEGER parameter, read-only)

Parameter indicating the *transaction number* for specific service tasks.

system-messages:

(parameter section)

Parameters providing access to system messages.
The information of system messages is provided in the following component structure:

- timestamp in ISO 8601 format
- status character
- priority indicator
- status/message ID (negative value for *Error* and *Alert*-priority messages)
- message text

The priority of a system message reflects the importance of the event that triggered the message.
Priority indicators of system messages:

0 Information: information only; no action required. Example:

```
laser1: new laser head detected
```

1 Warning: The system is operating within the limits of regular operating conditions. However, check for incorrect parameter settings. Example:

```
laser1: laser diode current at upper limit
```

2 Error: System error; action is required to return the system to regular operating conditions. Example:

```
laser1: diode current safety clip (Imax), current switched off
```

3 Alert: Indication of a system defect. Example:

```
TC board not found
```

Note:
In the PC-GUI, system messages are indicated by a lit-up error indicator in the header of the PC-GUI screen. The system messages and the related code are displayed in the footer of the PC-GUI screen. System messages can also be displayed by clicking the error indicator in the header of the PC-GUI screen.
On the touchscreen, system messages are displayed in the bottom right area. Tapping the bell symbol opens the system messages window where all current system messages are displayed. The system messages window is also accessible from the home screen.

system-messages:count

(INTEGER parameter, read-only)

Parameter indicating the number of system messges.
Number of messages in the *show-all* list

system-messages:count-new

(INTEGER parameter, read-only)

Parameter indicating the number of unread system messages.
Number of messages in the *show-new* list

system-messages:latest-message

(STRING parameter, read-only)

Parameter indicating the latest, unread system message.

system-messages:mark-as-read

(command, 1 argument, returns empty tuple)

Arguments:
1. *ID* of type INTEGER

Command to mark a message, identified by a specific ID, as read and remove it from the *show-new* list of new system messages.
The message ID can be retrieved with the *show-all* command.

system-messages:show-all

(command, no arguments, returns empty tuple)

Command to print the list of system messages to the console. Example:

```
> (exec 'system-messages:show-all)
2014-04-02T10:45:19.915Z * 1 (   1002) emission disabled
()
>
```

Each printed line provides a system message in the structure described in **system-messages:**
The status character displayed after the timestamp indicates the "message read" status:

'*' : message unread

' ' : message read

system-messages:show-new

(command, no arguments, returns empty tuple)

Command to print the list of unread system messages to the console.
Each printed line provides a system message in the structure described in **system-messages:**
The * status character displayed after the timestamp indicates the "message unread" status.

system-messages:show-log

(command, no arguments, returns empty tuple)

Command to print the system message log file to the console. Example:

```
> (exec 'system-messages:show-log)
2014-04-01T16:02:52.818Z + 1 (   1002) emission disabled
2014-04-01T16:02:53.600Z + 1 (   3016) laser1: temperature not settled
2014-04-01T16:04:19.922Z - 1 (   3016)
2014-04-01T16:17:25.954Z - 1 (   1002)
2014-04-02T10:45:19.915Z + 1 (   1002) emission disabled
()
>
```

Each printed line provides a system message in the structure described in **system-messages:**
The status character displayed after the timestamp indicates the chronological sequence of messages in the *show-all* list:

'+' : message is added to the *show-all* list

'-' : message is removed from the *show-all* list

system-messages:show-persistent

(command, no arguments, returns empty tuple)

Command to print the persistent log to the console.
The persistent log collects critical system messages, that is, all messages with *Alert* priority, in the DLCpro's flash memory. Example:

```
> (exec 'system-messages:show-persistent)
2013-11-14T10:08:39.257Z + 3 (  -3003) laser1: no peltier connected
2013-11-14T10:08:39.260Z + 3 (  -3005) laser1: temperature sensor missing
()
>
```

Each printed line provides a system message in the structure described in **system-messages:**
The + status character displayed after the timestamp indicates that the message was added to the *show-all* list.

licenses:

(parameter section)

Parameter providing access to the installed license options and license-related commands.

licenses:options:

(parameter section)

Parameter providung a list of TOPTICA license options.

licenses:options:lock:

(parameter section)

Parameter for the TOPTICA Lock License option.

licenses:options:lock:enabled

(BOOLEAN parameter, read-only)

Parameter indicating whether the license option is enabled.
#t - license option enabled
#f - license option disabled.

licenses:options:lock:licensee

(STRING parameter, read-only)

Parameter indicating the licensee of the TOPTICA license option.

licenses:options:lock:valid-until

(STRING parameter, read-only)

Parameter indicating the validity of the license option:
- a specific date in ISO8601-format
- 'forever'

licenses:options:dual-laser-operation:

(parameter section)

Parameter for the TOPTICA Dual-Laser-Operation License option.

For usage see **licenses:options:lock:** on page 180.

licenses:options:quad-laser-operation:

(parameter section)

Parameter for the TOPTICA Quad-Laser-Operation License option.

For usage see **licenses:options:lock:** on page 180.

licenses:options:automatic-nlo-operation:

(parameter section)

Parameter for the TOPTICA Automatic-NLO-Operation License option.

