TL-OSL Command List

For Controller & MiniSys III, software version 4.13

With support for the DASH driver board

Command index

Command	**Description**
Communications control	
!	Initialize communications. Must be issued as the first command, all prior commands will be ignored. This command resets and enables a 5min [1]communications timeout; if no command is received within 5 min then a "CA" command is issued. *Restrictions*: none *Returns*: Version number and hardware identifier (See **RV** command)
&	Acknowledge. Instructs command interpretter to execute the currently pending command. Used in command echo mode only (see **EO** command).
%	Negative acknowledge. Instructs command interpretter to ignore the currently pending command. Used in command echo mode when the returned string does not match the command which was sent.
CT *i*	Specify a new End Of Transmission (EOT) Command buffer must be empty and there can be no currently executing command. *i* = 0 EOT = CR 1 LF 2 CR+LF 3 LF+CR *Default*: CR+LF *No parameter*: Error 110 *Invalid parameterr*: Error 112. *Restrictions*: Cannot be issued while a command is running or an error 111 will occur.
EC¤	Cancel (disable) echo-back function (see **EO**). In this mode commands are processed as soon as they are received. *Default*: Echo disabled. *Restrictions*: Cannot be issued while a command is running or an error 111 will occur.
EO¤	Echo-back on. Echo all commands back to the sender for verification and wait for either an acknowledge or negative acknowledge before proceeding. *Default*: Echo disabled. *Restrictions*: Cannot be issued while a command is running or an error 111 will occur.
EP¤ *pw*	Enter password (*pw*) to allow access to protected commands. *Default*: none. *No parameter or wrong password*: command ignored. *Restrictions*: none
RV¤	Read software version and hardware ID as a string of length 5. The first two characters are the major software version, the next two characters are the minor version number and the fifth character identifies the hardware ("A" for Mini-Sys; "B" for TL-DA board). *Returns*: A string of the form "vvrri" where "vv" is the software version number, "rr" is the revision number and "i" is either "A" for Mini-Sys or "B" for the TL-DA board configured as a Mini-Sys.
HW	Read Minisys/controller hardware version, from hardware version E.
HT	Read Minisys/controller test date, initials,repair note.From hardware version E.
CB *b p l s*	Change Baud. Set communications parameters. *b* = Baud rate (1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200) Only requires first two digits. *p* = Parity (N:none, E:even, O:odd) *l* = Length (7 or 8) *s* = Stop bits (1 or 2) *Restrictions*: Mini-Sys only (ignored on TL-DA system - no error) Must re-establish connection within 30 sec or Mini-Sys will revert back to original settings. System must be idle. If a command is running then Error 111 results. *Missing parameters*: Error 110. *Invalid parameters*: Error 112.

[1]

System control commands:

AC Cancel Alpha irradiation. May be used in conjunction with **AI** without time parameter.
Restrictions: none

AI [*t*] Alpha irradiation for ***t*** seconds.
Restrictions: Beta and X-ray irradiator must be off and system lid must be closed.
Beta on: error 111
Lid open: error 12
No parameter: Turn irradiator on indefinitely.

AP *p* Move sample *p* to the Alpha irradiator.
Restrictions: The sample lift must be down. Hardware must be idle. System lid must be closed. Turntable must have been reset.
Heating, recording data, running TT or running lift: error 111
Lift not down: error 5
Lid open: 12
TT not reset: error 114
Already on position p: ignore command.
No parameter: error 110.
Invalid parameter value: error 112.
Timeout: error 2

BC Cancel Beta irradiation. May be used in conjunction with **BI** without time parameter.
Restrictions: none

BD *sc*[*v*] Control the blue diodes based on the sub-command (***sc***)
sc = "ON"
Turn on the blue diode array.
sc = "OFF"
Turn off the blue diode array.
sc = "RESET"
Clears the error condition which arises from a high blue diode current. Available on Mini-Sys only.
sc = "SET"
Set the output control voltage (***v***) to a value between 0 and 100 tenths of a volt (i.e. 0 to 10 volts). This voltage controls the current to the blue diodes. Available on Mini-Sys only.
Note:
The same control is used for the IR diodes. So changing the voltage using this command for the blue diodes will also change the voltage for the IR diodes (and vice versa).
Restrictions:
TL-DA: Halogen lamp must be off. Lamp on: error 7
Minisys: Only allowed on Controllers with the old OSL driver board (instead of the combi driver board. *Illegal Combi board command*: Error 15.

BI [*t*] Beta irradiation for ***t*** seconds.
Restrictions: Alpha and X-ray irradiator must be off and system lid must be closed.
Alpha on: error 111
Lid open: error 12
No parameter: Turn irradiator on indefinitely.

BP *p* Move sample *p* to the Beta irradiator.
Restrictions: The sample lift must be down. Hardware must be idle. System lid must be closed. Turntable must have been reset.
Heating, recording data, running TT or running lift: error 111
Lift not down: error 5
Lid open: 12
TT not reset: error 114
Already on position p: ignore command.
No parameter: error 110.

Invalid parameter value: error 112.
Timeout: error 2

CC Turn off the system calibration LED.
Restrictions: (TL-DA only) The turntable motor must be off. There are no restrictions in the Mini-Sys.

CO Turn on system calibration LED
Restrictions: (TL-DA only) The turntable motor must be off. There are no restrictions in the Mini-Sys.

HA Activate heater relay. When this is done, the set-point and the heater DAC output are both set to zero.
Restrictions: Fails if thermal failure condition exists.
Thermal Failure: error 13.

HD Deactivate heater relay. When this is done, the set-point and the heater DAC output are both set to zero.
Restrictions: none.

HP Advance turntable by one half position. This is done mainly to move samples away from the irradiator before turning on the vacuum pump thus avoiding scattering of grains when air is rapidly "sucked" out of the irradiator.
Restrictions: Turntable must be on position. System must be idle.
TT not on position: error 115.
Command running: error 111.

HV *sc* Control the high voltage supply to the photomultiplier tube based on the sub-command (sc).
sc = "ON"
Turn on the high voltage
sc = "OFF"
Turn off the high voltage.
Restrictions: Available only on MiniSys II systems.

