

Version	Änderungen	Name	Datum
V1.0	Initial Release		
V1.1	Addons for Luxx Plus, Reorganization of View	CS	16.06.2014
V1.21	Addons for LEDMODv2	CS	16.09.2014
V1.22/23	Bugfixing	CS	09.10.2014
V1.24	Addons for BrixxPS	CS/RS	18.05.2015
	Addons for Phoxx FW V2.83/V2.15	CS	24.07.2015
V1.25	Bugfixing	CS	07.03.2016
	RELEASE V1.25 for LEDHUB/LEDMOD	CS	07.03.2016
V1.3	RELEASE V1.3 Single Tabs for all devices	CS/RS	06.04.2016
V1.31	BrixxPs - removed hints from "User Protocol"	RS	21.06.2016
V1.32	BrixxUHP added for Detailed Failure	CS	10.11.2016
V1.33	customer specific ledmod commands for B&C (?BCM, ?SBM)	RS	10.05.2017
V1.34	LEDHUB commands for power up sequence and communication modulation	CS	06.09.2017
V1.35	User: Fixing bug at TPP bytelength	CS	25.10.2017
	LightHUBultra added	CS	10.04.2018
	updates for BrixxUHP commands	CS	20.06.2018
	ROM command for Quixx added	CS	20.06.2018
	RELEASE V1.35	CS	20.06.2018

Global Command List for all xX-Series laser and LED devices

Color marking **User Commands, available for all systems**
Extended User Commands, not necessary for standard operation

Please also refer to the "xX-Laser Series and LED Programmers Guide"
for detailed information on using the different commands.

command type:	RsC														
function:	Reset Controller														
explication:	The command sets back the controller														
byte number:	1	2	3	4	5	6									
command:	?	R	s	C	cr										
answer:	!	R	s	C	cr										
adhoc 1:	\$	R	s	C	r1	cr									
adhoc 2:	\$	R	s	C	>	cr									
interpretation answer:	Reset command resets the controller. The Reset command is receipted by the "IRsC" command.														
interpretation adhoc 1:	If the reset isn't initiated by usb connection, the controller sends an "\$RsC" with a decimal number r1 following, if adhoc mode is enabled. The number contains the reset origin, "0" is for key switch reset after interlock, "3" is for a reset initiated from RS232 connection, "4" ist for Auto-Reset after the interlock loop was open.														
interpretation adhoc 2:	The controller sends a "\$RsC>" if the reset is finished, no matter if adhoc mode is enabled or not. It is send both to RS232 and USB.														

command type:	GFw														
function:	Get Firmware														
explication:	Ask for the controller's model code, device-ID and firmware version														

byte number:	1	2	3	4	5											
command:	?	G	F	w	cr											
answer:	!	G	F	w	Model code				\$	Device-ID			\$	Firmware		cr
interpretation:	The answer contains the the model code of the device. After a "\$" a Device-ID is displayed. After another "\$" the firmware version is displayed. Max byte length for model code and firmware is 14byte, for Device-ID 7byte.															

command type:	GSN														
function:	Get Serial Number														
explication:	Ask for the controller's serial number.														

byte number:	1	2	3	4	5												
command:	?	G	S	N	cr												
answer:	!	G	S	N	serial number						cr						
interpretation:	The answer contains the the serial number of the device. Max byte length is 14 byte																

command type:	GSI														
function:	Get Spec Info														
explication:	Ask for the Specs of the device														

byte number:	1	2	3	4	5												
command:	?	G	S	I	cr												
answer 1:	!	G	S	I	wavelength					\$	spec power				cr		
answer 2:	!	G	S	I	[a1]	wavelength			\$	spec power					cr
interpretation 1:	The answer contains the spec wavelength and spec power of the laser/led. Spec wavelength is max 5 byte long, spec power is a integer number with a range from 0 to 50000mW.																
Important Note	When using the command on the main controller of an Omicron Light Engine or LEDHUB you get additional important information [a1] on handling the device. a1 is given in square brackets and contains information on the number of channels installed in your device. Please refer to the chapter "Controlling Mult-Channel - Single-Port devices" in the "xX-Laser Series and LED Programmers Guide"																
LightHUB® ULTRA	When using the command on a LightHUB® ULTRA system, a1 is given as zero, as the lighthub channels cannot be controlled from the main controller. LightHUB® ultra has a built in USB hub to give access to every single laser channel. The controller manages all supervisory tasks.																

command type:	GMP
function:	Get Maximum Power
explication:	Get the maximum laser/led power value in mW

byte number:	1	2	3	4	5												
command:	?	G	M	P	cr												
answer:	!	G	M	P		max power	cr										
interpretation 1:	Gets the maximum available power in mW. This value may differ slightly from the spec power value.																