For usage see **licenses:options:lock:** on page 180.

licenses:install

(command, 1 argument, returns BOOLEAN)

Arguments:
1. *licensekey* of type STRING

Command to install a license option with a specific license key.

fw-update:

(parameter section)

Commands for applying and diagnosing firmware updates.

fw-update:upload

(command, 1 argument, returns empty tuple)

Arguments:
1. *filename* of type STRING

Command to upload firmware updates of the DLCpro control firmware. Firmware updates are provided by TOPTICA as single ASCII files, containing BASE64-coded binary data.
Start the command with `(exec 'fw-update:upload "filename")`.
The device prompts for the update file:
`waiting for input (terminate with # ) ...`
Send the entire update file. When the file transfer is complete, a message acknowledges:
`transfer complete.`
The end-of-file signal (# character) tells the firmware to process the data.
Multiple firmware updates can be uploaded consecutively. The updates are installed when the device is booted next time.

fw-update:show-log

(command, no arguments, returns empty tuple)

Command to print the firmware update log to the console.

fw-update:show-history

(command, no arguments, returns empty tuple)

Command to print the firmware update history to the console.

system-service-report:

(parameter section)

Parameters to control the service report functionality.

system-service-report:ready

(BOOLEAN parameter, read-only)

Parameter indicating whether a service report request (cf. **:request**) is ready to be printed using **:print**.

system-service-report:service-report

(command, no arguments, returns empty tuple)

Command to print a (base64-encoded) data stream containing detailed information about the system status to the console.
It combines **:request** and **:print** in a single step.

system-service-report:request

(command, no arguments, returns empty tuple)

Command to request the generation of a system summary suitable for the service report.

system-service-report:add-info

(command, 1 argument, returns empty tuple)

Arguments:
1. *text* of type STRING

Command to add informations to service report.

system-service-report:print

(command, no arguments, returns empty tuple)

Command to print a previously requested (cf. **:request**) service report as a data stream to the console.

error-log

(command, no arguments, returns empty tuple)

Command to print the firmware error log file to the console.

service-script

(command, no arguments, returns empty tuple)

Command to execute DeCoF command scripts, provided by TOPTICA service staff.

service-report

(command, no arguments, returns empty tuple)

Prints a summary of the most important system components to the console.

3.3 Device Information

Parameters to provide general device information.

uptime

(INTEGER parameter, read-only)

Parameter indicating the accumulated system uptime in seconds. The uptime counter records whenever the device is switched on.

uptime-txt

(STRING parameter, read-only)

Parameter indicating the accumulated system uptime **uptime** as string.
Format: hours:minutes:seconds

fw-ver

(STRING parameter, read-only)

Parameter indicating the version of the currently active firmware.
Note: After a firmware update, the system has to be rebooted to activate the new firmware.

ssw-ver

(STRING parameter, read-only)

Parameter indicating the version of the currently installed system software.

echo

(BOOLEAN parameter, read-write)

Parameter to control the echo behavior of the command console.
#t - each character sent to the device is echoed
#f - no echo
For USB connections the default setting is #t, because this is usually required for use with serial terminal programs (like eg Hyperterminal). For TCP/IP connections the default setting is #f.

serial-number

(STRING parameter, read-only)

Parameter indicating the DLCpro's serial number.

system-type

(STRING parameter, read-only)

Parameter indicating the device type. Currently always returns "DLCpro".

system-model

(STRING parameter, read-only)

Parameter indicating the laser hardware composition. The string consists of one or more of the following substrings, separated by dashes:

- DFB or DFB* (for a DFB laser)
- DL or DL* (for an external cavity laser)
- CTL (for CTL laser)
- TA or TA* (for a tapered amplifier)
- SHG (for a TOPTICA second harmonic generation)
- FHG (for a TOPTICA fourth harmonic generation)
- servo (for AutoAlign option)
- fiber (for FiberMon option)
- uv (for TOPTICA UV cavity)

Examples:
"DL*-TA*-SHG-servo-fiber" for a TOPTICA "TA-SHG pro" laser head with or AutoAlign and FiberMon option.
"DFB*" for TOPTICA "DFB pro"
Asterisks mark modern TOPTICA versions of the respective laser heads, featuring non-volatile memory with factory settings for the most important operation parameters for easy installation.

system-label

(STRING parameter, read-write)

Parameter providing a user-configurable string that can be used to easily identify the device, for example, "pump laser for flux compensator".
On delivery, the **system-label** string is empty.

vcs-id

(STRING parameter, read-only)

Parameter providing an unique identifier for the current firmware in the version control system.

ssw-vcs-id

(STRING parameter, read-only)

Parameter providing an unique identifier for the current system software in the version control system.

build-information:

(parameter section)

Parameters providing the build information.

build-information:build-number

(INTEGER parameter, read-only)

Parameter indicating the internal build number.

build-information:build-id

(STRING parameter, read-only)

Parameter indicating the date of the build.

build-information:build-tag

(STRING parameter, read-only)

Parameter providing a string description of the build.
Format: jenkins-{JOB_NAME}-{BUILD_NUMBER}

system-summary

(command, no arguments, returns empty tuple)

Command to print a summary list of the most important system components to the console.

3.4 Network Configuration

Parameters related to the network configuration module
net-conf:

(parameter section)

Parameters providing information about the current network configuration.
Commands for changing the network configuration.
Your device can be controlled via Ethernet. You can either connect it to a local area

network (LAN) or directly to your computer. In both cases, the device's TCP/IP network address has to be configured correctly.
In many LANs, the configuration can or must be done automatically by a DHCP server. For a direct PC-to-device connection, the device usually needs a fixed network address assigned.

net-conf:ip-addr

(STRING parameter, read-only)

Parameter indicating the current IP address of the device[5]. To change the IP address, use the **net-conf:set-dhcp** command for automatic address retrieval in a LAN with a DHCP server, or the **net-conf:set-ip** for manual configuration.

net-conf:net-mask

(STRING parameter, read-only)

Parameter indicating the current netmask of the device. To change the netmask, use the **net-conf:dhcp** command for automatic address retrieval in a LAN with a DHCP server, or the **net-conf:set-ip** for manual configuration.

net-conf:mac-addr

(STRING parameter, read-only)

Parameter indicating the device's MAC[6] address.