IR *sc*[*v*] Control the IR diodes based on the sub-command (***sc***)
sc = "ON"
Turn on the IR diode array.
sc = "OFF"
Turn off the IR diode array.
sc = "RESET"
Clears the error condition which arises from a high IR diode current.
Available on Mini-Sys only.
sc = "SET"
Set the output control voltage (***v***) to a value between 0 and 100 tenths of a volt (i.e. 0 to 10 volts). This voltage controls the current to the IR diodes.
Note:
The same control is used for the blue diodes. So changing the voltage using this command for the IR diodes will also change the voltage for the blue diodes (and vice versa).
Restrictions:
TL-DA: Halogen lamp must be off. Lamp on: error 7
Minisys: Only allowed on Controllers with the old OSL driver board (instead of the combi driver board) except the "SET" mode which is generally allowed. *Illegal Combi board command*: Error 15.

LA *sc*[*v*] Control the power of the green laser in the single grain system based on the sub-command (***sc***)
sc = "ON"
Turn on the laser.
sc = "OFF"
Turn off the laser.
sc = "SET"
Set the laser power to a value between 0 and 100% of maximum power.
Restrictions:
Mini-Sys: A single grain system must be present and selected in the system parameters (parameter number 17)

LC Turn off halogen/xenon lamp used for optical stimulation.
Restrictions:
Mini-Sys - none

TL-DA: IR diodes must be off (error 9)

LD Lower the sample lift.
Restrictions: Turntable must be on position and not running. Cannot be issued during data aqcuisition or heating.
Heating, taking data or TT running: error 111.
Not on position: error 1.
Timeout: error 3.

LI *sc*[*v*] Control the power of the infrared laser in the single grain system based on the sub-command (***sc***)
sc = "ON"
Turn on the laser.
sc = "OFF"
Turn off the laser.
sc = "SET"
Set the laser power to a value between 0 and 100% of maximum power.
Restrictions:
Mini-Sys: A single grain system must be present and selected in the system parameters (parameter number 17)

LO Turn on halogen/xenon lamp used for optical stimulation.
Restrictions:
Mini-Sys - none
TL-DA: IR diodes must be off (error 9)

LS s *sc* Controls the light source *s* based on the sub-command (***sc***)
sc = "ON"
Turn on the IR diode array.
sc = "OFF"
Turn off the IR diode array.
Restrictions:
Mini-Sys: Only allowed with the combi driver board (not th earlier OSL driver board)
TL-DA: Not allowed

LU Raise the sample lift.
Restrictions: Turntable must be on position and not running. Cannot be issued during data aqcuisition or heating.
Heating, taking data or TT running: error 111.
Not on position: error 1.
Timeout: error 3.

LX Lower the sample lift. This command is used to get out of lift/position deadlock. The command interpretter will attempt to lower the lift regardless of the turntable position.
Restrictions: Other restrictions of **LD** still apply.

MC Turn off the turntable motor.
Restrictions: none

MF Turn on turntable motor (high speed).
Restrictions: The calib-LED must be off (TL-DA only). Lift must be down.
Calibration LED on: error 11.
Lift not down: error 5.

MO Turn on turntable motor (low speed).
Restrictions: The calib-LED must be off (TL-DA only). Lift must be down.
Calibration LED on: error 11.
Lift not down: error 5.

NC Close the nitrogen valve.
Restrictions: none

NO Open the nitrogen valve to purge system.
Restrictions: The system lid must be closed and the vacuum pump must be off.
Lid open: 12
Vacuum on: error 14.

NP Goto the next sample position.
Restrictions: The sample lift must be down. Hardware must be idle. System lid must be closed:

Heating, recording data, running TT or running lift: error 111
Lift not down: error 5
Lid open: 12
Timeout: error 2

OR *s i* Operate relay. Place the relay(s) specified by *i* into the state specified by *s*. This function is only available on Mini-Sys systems equipped with the user I/O board option. and is not available if a single grain system is attached. If the board is not present or a single grain system is present then the command has no effect.
s: Relay state, either "ON" or "OFF".
i: Relays to be affected, for example i = "145" indicates that relay numbers 1, 4 and 5 should be placed into the state specified by *s*, use i = "ALL" to change all relays at once).

PS *p* Move sample *p* to the heater position.
Restrictions: The sample lift must be down. Hardware must be idle. System lid must be closed. Turntable must have been reset.
Heating, recording data, running TT or running lift: error 111
Lift not down: error 5
Lid open: 12
TT not reset: error 114
Already on position p: ignore command.
No parameter: error 110.
Invalid parameter value: error 112.
Timeout: error 2

PL *p s* Move sample *p* to the correct position to be exposed to the light source *s*. This is the measurement position for all light sources except the white light source.
s = light source ID†
Restrictions: The sample lift must be down. Hardware must be idle. System lid must be closed. Turntable must have been reset.
Heating, recording data, running TT or running lift: error 111
Lift not down: error 5
Lid open: 12
TT not reset: error 114
Already on position p: ignore command.
No parameter: error 110.
Invalid parameter value: error 112.
Timeout: error 2

QT Quit. Terminate Mini-Sys program and run DOS command shell. If the DOS command shell does not receive a command within 10 seconds, the Mini-Sys program starts again. (Mini-Sys only)

SC Close the illumination shutter for the halogen/xenon lamp or single grain laser used for optical stimulation.
Restrictions:
Mini-Sys: none
TL-DA: IR diodes must be off.
IR diodes on: error 6.

SO Open the illumination shutter for the halogen/xenon lamp or single grain laser used for optical stimulation.
Restrictions:
Mini-Sys: none
TL-DA: IR diodes must be off.
IR diodes on: error 6.

TR Reset the turntable to position 1.
Restrictions: The sample lift must be down. Hardware must be idle. System lid must be closed:
Heating, recording data, running TT or running lift: error 111
Lift not down: error 5
Lid open: 12
Timeout: error 2

VC Deactivate the system vacuum pump.

VO Activate the system vacuum pump.
Restrictions: The system lid must be in the down position and the nitrogen valve must be closed.

