



DAYBREAK NUCLEAR AND MEDICAL SYSTEMS, INC.

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FIRMWARE -- COMMAND CONTROL LANGUAGE (ALL MODELS)

The firmware architecture is that of a command-driven state machine incorporating a generalized ramp whose controller is another state machine. The actual ramping function is timer-interrupt-driven and subject to hardware and software interlocks for safety. Command codes from the host computer consist of an ASCII character (the set '@' to '-', including the upper case alphabetic characters, 32 altogether), and up to eight integer parameters (ASCII decimal strings) as required by the control function.

The general form of a command is 'c xx yy ' where c is the control character, and xx and yy are ASCII positive decimal integer strings. <Space> characters are used as delimiters, and the command string may end with any non-digit character.

In general the commands for the entire Daybreak line of instruments are the same. The only differences are in the 'T' (test) commands that reflect the different mechanical design. The legal sample position numbers likewise differ. For the single sample system, 'A' and some of the 'T' commands are ignored. Earlier 1100-series instruments do not support multiple detectors or alterable time bases, so these must not be used. Current instruments return an ID and firmware revision number when the command 'T15' is sent.

Set data space	'Dxx'	xx=1-20 (C/point)
Set ramp rate	'Rxx'	xx=1-25 (C/sec) ramp rate may be changed during the ramp and takes effect with the beginning of the next point
Vacuum	'Vxx'	xx=0 (both off) 1 (bleed on-->main) 2 (main on)
Purge	'Pxx'	xx=0 off 1 on
Cool	'Cxx'	xx=0 off 1 on
Ramp ("Go")	'Gxx'	xx=0 stop ramp

1 start ramp

For 2200 series

xx=0 stop ramp

1 start sample ramp (not active if TEM selected)

2 start irradiation ramp

Preheat ("Wash")	'Wxx yy'	xx=0-700 (C) yy=preheat time (sec)
Stage preheat	'Sxx yy'	xx=0-700 (C) yy=stage time (sec)
Endpoint	'Exx yy'	xx=0-700 (C) yy=hold time (sec)
Cool-temp ("Low")	'Lxx'	xx=temperature to start ramp after preheat or for BG
Send ("Query")	'Qxx'	send pt# xx
HV	'Hxx'	xx=0 off 1 main HV supply on if multiple detectors present: 2 multi-detector PMT #0 3 multi-detector PMT #1 4 multi-detector PMT #2 5 multi-detector PMT #3
Calibrate	'Kxx'	xx=0 off >0 on
Irradiate	'Ixx yy'	xx=irrad time (sec) yy=0 pos="top" 1 pos="low"

2 pos="high"
 pos+4 moves 770 into 1100 for irradiation and back after
 pos+8 moves 770 into 1100 for irradiation and leaves it
 (for batch mode)

Advance	'Axx'	xx=0-19 sample position 0-59 for 1150 (0, 20, 40 invalid), or 2200
Set time bases	'Bx1 y1 x2 y2 x3 y3 x4 y4'	x=1-255 num of ticks/base y=1-255 num of msec/tick sets the four time bases: length of each time base is x*y msec - it is better to have y as large as possible - for 2200 only at this time
Jump	'Jxx'	xx=0-19 (0-59 for 1150) jumps to position - no load (for irradiation)
Reset ("Zero")	'Z'	initialize 1100
Setpoint ("at")	'@xx'	xx=0-700 (C) setpoint temp
Oven	'Oxx'	xx=0 oven power disabled 1 oven power enabled For 2200 series: xx=0 oven power disabled 1 sample power enabled (nichrome only) 2 irrad power enabled
Control TEM temperature (only for 2200 series)	'\nn'	nn=1-200 for 1-200 degC 0 turns TEM off
Sample-back	'^'	back to platter for jump

(use 'M' here)

Sample-back 'M' back to platter for jump

Test (mechanical - 1100 and 1150) (see next pages for 2200)

'Txx' x= 0 arm in to pos sensor
 1 arm out to pos sensor
 2 platter --> sensor
 3 elevator down absolute
 4 rotate one
 5 arm in
 6 arm home
 7 arm out
 8 elevator home
 9 elevator low position
 10 elevator high
 11 home platter (0-19)
 12 mid platter (20-39)
 13 high platter (40-59)

Test (mechanical - 1150 only)

'Txx' xx=17 platters down to pos
 18 platters up to pos

Test (mechanical - 2200 only)

'Txx' xx= 0 platter to pos CCW
 1 platter to pos CW
 2 backlash remove(if CW)
 3 brake
 4 rotate one CCW
 5 rotate one CW
 6 high speed
 7 low speed
 8 irrads elevator down
 9 irrads elevator up

		10 - 11 sample elevator down 12 sample elevator up 13 -
Test (status)	'Txx'	xx=14 status dump 15 variable dump 16 OSL variable dump ('T15' and 'T16' return empty pages for 1150 system) ('T14' does nothing for 2200) In new models 'T15' returns firmware version string
Write to expansion	'T19 nn mm'	nn=offset from expansion base address mm=0-255 value to be written
Transfer 770 irradiator	'T20 nn' nn=0 irradiator over irradiator port	1 irradiator back
Set number of detectors	'T21 nn' nn= num of detectors (1 is default). The number of characters in the serial data string will increase by six for each additional detector.	
Set default time between points (2200 only)	'T22 x y' x=1-255 num of ticks/point y=1-255 num of msec/tick (x*y is the time in msec between points - it is better to have y as large as possible)	
Enter OSL timebase data	'Xnn xx yy zz'	nn=number of 10msec points xx=number of 100msec points yy=number of 1sec points zz=number of 10sec points
Reset error code	'_'	resets errors

Control 862 '[nn mm]' sets excitation filter where
 nn=0
 mm=0-7 (filter wheel position)

 or selects Xe lamp where
 nn=2
 mm=0

IR LEDs select(862) '[2 1' selects IR LEDs

Control OSL LEDs 'Nxx yy' xx=0-4095 for 0-100% power
 0 - turns them off,
 >0 - turns them on.
 yy=0,1 IR LEDs
 yy=2 external shutter, or Xe lamp shutter or visible LEDs

Multiple solid state device control for the 2200 series

'Nxx yy' xx=0-4095 for 0-100% power
 0 - turns all light sources off,
 >0 - turns selected source (yy) on.
 yy=0,1 IR LEDs constant power
 yy=2 green/blue/external shutter
 yy=3 reserved

 xx>0 - power increment and start level of ramp
 yy=4,5 IR LEDs linear modulation
 yy=6 green/blue linear modulation
 yy=7 reserved

NOTE: power increment added at end of each counting period.
 It is recommended that a single timebase be used. If the power level after an increase should exceed 4095, actual power level will be (level mod 4095).

Start/stop OSL program	'Uxx yy zz'	as for "N", with the additional third parameter zz=0 start point number at 0 1 start at 1 (for Daybreak OSL software)
Detector filter select	'Fnn'	nn=0-3 filter number in four-filter changer
Set DAC value	'Ynn'	nn=0-4095