net-conf:dhcp

(BOOLEAN parameter, read-only)

Parameter indicating whether the device is configured for automatic IP configuration by a DHCP server.
#t - automatic IP configuration by a DHCP server #f - static IP configuration

net-conf:cmd-port

(INTEGER parameter, read-only)

Parameter indicating the TCP/IP port to access the device's command line console.

net-conf:mon-port

(INTEGER parameter, read-only)

Parameter indicating the TCP/IP port to access the device's monitoring line.
0 - monitoring lines are not supported on this system.

net-conf:set-dhcp

[5]If you want to access your device via TCP/IP but don't know the current IP address (e.g. in case of DHCP configuration), you can use the "Identification Server" in Appendix 4.4.2 on page 197 to find out.
[6]Media Access Control

(command, no arguments, returns empty tuple)

Command to change the device's network adapter configuration for automatic setup by a DHCP server.
After executing the command, the **net-conf:dhcp** parameter will return #t. However, IP address and netmask did not yet change accordingly. The new network adapter configuration will take effect with the next adapter restart.
To use the DHCP mechanism, reboot the system or use the **net-conf:apply** command.

net-conf:set-ip

(command, 2 arguments, returns empty tuple)

Arguments:

1. *ip-addr* of type STRING
2. *net-mask* of type STRING

Command to change the device's network adapter configuration to a static IP configuration. The desired IP address and netmask must be provided as IPv4 addresses in the following format:
xxx.xxx.xxx.xxx, for example,
`(exec 'net-conf:set-ip "192.168.1.1" "255.255.255.0")`
After executing the command, the **net-conf:dhcp** parameter will return #f. However, IP address and netmask did not yet change accordingly. The new network adapter configuration will take effect with the next adapter restart.
. To use the new address, reboot the system or use the **net-conf:apply** command.

net-conf:apply

(command, no arguments, returns empty tuple)

Command to restart the network adapter with the current network configuration. newline Note: Your current TCP/IP connections can get lost if you execute the **net-conf:apply** command. Be careful when executing the **net-conf:apply** command from within a TCP/IP command console.

3.5 Userlevel

Parameters and commands for user level control.
ul

(INTEGER parameter, read-write)

Parameter indicating the currently active user level.

Some parameters and commands are not made available to all users, either because they are not required for regular operation, or because they can adversely affect the system performance. The following user levels are implemented:

4 - read-only level, lowest priority

3 - normal operation

2 - maintenance level

1 - service level

0 - TOPTICA internal

The lower the user level the more parameters and commands are accessible. It is always possible to change the **ul** parameter to a higher value, but setting it to a lower value requires the **change-ul** command.

change-ul

(command, 2 arguments, returns INTEGER)

Arguments:

1. *ul* of type INTEGER
2. *passwd* of type STRING

Command to change the active user level.

All user levels except for the read-only level (4) are password protected. The password for normal operation (user level 3) can be configured with the **change-password** command. By default, it is an empty string. The higher-priority user-level passwords are predefined.

In order to change the user level, enter the desired level as first argument, and the corresponding password as second argument. Passwords of higher-priority levels are valid for all lower-priority levels as well.

If you provide an empty string instead of the correct password as second argument, the system prints `password:` to prompt you for input. You may then enter the password without any letters being displayed.

The return value is the new user level.

change-password

(command, 1 argument, returns empty tuple)

Arguments:

1. *password* of type STRING

Command to change the password for the NORMAL user level. If the password is not empty, each subsequent remote connection starts in READONLY mode. The user level has to be explicitly changed to NORMAL.
Please note that there is no way to read out the password.

4 Appendix

4.1 Signal Channel IDs

The following lists provide the numeric ID values to be entered if a specific signal input or output channel is to be configured, for example, the output channel of a PID controller for lock settings:

ID	signal name	type	remark
		special	
-3	none		
-2	Time	x-axis	for display only
-1	Frequency	x-axis	for display only
		external signals (BNC connector)	
0	Fine In 1	input channel	for PID controllers and display
1	Fine In 2		
2	Fast In 3		
4	Fast In 4		
20	Output A	output channel	for signal generators, PID controllers, and display
21	Output B		
		internal signals (FPGA)	
30	Lock-In Out	internal signal	for display only
31	PID 1 Out		
32	PID 2 Out		
		PDH signals	
40	PDH Error 1	input channel	for PID controllers and display
41	PDH In 1		
42	PDH Error 2		
43	PDH In 2		
		laser related signals	
50	Piezo Voltage	output channel	for signal generators, PID controllers, and display
51	CC Current, Laser Current		
52	CC AIn A	input channel	for PID controllers and display
53	CC AIn B		

54	Laser PD, Monitor Photo Diode		for display only
55	PD EXT, user calibrated laser power		for power stabilization and display
56	Laser Set Temperature	output channel	for signal generators, PID controllers, and display
57	Laser Actual Temperature	input channel	for display only
60	AMPCC AIn	input channel	for *TA pro* and *TA-SHG/FHG pro* only
61	Seed Power		for *TA pro* only
62	Amplifier Power		for *TA pro* only
63	Amplifier Current	output channel	for *TA pro* and *TA-SHG/FHG pro* only
69	CTL Laser Photodiode	input channel	for *CTL* only
70	CTL Laser Power		
78	CTL Set Wavelength	output channel	
79	CTL Actual Wavelength	input channel	
80	SHG Cavity Error Signal	input channel	for *DL-/TA-SHG pro* only
81	SHG Cavity Rejection Signal		for *DL-/TA-SHG pro* only
82	SHG Intra-Cavity Signal		for *DL-/TA-SHG pro* only
83	SHG Power		for *DL-/TA-SHG pro* only
84	Amplifier Power		for *TA-SHG pro* only
85	Seed Power		for *DL-/TA-SHG pro* only
86	Fiber Power		for *DL-/TA-SHG pro* with FiberMon option only
87	SHG Input Power		for *DL-/TA-SHG pro* only
90	SHG Cavity Piezo Voltage Slow	output channel	for *DL-/TA-SHG pro* only
91	SHG Cavity Piezo Voltage Fast		
110	FHG Cavity Error Signal	input channel	for *DL-/TA-FHG pro* only
111	FHG Cavity Rejection Signal		for *DL-/TA-FHG pro* only
112	FHG Intra-Cavity Signal		for *DL-/TA-FHG pro* only