Lid open: error 12
Nitrogen on: error 14.

WA Turn on the white lamp used for bleaching.
Restrictions:
Available on Mini-Sys only

WC Close the illumination shutter for the white lamp used for bleaching.
Restrictions:
Available on Mini-Sys only

WD Turn off the white lamp used for bleaching.
Restrictions:
Available on Mini-Sys only

WO Open the illumination shutter for the halogen/xenon lamp or single grain laser used for optical stimulation.
Restrictions:
Available on Mini-Sys only

XC Cancel X-ray irradiation. May be used in conjunction with **XI** without time parameter.
Restrictions: Available on Mini-Sys II only

XI [*t*] X-ray irradiation for ***t*** seconds.
Restrictions: The high voltage and current for the device must previously have been set using the command 'SX'.
If the monitored output from the X-ray system is not within specification of that requested: Failure 11
If the x-ray interlock is broken: Failure 11
Alpha and beta irradiator must be off and system lid must be closed.
Alpha or beta on: error 111
Lid open: error 12
Available on Mini-Sys II only
No parameter: Turn irradiator on indefinitely.

XP *p* Move sample *p* to the X-ray irradiator.
Restrictions: The sample lift must be down. Hardware must be idle. System lid must be closed. Turntable must have been reset.
Heating, recording data, running TT or running lift: error 111
Lift not down: error 5
Lid open: 12
TT not reset: error 114
Available on Mini-Sys II only
Already on position p: ignore command.
No parameter: error 110.
Invalid parameter value: error 112.
Timeout: error 2

Process control commands:

BL *s* [*t*] Bleach a sample for a specified time ***t*** with illumination source ***s***† If the time parameter is omitted then the bleaching continues until cancelled with the **BS** command. The turntable must be on position and the restrictions for the operation of the light source must be observed.
s = light source ID† (cannot use 'N')
t = time (sec) - optional.

BS Stop a bleaching which was started with the **BL** command.

CA¤ Cancel any running data aquisition or timed processes, turn off light sources and irradiators and clear the input buffer of all pending commands. This command is executed automatically after a 5 minute pause in communications from the host.

CI¤ Clear interrupts (debugging). This command is password protected.

CL¤ Clear internal command buffer (i.e. delete all pending commands).

CR¤ Reset event counts (debugging)

LP n Load default configuration parameters from configuration file. This command is available on the Mini-Sys only.
n (optional) : given an f as parameter the mini-sys settings are read from the factory settings file

LV *x* Enable or disable live data download mode. In this mode data is sent to the host during a data aquisition (i.e. Data is sent to com port as soon as it is available)
x: ON = Enable; OFF = Disable.

MD *x* Set the mode of operation for the command interpreter. *x* = command mode.
1: Single command mode. Complete execution of low priority commands before proceeding to the next low priority command. All commands are low priority unless otherwise indicated; 2: Allow execution of multiple low priority commands simultaneously.

PA *t* Pause the command interpretrer for *t* seconds before executing the next low priority command.

SA *n v* Set system parameter ***n*** to the value ***v***. This command is password protected.
A full list of system parameters is given at the end of this document. Parameter values can be read using the RA command.

SB *t* Start a background integration for *t* seconds. Monitor the *command running* status bit to determine when the background is finished, then use the 'RB' command to read the value of the background.

ST *t* [*r*] Set the sample temperature to ***t***. May not be issued during data acquisition.
t = temperature (C)
r = heating rate (C/s) - optional.

Warning:
The temperature setpoint when cooling are calculated therefore the command can end before the hotplate obtains the setpoint ***t.***

Example:
ST 400 5 */heat to 400 degrees C with 5 degrees per second.*
ST 300 1 */lower temperature from 400 to 300 degrees C with 1 degrees per second.*

SX *v i* Set the voltage (***v***) in kV and current (***i***) in mA for the x-ray irradiation system.
Valid values are 0-50 kV and 0-2 mA.
Restrictions:
The maximum power for the system is 50W, so ***v*** * ***i*** must not exceed this value: error 112.
Only available on Mini-Sys II

WP n¤ Write current parameter values to the configuration file. This is a password protected command and is only available with the Mini-Sys.

n (optional) : given an f as parameter the mini-sys settings are written to factory settings file

SP n i Command to communicate with the built-in HC08 Pulsed OSL board
Protocol for DASH driver board see below in this document…
Parameters:
n = command array 1..8 bytes
i = response array 0..4 bytes

list of commands n =
1 Setup pulser.
Argument: sp 1 onpulse offpulse exponent power PMTgate counterGating CRFC
Response : none.
2 reset pulser
Argument: sp 2
Response: none
3 calibrate pulser (password protected, use EP command before this command)
Argument: sp 3
Response: none
4 Not applicable
5 Not applicable
6 read blue heatsink temperature, some value between 0 and 1023

7 read red heatsink temperature, some value between 0 and 1023
Argument: sp 6 or sp 7
Response: command_no hi(value) lo(value) zero
8 read pulser status
Argument: sp 8
Response: command_no bitpattern zero
Bit pattern: bit7 = OSL on
Bit6..1 = reserved
Bit0 = crc fault

PC

PC pw p1 p2 p3 p4 g1 g2 g3
pw: power (0-100%)
If pw =0 the pulsed option board enters calibration mode. If pw=0 all following parameters are ignored
p1: On time (sec) mantissa (0.0-9.9)
p2: On time (sec) exponent
p3: Off time (sec) mantissa (0.0-9.9)
p4: Off time (sec) exponent
g1: Gating on [0..3]
0: Gating disabled, Photon Timer disabled
1: Gating enabled, Photon Timer disabled
2: Gating disabled, Photon Timer enabled
3: Gating denabled, Photon Timer enabled]
g2: On gate delay (index)
g3: Off gate delay (index)

System monitoring commands:

RA¤ *i* Read system parameter ***i***. A description of parameters is given at the end of this document. Parameters can be set using the SA command.

RB¤ Read background counts which have been previously recorded. To start recording a background use the 'SB' command.