command type:	GWH
function:	Get Working Hours
explication:	Ask for the working hours of the device

byte number:	1	2	3	4	5												
command:	?	G	W	H	cr												
answer:	!	G	W	H		working hours	cr										
interpretation 1:	The answer contains the the working hours of the diode. No byte length specified for working hours. Working hours are counting if the device is active (LASER ON / LED ON). The setting of power is ignored. Value displayed as integer value in whole hours.																

command type:	GOM
function:	Get operating mode
explication:	Ask for the bit combination showing the actual operating mode settings.

byte number:	1	2	3	4	5	6	7	8	9								
command:	?	G	O	M	cr												
answer 1:	!	G	O	M	m1				cr								
interpretation 1:	The operating mode represents the setpoint of the device, not the actual status! 16Bits describe different functions according to the following table. The two bytes are written as ASCII HEX numbers.																
Bit	15	14		13		12		11		10		9		8			
Mode	Auto Powerup	Auto Startup		USB Ad-Hoc mode		50Ohm/TTL Analog IN (except LuxX, LEDMOD)		50Ohm/TTL Digital IN (except LuxX, BrixX, LEDMOD)		reserved		Laser Enable Override (LightHUB only)		ACC/APC (except PhoxX and LEDMOD)			
explanation:	Bit 15: 0: Auto Powerup deactivated, set manually with POn and POI, 1: Auto Powerup activated, Laser will powerup automatically (not to confuse with Autostart, only system power stage is activated)																
	Bit 14: 0: "Auto startup" OFF, 1: "Auto startup" ON																
	Bit 13: 1:controller sends adhoc answers on important changes, 0: AdHoc answers deactivated. Option available for USB																
	Bit 12: 0: SMA Analog Input at Laserhead: 50ohm, 1V, 1: SMA Input at laserhead: TTL																
	Bit 11: 0: SMA Digital Input at Laserhead: 50ohm, 1V, 1: SMA Input at laserhead: TTL																
	Bit 9: 0: Standard Laser Enable Operation, input enabled, Laser																
	Bit 8: 0: ACC - Automatic constant Current Operation, 1: APC - Automatic Power Control Operation																
Bit	7	6		5		4		3		2		1		0			
Mode	Analog input release	enable ext. Trigger (LEDHUB only)		Digital input release (except LuxX)		Operating Level release		Bias Level release		enable Internal Clock Generator ICG (LEDMOD)		reserved		reserved			
explanation:	Bit 7: 1: Analog external input enabled, 0: Analog external input disabled																
	Bit 6: 1: External Trigger enabled, 0: External Trigger disabled - Valid for LEDMOD if integrated in LEDHUB systems (Sync IN)																
	Bit 5: 1: external digital input enabled, 0: external digital input disabled																
	Bit 4: 1: Operating level active 0, Operating level not active																
	Bit 3: 1: Bias level active, 0: Bias level not active																
	Bit 2: 1: Internal clock generator active, 0: internal clock generator inactive																

command type:	SOM
function:	Set operating mode
explication:	Set the operating mode

byte number:	1	2	3	4	5	6	7	8	9								
command:	?	S	O	M		m1	cr										
answer:	!	S	O	M	>	cr											
interpretation 1:	The operating mode represents the setpoint of the device, not the actual status! 16Bits describe different functions according to the table shown with ?GOM command. The Bytes are written as ASCII HEX numbers.																

command type:	SAS														
function:	Set Auto Start														
explication:	Set the Auto Start Function ON or OFF (Laser/led light will be emitted after power-up)														

command:	?	S	A	S	a1	cr									
answer 1:	!	S	A	S	>	cr									
interpretation 1:	Auto Start Function ON will set the device to Laser/LED ON state after Power-Up. Laser/LED light will be emitted according to the power level and operating mode. Set a1 to "1" to activated autostart function, set a1 to "0" to deactivate autostart. Use command without parameter or ?GOM to query														

command type:	SAP														
function:	Set Auto Powerup														
explication:	Set the Auto Powerup Bit (not to confuse with Autostart!)														