113	FHG Power		for *DL-/TA-FHG pro* only
120	FHG Cavity Piezo Voltage Slow	output channel	for *DL-/TA-FHG pro* only
121	FHG Cavity Piezo Voltage Fast		
144	OPO Pump Power	input channel	for *DFB-OPO pro* only
145	OPO Pump Depleted Power		
146	OPO Signal Power		
147	OPO Idler Power		
150	OPO Cavity Piezo Voltage Slow	output channel	for *DFB-OPO pro* only
151	OPO Cavity Piezo Voltage Fast		
aliases			
100	Lock Input	input channel	for display only
101	Scan Output Channel	output channel	
102	PowerLock Input	input channel	

For the so-called 'alias'-settings [100], [101] and [102], the actually used signal channel is determined by the signal channel setting for the following parameters:

100	Spectrum Input Channel: **laser1:dl:lock:spectrum-input-channel**
101	Scan Output Channel: **laser1:scan:output-channel**
102	Laser Output Power: **laser1:power-stabilization:input-channel**

Example: If [100] is selected for the Input Trace Signal (laser1:scope:channel:signal), the actual channel of the Input Trace Signal is
Fast In 3 if **laser1:dl:lock:spectrum-input-channel** is set to *2*
Fine In 1 if **laser1:dl:lock:spectrum-input-channel** is set to *0*

4.2 Scope, Lock and Recorder Binary Data

Most signal display-relevant data is transferred coded as BASE64 binary blobs[7] in parameters like **laser1:scope:data**, **laser1:dl:lock:candidates**, **laser1:dl:lock:background-trace** and **laser1:recorder:data:zoom-data**. Also the return value of the command **laser1:recorder:data:get-data** is formatted in the same way. These blobs consist of

[7] blob = binary large object

multiple blocks of different type. Each block starts with a header, containing an identifier byte and a blocklength value. The block-length is provided as a null-terminated string in decimal format. After the block-length, the payload data is provided. The format of the payload data depends on the type of data.

4.2.1 Data Blocks

The following table illustrates the layout of a single block:

ID *(1 byte)*	block-length value *(multiple bytes)*	'\0' *(1 byte)*	payload data *(many bytes)*

1. Example[8]: a signal trace (array of 1000 single precision floating point values) as in **laser1:scope:data**:

ID *(1 byte)*	block-length value *(4 bytes)*				'\0' *(1 byte)*	payload data *(4000 bytes)*
'y'	'4'	'0'	'0'	'0'	'\0'	4000 bytes, containing 1000 floating point values

2. Example: state of the lock module (single byte) as in **laser1:dl:lock:candidates**:

ID *(1 byte)*	block-length value *(1 byte)*	'\0' *(1 byte)*	payload data *(1 byte)*
's'	'1'	'\0'	2

Usually, mutliple blocks are concatenated inside one blob.

The following types of blocks are used:

[8] In the following examples, values of single bytes are either given as decimal numbers or as ASCII characters. For example, ASCII character *'y'* is the same as the decimal value *121*.
In some cases, *backslash escaped* characters are used to stress the difference between character and number. For example, *'\0'* means decimal number *0* and not the ASCII character '0' (or decimal 48).

ID	description
'x'	x-axis values for signal display or wide-scan array of single precision floating point values (see 4.2.2)
'y'	y-axis values of first trace for signal display array of single precision floating point values (see 4.2.2)
'Y'	y-axis values of second trace for signal display array of single precision floating point values (see 4.2.2)
'l'	selected lockpoint single *candidate type* of data (see 4.2.4)
'c'	list of lockpoint candidates array of *candidate type* of data (see 4.2.4)
's'	ID of the lock module's state single byte
't'	lock tracking position, ie center of mass of the x and y data during lock single *candidate type* of data (see 4.2.4). The *type* reflects the type of the lockpoint at the time the lock got closed.
'a'	y-axis values with of the lower envelope (minimum values) of the first trace for wide-scan display array of single precision floating point values (see 4.2.2)
'A'	y-axis values with of the upper envelope (maximum values) of the first trace for wide-scan display array of single precision floating point values (see 4.2.2)
'b'	y-axis values with of the lower envelope (minimum values) of the second trace for wide-scan display array of single precision floating point values (see 4.2.2)
'B'	y-axis values with of the upper envelope (maximum values) of the second trace for wide-scan display array of single precision floating point values (see 4.2.2)
'i'	index range of the data returned by **laser1:recorder:data:get-data** two 32 bit integer values (see 4.2.3)

4.2.2 Floating Point Format

Non-integer numerical values are represented as single precision floating point values with 32 bit, according to IEEE 754 standard. The most significat bit 31 contains the sign, bits 23 to 30 contain the exponent, and bits 0 to 22 contain the mantissa.

31	30 23	22 0
+-	8 bit exponent	23 bit mantissa

These 32 bits are transferred in little endian manner, starting with the least significant bytes.

first byte	second byte	third byte	fourth byte
7 0	15 8	23 9	31 24

This is in accordance with the native way of storing single precision floating point numbers on x86-based computers and, for example, the *float* data type in C on such computers.