RC¤ Read interrrupt event counts (debugging)

RD¤ *i* [*j*] Read data array points ***i*** through ***j***. If ***j*** is omitted then only data point *x* is returned. If the point has not been defined yet then –1 is returned. If ***j*** > ***i*** a syntax error is reported. For version 2.12 and after, RD is a timed process and cannot be used if another timed process is active. The rate at which data are written to the COM port is specified by parameter 13 in the MiniSys – ComPortOutputDelay. This is specified in µs and should not be less than 100.

RH Read the location of the last hole that was found using the SGLL attachment. The hole search is started using FH or one of the higher level commands such as FD. The X and Y location of the last hole are returned. If no hole was found previously then "-1 -1" is returned.

RI¤ *n* Read analog input channel ***n***

RO *i* Read optically isolated input *i*, this is a binary input and thus returns the state as 0 or 1. This function is only available on Mini-Sys systems equipped with the user I/O board option. If the board is not present then a zero is returned (i must be in the range 1 to 16). This function is not available on single grain systems.

RP¤ Read the turntable position. If the turntable has not been reset then a zero is returned.

RR¤ *i* Read the X-ray power parameters. These are set using the SX command.
i = 0, Read: Set point for voltage (kV)
1 Set point for current (mA)
2 Actual voltage (kV)
3 Actual current (mA)
Restrictions: Only available on Mini-Sys II systems.

RS¤ [*i*] Read status byte ***i***. If the parameter ***i*** is omitted then all of the status bytes are returned, each followed by the EOT character(s).

RT¤ [*i*] Read the temperature

i = 0, Read: Set point
1 Sample temperature
2 Room temperature
Default: If no parameter is given then the Set Point is returned.

LR [*i*] readout the total amount of retrys
i = S read out retrys on SPI bus
i = L read out retrys on LIN bus
i = C clear both retry counters

System update commands:

UP Update program
Then the UP command is issued from host the Controller assign a new file called "temp.exe". If the Controller succeeded this, an ascii ACK is transmitted, otherwise an ascii NAK is transmitted, by the Controller.

If an ACK is received by the host the file transmission can begin. The file is send by the host by a simple ascii protocol, described below.
The maximum length of a frame is 255 byte.
This command is password protected.
See revision history at ver. 3.00

UW^{x} [crc] Update write.
Where CRC is the expected checksum of the file (temp.exe) received by the Controller. If the temp.exe file did not have the same CRC as received, the Controller respond with an errorcode 119. And the existing program remains as before. Otherwise the old program is replaced with the new received file.

If something vents wrong overwriting the existing program the Controller respond with an errorcode 120. in that case it is important not to turn power off from the controller. But try to update the controller again!

Encoder commands:

DM *x y v acc* Diagonal move. This command will move both encoders together in order to move from their current positions to those specified by x and y. The total velocity and acceleration values also have to be set. Velocity is specified in µm/s. Permissible values are between 250 and 5000µm/s.
Invalid parameter: Error 112.
Restrictions: Cannot be issued while a command is running or an error 111 will occur

EI *id* [*p*] [*r*] Initialize encoder
id = Encoder ID*
p = Current position (µm)
r = µm/step
Initialise the encoder, setting the current position to p and the calibration value for the encoder to r. If p is not specified then it is set to 0. If the calibration value is not specified it is set to the default value of 0.4960µm/step. Both encoders are automatically initialised when the MiniSys boots up - so normally this instruction is not required. Simply issue an EM command to reset the encoder with respect to its end stop.
Invalid parameter: Error 112.

EM *id* Reset the specified encoder to the minimum encoder position. The encoder must have previously been initialized. The encoder is moved 1000µm away from the end stop and this position is then defined as position zero.

PE *id p* [*v acc*] Set the position of the specified encoder to p µm. Permissible limits for position are from 0 to 20,000µm in normal used. The encoder must have previously been initialized and reset. The encoder moves using the Trapezoidal Move command of the HP chip. The maximum velocity and acceleration can be set. If these values are not specified then the current values from the last move are used.

Velocity is specified in µm/s. Permissible values are between 250 and 5000µm/s. The encoder is not able to run at speeds above this.

ER *id* Read the current position of the specified encoder. The value is returned in µm relative to the last encoder initialise or reset.

RG *id reg* Read register number *reg* from encoder *id*.

WG *id reg v* Write the value *v* to register number *reg* of encoder *id*.

Encoder ID may have the values 0 and 1. The X axis encoder is encoder 1, and the Y axis encoder 0.

Data acquisition commands:

note: The maximum data acquisition rates are 150 points per second in live mode and 200 data points per second with live mode off. Attempting greater data rates will result in error code 112 (invalid parameter value).

SR *id s ew r p ch g* Perform an encoder scan from the current position to *ew* µm. During this the value at the analogue input *ch* is recorded. The turntable must be on position and the encoder must have been previously reset.
id = encoder ID*
s = light source ID†
ew = ending position (µm)
r = scan rate (µm/s)
p = number of data points
ch = analogue channel to read
g = gain (this is not used in systems with controller) valid values are 1,2,4,8.

An additional three values are available for downloading beyond the number of data points *p* specified. *p+1* is the measured position of the encoder when the scan was started, *p+2* is the calculated end position of the encoder, and *p+3* is the measured position of the encoder at the end of the scan. The calculated end position may not be exactly the value specified in *ew* since it is adjusted so that a whole number of encoder steps are used per data point. This is important since the collection of data is tied to the number of encoder pulses.

OS *s t p* [*p1 p2 m*] Record an OSL decay curve. The turntable must be on position. Restrictions for the light source must be observed and the turntable must be on position. If the MiniSys is equipped with the diode control board that allows software control of the diode current, then the diode power can be ramped during the OSL measurement (see light source ID's at the end of this section). The power is defined in terms of the percentage of the full operating range, and is specified in %. Therefore the maximum and minimum values are 100 and 0 respectively.
s = light source ID†
t = Acquisition time (sec)
p = number of data points/frames
p1 = % diode power at the beginning of the measurement (*note1)
p2 = % diode power at the end of the measurement (*note1)
m = omitted or 0: data points generated from PMT counts
m = 1: no data points generated, but HW ACQ (ACQuisition) signal set for EMCCD camera acquisition

note 1: only available with ramped lightsourses like BR,IR,GR,AR, see the list of all valid lightsourses below.

OP The standard OSL command is using two different low level commands depending on whether or not you have periods without stimulation included in the data acquisition period.
The low level control of the new POSL operation is implemented as a single command OP (OSL, Pulsed stimulation) as described below.

Argument:
OP s t p pb pa pw p1 p2 p3 p4 g1 g2 g3
there:
s: LED light source i.e. I or B
t: acquisition time (sec)
p: number of data points (channels)
pb: number of data points before stimulation
pa: number of data points after stimulation
pw:power (0-100%)
p1: On time (sec) mantissa (0.0-9.9)
p2: On time (sec) exponent
p3: Off time (sec) mantissa (0.0-9.9)
p4: Off time (sec) exponent
g1: Enabling [
    0: Gating disabled, Photon Timer disabled
    1: Gating enabled, Photon Timer disabled
    2: Gating disabled, Photon Timer enabled
    3: Gating denabled, Photon Timer enabled]
g2: On gate delay (index)
g3: Off gate delay (index)

note : this command can only be used with HC08 pulser (old model) for DASH board driver board use the PU command

PO *s t p ea ei d*[*a m*] Record a pulsed OSL decay curve. The turntable must be on position. Restrictions for the light source must be observed and the turntable must be on position.
s = light source ID†
t = Acquisition time (sec)
p = Number of data points/frames
ea = channels/frames with excitation active
ei = channels/frames with excitation inactive
d = delay before first excitation (channels/frames)
a = Number of scans to accumulate (default = 1).
m = omitted or 0: data points generated from PMT counts (a=1) (*note1)
m = 1: no data points generated, but HW ACQ (ACQuisition) signal set for EMCCD camera acquisition (a=1) (*note1)

note 1: when camera option *m* 0 or 1 is defined, option *a* must also be defined.

TL *t r p f [m]* Record a TL glow curve. The turntable must be on position.
t = maximum temperature
r = heating rate
p = number of data points (see note1)
f = final temperature (f <= t)
m = omitted or 0: data points generated from PMT counts (*note 1)
m = 1: no data points generated, but HW ACQ (ACQuisition) signal set for EMCCD camera acquisition (see note 2)

note 1: If p=0 no data points are generated and the Controller immediately starts setting final temperature to f.

note 2: When camera option *m* 0 or 1 is defined, option *f* must also be defined.

TO *t r p f s ea ei d* Record a thermo-optical stimulated luminescence (TOL) curve. The turntable must be on position. Restrictions for the light source must be observed and the turntable must be on position.
t,r,p,f: see definitions in **TL** (*note 1)
s = light source ID†
ea = channels with excitation active
ei = channels with excitation inactive

d = delay before first excitation (channels)
m = omitted or 0: data points generated from PMT counts
m = 1: no data points generated, but HW ACQ (ACQuisition) signal set for EMCCD camera acquisition

note 1: when camera option *m* 0 or 1 is defined, option *f* must also be defined.

DASH driver board commands:
The new combined CW and pulsed driver board is controlled via SPI bus. The board also serves as a LIN-bus master that controls the controllers in the new detection/stimulation head.

FS w n

Filter selection
w: Filter wheel no (1 (lower layer) or 2 (upper layer))
n: Filter no to be used (1-4)

As w an ? can be typed and the actual position will be returned if a 0 is returned the filter reel has not been initialize before.
-1 is returned if there is no answer within 60 seconds.
-2 is returned if the LIN bus return 0x20, master error
-3 is returned if the LIN bus return 0x22, master and slave error.
-4 is returned if a unknown

DU n

Detection Unit selection
n: Detection unit no to be used (0-3)
As n an ? can be typed and the actual position will be returned if a 0 is returned the filter reel has not been initialize before.

SF w

Set focus
w: (wavelength (in nm)) just a value minimum – maximun
As w an ? can be typed and the actual focus position will be returned if a 0 is returned the fousing unit has not been initialize before.
The minimum focus position is defined in parameter no. 129
The maximum focus position is defined in parameter no. 130
The timeout in seconds for obtain the desired focus position is defined in parameter no. 132.
The tolerance of the desired focus position is defined in parameter no. 131.

SI w

Set Iris
w: number between minimum and maximum
As w an ? can be typed and the actual iris position will be returned if a 0 is returned the fousing unit has not been initialize before.
The minimum iris position is defined in parameter no. 135.
The maximum iris position is defined in parameter no. 136.
The timeout in seconds for obtain the desired iris position is defined in parameter nr. 138.
The tolerance of the desired iris position is defined in parameter no. 137.

PU s t p pb pa ts to gs ge

The low level control of the POSL operation with the DASH diver-board (CW and pulsed

Argument:
OP s t p pb pa pw ts to gs ge
there:
s: Light source (see †)
t: acquisition time (sec)
p: number of data points (channels)

pb: number of data points before stimulation
pa: number of data points after stimulation
ts: stimulation time (sec)
to: on time (sec)
gs: gating start (sec, relative to stimulation start)
ge: gating end (sec, relative to stimulation start)

†Valid light source ID codes are as follows:

L = Halogen/Xenon Lamp
B = Blue diodes
BR = Blue diode power is ramped linearly during the OSL measurement over the range specified in the final two parameters of the OS command. This works only when recording OSL and is only available on Mini-Sys systems equipped with the correct OSL control board.
E= Green diodes
I = IR diodes or IR laser diode
IR = IR power is ramped linearly during the OSL measurement over the range specified in the final two parameters of the OS command. This works only when recording OSL and is only available on Mini-Sys systems equipped.with the correct OSL control board.
W= White light source used solely for bleaching and placed between the irradiator and the alpha irradiator position
G = Green laser on single grain systems
GR = Green laser power is ramped linearly during OSL measurements over the range specified in the final two parameters of the OS command. This works only when recording OSL on a single grain system
A= Infrared laser on single grain systems
AR = Infrared laser power is ramped linearly during OSL measurements over the range specified in the final two parameters of the OS command. This works only when recording OSL on a single grain system
C = Calibration LED
N = No illumination
D = Beta source irradiator (Radio lumminisens)
1=External 1 control
2=External 2 control
S= Violet laser, OSL shutter signal on older systems with lamp house.