For arrays of floating point numbers, the length of array must be calculated from the length of the payload block divided by 4 (size of floating point numbers).

Please note that LabVIEW, in contrast to most other programming languages, uses big endian format, independent of the computer hardware.
To use the "unflatten from string" VI to convert DLCpro floating point data into a LabVIEW SGL value, you first need to reverse the byte order of the 4-byte package.

4.2.3 Integer Format

Integer numerical values are, if not noted differently, given as signed 32 bits values in two's complement representation. Like the floating point values they are transferred in little endian manner, starting with the least significant bytes.

first byte	second byte	third byte	fourth byte
7 0	15 8	23 9	31 24

Again, for LabVIEW the order of the bytes needs to be reversed before converting them into a LabVIEW I32 value.

4.2.4 Candidate Type

Lockpoint candidates are represented by their x and y position and their type.
The x and y postions are provided as single precision floating point values. The type is given as a single byte.

x value *(4 byte, floating point)*	y value *(4 byte, floating point)*	type *(1 byte)*

The lockpoint candidate type is coded as follows[9]:

0 - none (not a valid candidate/lockpoint)

1 - top (candidate/lockpoint is a peak)

2 - bottom (candidate/lockpoint is a trough)

3 - positive-edge (candidate/lockpoint is on a rising edge)

4 - negative-edge (candidate/lockpoint is on a falling edge)

4.2.5 BASE64

The DLC pro's remote control protocol is a pure ASCII protocol. Binary data is not transmitted as is, but BASE64-coded. BASE64 data uses only 6 bit per byte. A binary blob of n bytes therefore results in $n * 8/6$ bytes of BASE64 code. The following alphabet is used for BASE64 coding and decoding:

```
"ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz0123456789+/"
```

4.2.6 Processing Binary Data

Interpreting these binary parameter values requires the following steps:

1. Decode the BASE64 data into a binary data buffer.
2. Read the first byte of the buffer to get the type of the first block.
3. Interpret the buffer contents as string - from the second byte up to the next zero byte. Parse the number from the string in variable n. This gives the number of bytes to read for the first block's payload.
4. Starting from the first byte behind the zero, read the next n bytes. This is the payload data. Now, interpret the data according to the block type read in step 2.
5. If there is more data available behind this block, repeat steps 2-4 at the buffer position behind the last byte of the previous block.

4.3 USB Connection

When connecting your DLC pro to a USB port of your PC, it will be identified as *"DLCpro"* Device and registered as a *virtual COM port* (Windows) or *ttyACMx* serial interface (Linux). You can use this virtual COM port exactly the same way as a real RS232C interface. The communication is much faster than with normal serial interfaces, though. Settings like baud rate, number of data and stop bits, as well a parity, and handshake settings are ignored.

Please note the following hints:

[9] Compare **laser1:dl:lock:lockpoint:type**.

- Send your commands, terminated by a linefeed character (ASCII code 10 decimal, 0x0A hexadecimal).
- The DLC pro's answer is terminated by the prompt which consists of the two characters "> " (greater-than and space) at the beginning of a new line (i.e. after a linefeed character).
- Any terminal emulator like PuTTY on Windows or Minicom or Kermit on Linux can be used to access the command console.

4.4 Ethernet Connection

The fastest and most flexible way of controlling the DLC pro is via the Ethernet interface. The DLC pro's firmware provides several servers that allow different ways of communicating with it. The device has to be connected to a local area network (LAN) or directly to a PC (e.g. with a cross link cable). Further, the DLC pro and the PC must have IP addresses of the same subnet. Upon delivery, the DLC pro is configured to retrieve its IP address automatically via DHCP. To change these settings, use the **net-conf:** commands on a USB console (for details, see chapter 3.4 above).

4.4.1 Telnet Server: Command Console and Monitoring Line

A Telnet server on standard port 1998 provides access to the Command Console. This connection is intended for automated remote control via Ethernet. The full set of control commands, as discussed in this reference manual, can be used on this console. For manual control, you can use any standard Telnet client. A popular choice on Windows is PuTTY or the "telnet" command at the MS-DOS command console. Alternatively, you can try entering

`telnet://xxx.xxx.xxx.xxx:1998`

in the address bar of your web browser, to let Windows choose its favorite Telnet client. The Telnet command also belongs to every standard Linux distribution. For programmatic control proceed as follows::

1. Open TCP/IP connection to port 1998 at the DLC pro's IP address.
2. Set the socket option TCP_NODELAY[10].
3. Receive the incoming welcome text. The DLC pro then sends a specific welcome text which is terminated by the prompt "> " consisting of the two characters (greater-than and space) at the beginning of a new line (that is, after a linefeed character).
4. Send your commands, terminated by a linefeed character (ASCII code 10 decimal, 0x0A hexadecimal).
5. The DLC pro's answer is again terminated by the prompt.

[10]This option is not mandatory. However, it usually helps speeding up communication since typically many very short telegrams are exchanged between PC and DLC pro.

6. At the end close the TCP/IP connection or send a `(quit)`.

The DLC pro will accept up to eight command line connections at the same time. For example, while the DLC pro is controlled by the software of your automated experiment on one connection, the second connection can be used manually for debugging purposes.

In addition to a Command Console, a second telnet connection may be used to establish a Monitoring Line, which uses port 1999. To establish the connection for the Monitoring Line use telnet as described above for the Command Console but using port 1999. For example:

`telnet://xxx.xxx.xxx.xxx:1999`

Please note that no welcome message will be displayed on the Monitoring Line. Depending on the used telnet program and its settings, the input typed in may be not displayed due to the lack of an echo setting.

Section 2.4 describes how to use the Monitoring Line, e.g. how to subscribe for notifications of changes of selected parameters.