R*ijk*... = Activate relay numbers *i*, *j*, *k*, etc. This allows control of external sources.
Values for relay numbers are 1 through 8.
Several relays may be activated simultaneously.
There must be no spaces in the string (i.e. “R145” will activate relays 1, 4 and 5 but “R 1 4 5” will generate a syntax error)
If “R” is replaced with “RI” then the logic state is inverted so that the relays are de-activated at the beginning of the process and activated at the end of the process. By inserting an “s” in the string the Mini-Sys can also be instructed to operate the shutter (e.g. The command “OS RS12 100 250” causes the Mini-Sys to activate relays 1 and 2, open the shutter and record 250 data points in 100 seconds).

(PW): Password protected commands.

SP c p1….pn SPI-bus commands to communicate with the combi board
Parameters:
c = command (0-255)
p1, p2, ….,pn= up to 64 bytes (0-255)

The parameters for SPI bus commands are described in a dedicated document

Command id:	Command name	Command type:
1	Setup Combi-board	acquisition setup
2	Setup integrator	acquisition setup
3	Command calibrate	acquisition setup
4	Write cpld register	acquisition setup
5	Read cpld register	acquisition setup
6	Read integrator settings	acquisition setup
7	Read board temperature	utility command
8	Read Combi-board status	utility command
9	Read Combi-board version	utility command
10	Read Combi-board firmware version	utility command
11	Read Combi-board settings	utility command
12	Read Maintenance temporary calibration parameters	utility command
13	Read photodiode feed-back and LED current	utility command
14	Read OSL power	utility command
15	Write ADC & DAC RAW values to EEPROM	Test utility command, internal use only
16	Read ADC & DAC RAW values from EEPROM	Test utility command, internal use only
17	CW on	Test utility command, internal use only
18	CW off	Test utility command, internal use only
19	Read factory calibration parameters	
20	Write factory calibration parameters	
21	Read number of points of maintenance calibration	
22	Write number of points of maintenance calibration	
23	Read maintenance calibration stored parameters	
24	Write maintenance calibration parameters	
25	Arm for CW stimulation	
26	Read all calibration parameters from Base unit to Combi-board	
27	Set integration time of the integrator	
28	Read integration time of the integrator	
29	Setup PU command	
30	Stop calibration	
31	Setup camera ACQ signal	
32	Read CPLD version and serial number	
33	Setup LM-OSL and arm	
34	Read the number of calibrated data points	
35	Read PID control parameters	
36	Write PID control parameters	
37	Arm for TOL	
128	Read Lin-bus status	Command using LIN-bus
129	Read Lin-bus error	Command using LIN-bus
130	Set filter to position	Command parse to LIN bus master
131	Read filter position	Command parse to LIN bus master
132	Set detector position	Command parse to LIN bus master

133	Read detector position	Command parse to LIN bus master
134	Read parameter	Command parse to LIN bus master
135	Write parameter	Command parse to LIN bus master
136	Set focus position	Command parse to LIN bus master
137	Read focus position	Command parse to LIN bus master
138	Read LIN-bus data	Command using LIN-bus
139	Read LIN slave SW version	Command parse to LIN bus master
140	Control general IO ports of the base unit	Command using LIN-bus
141	Execute bootloader of the combi-board	Command using LIN-bus
142	Select PMT	
143	Read selected PMT	

Status Byte definitions

Byte 0: bit:
- 0 Turntable running
- 1 On position
- 2 On position 1
- 3 Lift motor running
- 4 Lift up
- 5 Lift down
- 6 Heater relay closed
- 7 Thermal failure

Byte 1: bit:
- 0 Vacuum on
- 1 Vacuum ready
- 2 Alpha, Beta or X-ray Irradiator on
- 3 IR diodes on
- 4 Calibration LED on
- 5 Blue diodes on
- 6 Lamp on (either Halogen or white light source)
- 7 Shutter open (either Halogen or white light source)

Data acquisition codes: Identifies data acquisition, if any, which is currently running.
- 0 = none
- 1 = (TL) Thermoluminescence
- 2 = (OS) Optically stimulated luminescence
- 3 = (TO) Thermo-optical luminescence
- 4 = (MS) Monochromator scan
- 5 = (PO) Pulsed OSL

Byte 2: bit:
- 0 bit 0 of Data Acquisition Code (DAC)
- 1 bit 1 of DAC
- 2 bit 2 of DAC
- 3 bit 3 of DAC
- 4 Nitrogen on
- 5 Lid open
- 6 X-ray ready for use
- 7 Beta source on

Byte 3: bit: *(For systems **without** a single grain system)*
- 0 Not used
- 1 Not used
- 2 Not used
- 3 Not used
- 4 Not used
- 5 Not used
- 6 Command running (any timed or interrupt driven command)
- 7 IR or Blue diode failure (Mini-Sys only)

Byte 3: bit: *(For systems **with** a single grain system)*
- 0 Bottom end stop for encoder 0
- 1 Upper end stop for encoder 0
- 2 Encoder 0 running
- 3 Bottom end stop for encoder 1
- 4 Upper end stop for encoder 1
- 5 Encoder 1 running
- 6 Command running (any timed or interrupt driven command)
- 7 IR or Blue diode failure (Mini-Sys only)

Byte 4: Hardware conflict and command interpreter errors:
- 0: No error.
- 1: Attempt to move lift while not on position

5: Attempt to change position while lift is not down
6: Attempt to operate shutter while lamp is off (old system)
7: Attempt to operate IR diodes while lamp is on (old system)
8: Attempt to turn off lamp while shutter is open (old system)
9: Attempt to turn on lamp while IR diodes is on (old system)
11: Attempt to operate Cal. LED and turntable.(old system)
12: Command not allowed while lid is raised
13: Attempt to heat while thermal failure condition is present
14: Attempt to operate nitrogen and vacuum simultaneously
15: Illegal command for DASH driver board
16: SPI communication to DASH driver board failure
100: Unknown command
110: Invalid or missing command parameters
111: Command not allowed while hardware is active
112: Invalid command parameter value
113: Attempt to scan monochromator or encoder without first initializing
114: Attempt to locate a turntable position without first resetting the turntable
115: Turntable not on position
116: Command not allowed without valid password
118: Encoder move not allowed
119: Invalid update checksum
120: update critical write update error
121: no pulsing board installed (HC08 pulser version <1.08 not the DASH driver board)
122: Invalid ADC value (The Controller need to be calibrated at DTU nutech)
123: unknown EEprom table (The Controller need to be calibrated at DTU nutech)
124: No DASH driver board installed.

Byte 5: Failure errors:
0: No error.
1: Failure during heating
2: Time-out while searching for next position
3: Time-out while changing lift state
4: Time-out while scanning monochromator / encoder
5: Thermal failure
6: Lamp failure during OSL or bleaching (not yet implemented).
7: End stop encountered during monochromator / encoder scan.
8: Turntable position error - position 1 marker not found, or in wrong place
9: No XY system
10: unused
11: Irradiation failure
12: EEProm failure
13: DASH filter changer timeout (time value in seconds is set by parameter 118)
14: DASH detector changer timeout (time value in seconds is set by parameter 119)

15: TBD
16: TBD
17: Beta source irradiator is not turning off
18: Focus scan timed out
128: OSL head base unit error
129: LIN bus Filter changer 1 (lower filter layer) error
130: LIN bus Filter changer 2 (upper filter layer) error
131: LIN bus Detector changer error
132: LIN bus master error
133: LIN bus filter changer 1 (lower filter layer) did not end at the desired filter position
134: LIN bus filter changer 2 (upper filter layer) did not end at the desired filter position

135: LIN bus detector changer did not end at the desired detector position
136: LIN bus (baseunit) PMT signal selection is not at the desired detector signal
137: LIN Focus unit error
138: LIN Focus not with in tolerance

Byte 6:

Bit.0 EEPROM checksum fail;

System parameters

System parameters can be read using the command RA, and if the password has been supplied to the MiniSys they can be altered using the command SA. Parameter s can only be changed if the system password is entered.

parameter	Description	min	max	Default
1	Lift stop delay in mS	1	5000	450
2	Lift time in sec.	5	900	60
3	Turntable timeout in sec.	10	60	60
4	Turntable stop delay in mS	1	500	15
5	time in mS to wait before checking position	200	2000	500
6	time in ms to get halfway to next posistion	1	2000	2000
7	max hot plate temperature	500	700	700
8	max heating rate C/s	1	20	10
9	XY rails timeout	60	300	100
10	Max samples	24	48	48
11	Dual speed turntable	0	1	1
12	System type (0=old 1=new)	0	1	1
13	com output delay (time in uS between datapoints)	200	65000	100
14	Default powerlevel for IR & blue diodes in percent	0	100	40
15	Check heating	0	1	1
16	Irrad offset in mS (time for open/close of source can be added)	-1000	1000	0
17	XY system (0=no XY attachment 1 = XY attachment)	0	1	0
18	software T max (max allowed temperature	0	700	700
19	system ID	0	9999	N/A
20	XY scanmode (see the history document)	0	1	1
21	unused	x	x	X
22	unused	x	x	X
23	unused	x	x	x
24	unused	x	x	X
25	unused	x	x	X
26	unused	x	x	X
27	unused	x	x	X
28	unused	x	x	X
29	unused	x	x	x
30	Distance from disc centre to location hole in micron	1	10000	4000
31	Default X centre in micron	1	25000	10000
32	Default Y centre in micron	1	25000	10000
33	Default disc angle	-180	180	-90
34	location hole scan length	20	5000	1000
35	Lost hole scanlength	20	5000	3500
36	Grain scanlength	20	5000	660

37	Scanspeed	1	5000	1500
38	Threshold for hole finding	1	20000	1750
39	Y steps per 10000 micron (old=4960 new=2158)	100	10000	2158
40	X steps per 10000 micron (old=4960 new=2158)	100	10000	2158
41	Max X travel	1000	50000	12000
42	Max Y travel	1000	50000	12000
43	unused	x	x	X
44	unused	x	x	X
45	unused	x	x	X
46	unused	x	x	X
47	unused	x	x	X
48	unused	x	x	X
49	unused	x	x	X
50	lift down timeout	5	900	60
51	Heater parameter for X4	-1,00E+20	10	0
52	Heater parameter for X3	-1,00E+20	10	0
53	Heater parameter for X2	-1,00E+20	10	0
54	Heater parameter for X	-1,00E+20	10	0
55	Heater parameter offset	-1,00E+20	10	0
56	XY Gearbox ratio (old = 16, new = 35,55)	0,00	N/A	35.55
57	XRaykVMax	0,00	N/A	50
58	XRaykVMin	0,00	N/A	0
59	XRaymAMax	0,00	N/A	1
60	XRaymAMin	0,00	N/A	0
61	XRayPowerMax	0,00	N/A	50
62	Accuracy of Xray kv and ma in percent	0,00	N/A	20
63	Count of sampl to measure Xray Kv and mA	1	10	5
64	SR scan divider (10Mhz/parameter64=sample frequency)	100	10000	500
65	Minisysbus board (1=2005, 0=9-2005, default=0)	0	1	0
66	Checkdiodes OSL (default=1 nocheck = 0)	0	1	1
67	OSL Shutter (Halogen lamp) activehigh=1 or default activelow=0	0	1	0
68	OSL blue led polynomial X^4	-1,00E+20	10	0
69	OSL blue led polynomial X^3	-1,00E+20	10	0
70	OSL blue led polynomial X^2	-1,00E+20	10	0
71	OSL blue led polynomial X	-1,00E+20	10	0
72	OSL blue led polynomial offset	-1,00E+20	10	0
73	OSL IR led polynomial X^4	-1,00E+20	10	0
74	OSL IR led polynomial X^3	-1,00E+20	10	0
75	OSL IR led polynomial X^2	-1,00E+20	10	0
76	OSL IR led polynomial X	-1,00E+20	10	0
77	OSL IR led polynomial offset	-1,00E+20	10	0
78	XY Green laser polynomial X^3	-1,00E+20	10	0
79	XY Green laser polynomial X^2	-1,00E+20	10	0
80	XY Green laser polynomial X	-1,00E+20	10	0
81	XY Green laser polynomial offset	-1,00E+20	10	0
82	XY IR laser polynomial X^3	-1,00E+20	10	0
83	XY IR laser polynomial X^2	-1,00E+20	10	0
84	XY IR laser polynomial X	-1,00E+20	10	0