4.4.2 Identification Server

To find the DLC pro's IP address (e.g. in a DHCP-based IP configuration), the firmware provides an UDP-based identification service on port 60010.

For programmatically finding a DLC pro in the LAN proceed as follows:

1. Broadcast a short string like "laserfinder" on port 60010 to the whole LAN (address 255.255.255.255) or to the broadcast address of you network adapter (e.g. 192.168.1.255).

2. On the same port, listen for an answer. The DLC pro will answer the broadcast with an UDP message containing information like its serial number and its firmware version as the payload. The IP address of the DLC pro is contained in the header of the UDP packet.

3. Repeat step 2 until no answer is received within a second. If, within a second, no message is received at all, no device is available.

If more than one DLC pro is connected to the LAN, this procedure should return the list of all devices.

Index

abort, 72, 110, 137
add-info, 182
air-pressure, 64, 163
all, 55, 117, 126, 137
amp, 75, 80, 84, 104, 173
ampcc1, 159
ampcc2, 160
amplifier-current-margin, 111, 157
amplitude, 53, 59, 88, 90, 112, 116, 119, 125, 130
analog-dl-gain, 118
analog-p-gain, 127
apply, 70, 75, 85, 127, 132, 140, 150, 187
apply-all, 153
attenuation-fhg-raw, 127
attenuation-raw, 119, 130
attenuation-shg-raw, 127
auto-dark, 171
auto-lir, 59
auto-nlo, 110, 155
auto-pdh, 120, 131
automatic-mode, 110, 156
automatic-nlo-operation, 181
aux, 43, 79

background-trace, 61, 120, 131
BASE64, 195
baseplate-temperature, 144, 155
baseplate-temperature-limit, 140
binary data, 191
board-temp, 158, 159, 162, 163, 168, 174
bottom, 60
brightness, 171
build-id, 185
build-information, 185
build-number, 185
build-tag, 185
buzzer, 170

c-gain, 67, 121
cal-factor, 65, 70, 104, 123, 145
cal-offset, 65, 70, 104, 105, 123, 124, 145
calibration, 117
candidate type, 194
candidate-filter, 60
candidates, 61
capacitance, 69, 123
caption, 149
cavity, 133, 136
cavity-fast-pzt-voltage, 120, 131
cavity-lock-settle-time, 141
cavity-lock-tolerance-factor, 141
cavity-scan-duration, 142
cavity-slow-pzt-voltage, 120, 131
cavity-tc, 139
cc, 39, 66, 76, 83
cc1, 158
cc2, 159
change-password, 188
change-ul, 188
channel IDs, 189
channel-count, 161
channel1, 93, 96, 98, 113, 160, 162, 174
channel2, 94, 96, 98, 114, 162, 176
channelx, 94, 96, 98, 114
clear-errors, 145, 155, 158
close, 63
cmd-port, 186
COM interface, 195
comp-hor, 135
comp-vert, 135
compensation-voltage, 65
config, 148
continuous-mode, 89
count, 178
count-new, 178
cryst, 135
crystal, 133
crystal-tc, 139
ctl, 70, 173
current-15V, 169
current-15Vn, 169
current-5V, 169
current-act, 42, 48, 78, 87

current-clip, 42, 66, 78, 83
current-clip-limit, 42, 78
current-max, 67, 87, 121
current-min, 67, 121
current-offset, 40, 77
current-set, 40, 48, 66, 77, 83
current-set-dithering, 41
current-spot, 134
cut-off-frequency, 96

d, 55, 118, 126, 137
d-gain, 46, 67, 121
data, 95, 98, 115
date, 149
degradation-detection-measurement-interval, 143
degradation-detection-number-of-measurements, 143
degradation-detection-slope-threshold, 142
delay, 53, 116, 125
dhcp, 186
digital-in0, 165
digital-in1, 166
digital-in2, 166
digital-in3, 166
digital-out0, 166
digital-out1, 167
digital-out2, 167
digital-out3, 168
disable, 173
disable-cc, 172, 173
disable-pc, 172, 173
disable-tc, 173, 174
display, 170
display-name, 101
dl, 38, 104, 172, 174
dpss, 85
dual-laser-operation, 180
duration, 90

echo, 183
edge-level, 60
edge-min-distance, 61
emission, 35, 37, 40, 77, 111, 153, 156
emission-button-enabled, 35
enabled, 40, 41, 44, 49, 53–55, 57, 64, 73, 77, 85, 87, 96, 101, 112, 116, 118, 125, 127, 130, 137, 146, 172, 180
end, 88
eom, 133
eom-tc, 139
error, 144, 154, 157
error-code, 86
error-log, 182
error-txt, 86, 144, 154, 157
export, 150
external-input, 41, 45, 49, 165

factor, 41, 64, 73
factory-settings, 65, 74, 82, 120, 131, 139
fast-3, 164
fast-4, 164
fault, 45
fc-ip, 56
fc-pd, 56
feedforward-enabled, 43, 50, 69, 78, 122, 147, 165
feedforward-factor, 43, 50, 66, 69, 79, 83, 122, 148, 165
fhg, 105, 127, 132
fhg-int, 106
fhg-pdh-dc, 106
fhg-pdh-rf, 106
fhg1-hor, 102
fhg1-vert, 102
fhg2-hor, 102
fhg2-vert, 102
fiber, 104, 124
fiber1-hor, 103
fiber1-vert, 103
fiber2-hor, 103
fiber2-vert, 103
find-candidates, 62
fine-1, 163
fine-2, 164
floating point, 193
flow, 72

fpga-fw-ver, 70, 158, 159, 161–163, 174
frequency, 53, 58, 88, 112, 116, 125, 152
frontkey-locked, 35
fru-serial-number, 39, 76
fw-update, 181
fw-ver, 183

gain, 55, 105, 117, 124, 137, 146
get-data, 100

head-temperature, 72
health, 37
health-txt, 38
heatsink-temp, 50, 169
hold, 52, 57, 87
hold-output-on-unlock, 147
hold-state, 57
hwp, 135
hwp-transmittance, 143

i, 55, 118, 126, 137
i-cutoff, 56, 118, 126
i-cutoff-enabled, 56, 118, 126
i-gain, 46, 67, 121
identification server, 197
idle-mode, 155, 157
idle-timeout, 171
import, 150
input, 107
input-channel, 54, 91, 117, 125, 145, 146
input-channel-value-act, 147
input-enabled, 91
input-level-max, 176
inputs, 96
install, 181
int, 124, 132
integer, 194
interlock-open, 35
invert, 167
io, 163
ip-addr, 186

laser-common, 151
laser-on, 111, 153, 156
laser1, 36, 172
laser2, 151, 174
last-recorded-sample, 99
last-valid-sample, 99
latest-message, 178
legacy, 38, 75
lens, 135
level-high, 54
level-hysteresis, 54, 117, 125, 147
level-low, 54, 146
licensee, 180
licenses, 180
limits, 47
list, 151
lo-output-amplitude-dbm, 175
lo-output-amplitude-vpp, 175
lo-output-enabled, 175
load, 149, 151, 152, 168, 169, 171, 176
load-all, 152
load-head, 151
local-oscillator, 118, 127, 130
lock, 50, 115, 124, 128, 132, 139, 140, 180
lock-enabled, 52, 115, 129
lock-level, 59, 176
lock-state, 57
lock-tracking, 61
lock-without-lockpoint, 51
lockin, 58
locking-delay, 61
lockpoint, 59
loop-enabled, 73
low-pass-filter, 96

mac-addr, 186
mark-as-read, 178
max, 57
mc, 162
memory-size, 98
microsteps, 74
mode, 167
mode-control, 73
model, 39
modulation-amplitude-dbm, 175
modulation-amplitude-vpp, 175
modulation-enabled, 58, 175

modulation-output-channel, 58
mon-port, 186
motor, 73

name, 94, 95, 98, 114, 115
negative-edge, 60
net-conf, 185
net-mask, 186
nlo, 101, 173
ntc-parallel-resistance, 68
ntc-series-resistance, 68, 122
numeric channel values, 189

offset, 88, 90, 112
ok-time, 46, 68, 122
ok-tolerance, 46, 68, 121
ongoing, 106, 136
ontime, 39, 76
ontime-txt, 39, 76
open, 64
operation-time, 86, 144
operation-time-amplifier, 111, 157
operation-time-cavity, 111, 157
operation-time-master, 111, 157
operation-time-pump, 154
operation-time-uv, 154
operational-pump-power, 142
optics-shifters, 134
optimization, 72
optimization-in-progress, 108
options, 180
out-a, 164
out-b, 165
out-of-range, 47
outcpl, 135
output-channel, 53, 57, 88, 89, 91, 147
output-enabled, 91
output-filter, 41, 49, 78, 165
output-limits, 81, 85
output-threshold, 92
outputlimit, 57

p, 55, 117, 126, 137
p-gain, 46, 67, 118, 121
parallel-mode, 158, 160
path, 40, 44, 48, 76
pc, 48, 68, 112, 122, 128, 131, 133, 139
pc1, 160
pc2, 161
pc3, 161
pd, 43, 65, 69, 80, 83, 103, 123, 132, 135, 140
pd-ext, 145
pdh-dc, 124, 132, 136, 140
pdh-rf, 124, 132, 136, 140
pdh1, 174
peak-noise-tolerance, 60
perform-auto-align, 111
perform-optics-shift, 144, 155
perform-optimization, 144, 155, 157
perform-single-mode-optimization, 111
phase-shift, 59, 119, 130, 175
phase-shift-fhg, 127
phase-shift-shg, 127
photodiode, 105, 145
pid-selection, 52, 116, 124, 129
pid1, 54, 117, 129
pid1-gain, 126
pid2, 58, 118, 130
pid2-gain, 126
play, 170
play-welcome, 170
position, 59
position-accuracy-fullstep, 73
position-accuracy-microstep, 74
position-hysteresis-fullstep, 73
position-hysteresis-microstep, 74
positive-edge, 60
positive-polarity, 42, 66
power, 65, 74, 80, 83, 104, 145
power-15v, 160
power-act, 74, 87, 138, 155, 157
power-lock-settle-time, 141
power-margin, 87, 143
power-margin-threshold, 141
power-margin-tolerance-time, 141
power-max, 81, 84, 87, 138
power-max-shutdown-delay, 81, 85
power-max-warning-delay, 81, 85

power-min, 80, 84, 138
power-min-shutdown-delay, 81, 84
power-min-warning-delay, 80, 84
power-optimization, 106, 136
power-output-relative-deviation-max, 142
power-output-relative-error-max, 142
power-save-disabled, 74
power-set, 86, 138, 155, 157
power-source, 68, 122
power-stabilization, 137, 145
power-stabilization-level-low-factor, 142
power-stabilization-strategy, 142
power-supply, 168
pressure-compensation, 64
pressure-compensation-factor, 69
print, 182
pristine, 149
product-name, 37, 149
progress, 59, 72, 91, 106, 107
progress-data, 137
progress-data-amp, 109
progress-data-fhg, 109
progress-data-fiber, 109
progress-data-shg, 109
pump, 133
pump-lock-settle-time, 141
pump-power-margin, 155