85	XY IR laser polynomial offset	-1,00E+20	10	0
86	enable USB 0=no 1=yes	0	1	0
87	Check pulser parameter read back	0	1	1
88	1 = Hardware check via microswitch whether betasource is on or off the result is shown on status register 2 bit 7 if the microswitch does not change to active state within 1.5s. an irradiation failure (code 11) will be set in status register 5 . 0 = The Beta source irradiator control signal is copied to status register 2 bit 7 one minisys syscheck circle (approx 0,5s) after. No change in status register 4 or 5.	0	1	1
89	Use Calibration EEProm, from Controller hardware version E. (released in March 2011). Analog inputs offset and full scale values, hardware version and testdata are stored in this EEPROM. 0 = do not use EEProm 1 = use EEPROM only relevant from hardware version E. 2 = value from parameter 90 – 105 are used as calibration values 3= use this value in case of EEProm failure, When this option is used the calibration parameters is copied from the flash memory to the EEProm and correct crc is calculated.	0	3	0
90	Analogue input 0 offset value @ 0V input	0	1000	0
91	Analogue input 0 full scale value @10V input	60000	65535	65535
92	Analogue input 1 offset value @ 0V input	0	1000	0
93	Analogue input 1 full scale value @10V input	60000	65535	65535
94	Analogue input 2 offset value @ 0V input	0	1000	0
95	Analogue input 2 full scale value @10V input	60000	65535	65535
96	Analogue input 3 offset value @ 0V input	0	1000	0
97	Analogue input 3 full scale value @10V input	60000	65535	65535
98	Analogue input 4 offset value @ 0V input	0	1000	0
99	Analogue input 4 full scale value @10V input	60000	65535	65535
100	Analogue input 5 offset value @ 0V input	0	1000	0
101	Analogue input 5 full scale value @10V input	60000	65535	65535
102	Analogue input 6 offset value @ 0V input	0	1000	0
103	Analogue input 6 full scale value @10V input	60000	65535	65535
104	Analogue input 7 offset value @ 0V input	0	1000	0
105	Analogue input 7 full scale value @10V input	60000	65535	65535
106	Use polynomial (parameter 107-111) for sample temperature readback (RT 1 command), 1=use polynomial	0	1	1

107	Poly X^4 RT 1	-1E+20	10	5.86008E-0010
108	Poly X^3 RT 1	-1E+20	10	-8.80585E-0007
109	Poly X^2 RT 1	-1E+20	10	3.86796E-0004
110	Poly X RT 1	-1E+20	10	9.48209E-0001
111	Poly X offset RT 1	-1E+20	10	-4.84946E-0002
112	Bleach shutter, active 0 or 1	0	1	1
113	IR Laser MAX output	32767	65535	65535
114	Green Laser MAX output	2047	4095	4095
115	pulsersystem	0	1	“0” none. or HC08 pulser “1” DASH driver board installed
116	SPI clockcircle with in micro sec	20	200	30
117	SPI delay after command byte in micro sec	300	20000	500
118	filter changer timeout in seconds	200	420	300
119	Detector unit timeout in seconds	200	420	300
120	Base unit timeout in seconds	100	420	100
121	LIN Hardware IRQ rate time in ms	60	5000	100
122	Camera trigger time in us	0	16E+6	500
123	SPI retry interval in ms	0	2000	100
124	SPI response check ok	0	1	1
125	SPI response check not ok	0	1	0
126	SPI comport answer if response = ok	0	1	1
127	DASH detector changer is installed by default "1"	0	1	1

128	System start up time in sec. (delay before startup)	5	25	20
129	Minimum focus position	0	65535	0
130	Maximum focus position	0	65535	65535
131	Focus tolerance	0	65535	100
132	Focus scan timeout in seconds	100	420	300
133	Reserved			
134	Reserved			
135	Minimum iris position	0	65535	0
136	Maximum iris position	0	65535	65535
137	Iris position tolerance	0	65535	100
138	Iris scan timeout in seconds	0	65535	300

Application notes

TL, OS, TO, SR, PO

Each of these commands starts a data acquisition sequence. Each entry in the internal data array is initialized to -1, the lift is raised if it is not already in the up position and the sequence is started. If the lift was in the up position when the command was issued then it is left in the up position upon completion.

If the lift was in the down position when the command was issued then it is returned to the down position and the temperature is reset to zero regardless of the value of the final temperature parameter (*f*).

Also, if the measurement uses a light source it is left in it's initial state (i.e. if it was on then it is left on, if it was off then it is turned off when the run is finished).

For measurements with no temperature parameters (**OS, SR** and **PO**) the sample temperature is unaffected. Thus, in order to measure OSL at elevated temperatures it is necessary to raise the lift (**LU**) and set the sample temperature (**ST**) before issuing the data acquisition command.

CA Cancels the current data acquisition run before completion. Resets heater output to zero, deactivates the heater relay, closes the shutter, deactivates all illumination sources, lowers the lift and cancels all timed operations. The internal data array is not cleared thus it is still possible to download the completed portion of the run. This command should always be issued before exiting a program to ensure that the system has been shut down properly.

If no communications via the serial port are received for a period of 5 minutes, the MiniSys will reset. This involves issuing a CA command. In addition to the CA, two other operations

are undertaken when the MiniSys does not receive a command for 5 minutes. The baud rate for communication is reset to 9600, and the X-ray power is ramped down to zero kV and mA.