quad-laser-operation, 180

ready, 45, 182
recorded-sample-count, 99
recorded-sampling-interval, 99
recorder, 95
recorder-stepsize, 91
recorder-stepsize-set, 90
recording-mode, 97
recording-time, 97
regress-tolerance, 108
regulating-state, 58
relative-humidity, 163
relock, 53, 116, 125, 129
remaining-optics-spots, 144, 155
remaining-spots, 134
remaining-time, 91
remote-control, 72
request, 182
reset, 54
restore-all, 153
restore-on-abort, 108
restore-on-regress, 108
retrieve, 150
retrieve-all, 153
revision, 158, 159, 161–163, 168, 174
RS232C, 195

sample-count, 97
sample-count-set, 97
sampling-interval, 97
sampling-rate, 97
save, 150–152, 168, 171, 176
save-all, 152
scan, 87, 112, 128, 139, 151
scan-amplitude, 69, 123
scan-begin, 89
scan-end, 89
scan-frequency, 123
scan-offset, 69, 123
scope, 92, 112, 128, 139
scope-timescale, 94, 114
seed, 80, 84
seed-limits, 80, 84
seedonly-check, 82, 85
select-lockpoint, 62
serial-number, 39, 76, 158–160, 162, 163, 168, 174, 184
service-report, 182, 183
service-script, 183
servo, 101, 134
set-dhcp, 186
set-ip, 187
set-output-to-zoom-offset, 92
set-scan-range-to-zoom-range, 92
set-zoom-range-to-scan-range, 92
setpoint, 53, 116, 125, 129, 146
settle-down-delay, 141
shape, 89

shg, 104, 111, 123, 136, 140
shg-advanced, 107
shg-input, 104, 124
shg-int, 105
shg-pdh-dc, 105
shg-pdh-rf, 105
shg1-hor, 102, 134
shg1-vert, 102, 134
shg2-hor, 102, 134
shg2-vert, 102, 134
show, 151
show-all, 178
show-candidates, 62
show-data, 100
show-history, 182
show-log, 179, 181
show-new, 178
show-persistent, 179
shutdown-delay, 82, 85
sign, 56, 146
signal, 41, 72, 93, 96, 98, 113
signal channels, 189
signal-type, 87
slew-rate, 41, 69
slew-rate-enabled, 42, 69
slew-rate-limited, 42
slope, 56
slot, 158–161, 174
smile, 72
snubber, 43, 66
source, 149
specs-fulfilled, 144, 154
spectrum-input-channel, 52
spectrum-omit-dc, 94, 114
spectrum-range, 94, 114
speed, 90
speed-max, 90
speed-min, 90
ssw-vcs-id, 185
ssw-ver, 132, 144, 183
stage1, 107
stage2, 108
stage3, 108
stage4, 108
stage5, 109
standby, 172
start, 88, 92
start-optimization, 108
start-optimization-all, 110
start-optimization-amp, 110
start-optimization-fhg, 110
start-optimization-fiber, 110
start-optimization-shg, 110
state, 51, 71, 89, 95, 115, 128, 138, 147, 171, 172
state-txt, 52, 72, 89, 95, 115, 129
status, 44, 45, 50, 79, 81, 82, 86, 107, 136, 143, 153, 156, 170
status-parameters, 140
status-string, 107, 136
status-txt, 44, 46, 50, 79, 81, 82, 86, 144, 154, 156, 170
stop, 92
store-all, 153
sync, 152
sync-laser1, 152
sync-laser2, 152
system-health, 35
system-health-txt, 36
system-label, 184
system-messages, 177
system-model, 184
system-service-report, 182
system-summary, 185
system-type, 184

t-loop, 46
ta1-hor, 101
ta1-vert, 101
ta2-hor, 101
ta2-vert, 101
tan, 176
tc, 44, 66, 79, 83, 112, 120, 128, 131, 133
tc-status, 86
tc-status-txt, 86
tc1, 161
tc2, 162
temp-act, 44

temp-max, 47, 67, 120
temp-min, 47, 66, 120
temp-roc-enabled, 48, 67, 121
temp-roc-limit, 48, 67, 121
temp-set, 45, 67, 121
temp-set-max, 48
temp-set-min, 48
temperature-settle-time, 141
threshold, 117, 125
threshold-current, 65
time, 176
timed-out, 47
timeout, 47, 68, 122
timescale, 95, 115
top, 60
trigger, 91
tuning-current-min, 71, 75
tuning-power-min, 71, 75
type, 36, 38, 51, 60, 75, 168

ul, 187
unit, 88, 93, 95, 98, 113, 114
update-rate, 93, 113
update-state, 172
update-strategy, 138
upload, 181
uptime, 183
uptime-txt, 183
USB, 195
use-external-oscillator, 119
use-fast-oscillator, 175
uv, 132, 153
uv-cryst, 103
uv-outcpl, 103

valid-until, 180
value, 101
value-act, 90, 164, 166
value-calibrated, 107
value-set, 90, 166
value-unit, 90
variant, 40, 77, 92, 113, 158, 159, 161
vcs-id, 184
version, 39, 76
voltage-15V, 169
voltage-15Vn, 169
voltage-3V3, 169
voltage-5V, 169
voltage-act, 42, 49, 78
voltage-clip, 43, 66, 78, 83
voltage-max, 49, 68, 122, 165
voltage-min, 49, 68, 122, 164
voltage-offset, 164
voltage-out, 78
voltage-set, 49, 164
voltage-set-dithering, 49

warning-delay, 82, 85
wavelength, 65, 83
wavelength-act, 70
wavelength-max, 71, 75
wavelength-min, 70, 75
wavelength-set, 70
welcome, 170
wide-scan, 89
window, 54, 117, 125, 129, 146

xy-signal, 94, 114

zoom-amplitude, 99
zoom-data, 99
zoom-offset, 99
zoom-out, 100