byte number:	1	2	3	4	5	6									
command:	?	S	A	P	a1	cr									
answer 1:	!	S	A	P	>	cr									
interpretation 1:	Auto Powerup Function ON will activate temperature regulation of the diode after Reset or applying supply voltage. Set a1 to "1" to activated auto powerup function, set a1 to "0" to deactivate auto powerup. Use command without parameter or ?GOM to query														

command type:	SID (Phoxx and Luxx Plus only)														
function:	Set Impedance Digital														
explication:	Set Impedance of the Digital Input														

byte number:	1	2	3	4	5	6									
command:	?	S	I	D	a1	cr									
answer 1:	!	S	I	D	>	cr									
interpretation 1:	Set a1 to "1" to set impedance of digital input to TTL level, set a1 to "0" to set impedance to 50ohms. Use command without parameter or ?GOM to query														

command type:	SIA (except LuxX and LEDMODv2)														
function:	Set Impedance Analog														
explication:	Set Impedance of the Analog Input														

byte number:	1	2	3	4	5	6									
command:	?	S	I	A	a1	cr									
answer 1:	!	S	I	A	>	cr									
interpretation 1:	Set a1 to "1" to set impedance of the analog input to TTL level, set a1 to "0" to set impedance to 50ohms. Use command without parameter or ?GOM to query														

command type:	LOn
function:	Laser/LED On
explication:	Set the Laser/LED to Laser ON (LED ON) Status

byte number:	1	2	3	4	5	6											
command:	?	L	O	n	cr												
answer 1:	!	L	O	n	>	cr											
answer 2:	!	L	O	n	x	cr											
interpretation 1:	LOn command sets the device to Laser ON (LED ON) status, if all necessary conditions were complied																
interpretation 2:	If the device cannot be switched on because of an active interlock or system power off, it will answer with "!LOnx".																

command type:	LOf
function:	Laser/LED Off
explication:	Set the Laser/LED to Laser OFF (LED OFF) Status

byte number:	1	2	3	4	5	6											
command:	?	L	O	f	cr												
answer 1:	!	L	O	f	>	cr											
interpretation 1:	LOf command sets laser/led to Laser/LED OFF status.																

command type:	POn
function:	Power On
explication:	Set system power on

byte number:	1	2	3	4	5	6											
command:	?	P	O	n	cr												
answer 1:	!	P	O	n	>	cr											
interpretation 1:	Set system power on. Thus the temperature regulation of the diode is activated. Necessary after applying supply voltage or reset if Auto Powerup is disabled.																

command type:	POf
function:	Power Off
explication:	Set system power off

byte number:	1	2	3	4	5	6											
command:	?	P	O	f	cr												
answer 1:	!	P	O	f	>	cr											
interpretation 1:	Set system power off. Thus the device is switched to Laser/LED OFF State and the temperature regulation is deactivated.																

command type:	GAS
function:	Get Actual Status
explication:	Ask for the actual device status

byte number:	1	2	3	4	5	6	7	8	9								
command:	?	G	A	S	cr												
answer:	!	G	A	S		e1			cr								

interpretation 1:	The actual status represents important states of the device, not the operating mode! 16Bits describe different functions according to the following table. The two bytes are written as ASCII HEX numbers.																
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Bit	15	14	13	12	11	10	9	8
Actual Status	reserved	reserved	reserved	reserved	Safety Shutter Status (LightHUB only)	reserved	system power	toggle key

explanation:																	
	Bit12: 1: Safety Shutter open - Emission possible, 0: Safety Shutter closed																

Bit9: 1: system is powered, temperature regulation is active, 0: system is in power off state, temperature regulation is inactive.																	
Bit8: 1: please toggle key switch to activate laser (only laser devices with active CDRH mode), 0: no need to toggle key switch																	

Bit	7	6	5	4	3	2	1	0
Actual Status	key switch	laser/led enable	reserved	reserved	reserved	preheating	Laser/led ON/OFF	Interlock

explanation:	
	Bit7: Represents the status of the key switch: 1: ON, 0: OFF
	Bit6: Represents the status of the laser/led enable input: 1:ON, 0: OFF
	Bit2: 1: device is in preheating state, 0: device is not in preheating state
	Bit1: 1: device is in ON state or, if autostart option active, will go to ON state if all conditions are complied.
	Bit0: 1: device is in Interlock state, 0: device is not in interlock state

command type:	GFB
function:	Get Failure Byte
explication:	Ask for the actual error status of the device

byte number:	1	2	3	4	5	6	7										
command:	?	G	F	B	cr												
answer 1:	!	G	F	B	e1				cr								
interpretation 1:	The error byte is given as a ASCII HEX number. Each bit has the meaning mentioned in the following table:																
Bit	15		14		13		12		11		10		9		8		
Failure	diode power		internal error		Test Error (BrixX, LEDMOD, LuxX Plus only)		diode temperature		ambient temperature		diode current		external interlock		under/over- voltage		
explanation:	Bit 15: Diode power exceeded max value																
	Bit 14: An internal error occurred																
	Bit 13: Test Error for software programming																
	Bit 12: The temperature at the diode exceeded the valid temperature range. Check ambient temperature																
	Bit 11: The ambient temperature exceeded the minimum or maximum value.																
	Bit 10: The current through the diode exceeded the maximum allowed value.																
	Bit 9: The interlock loop is not closed. Please close the interlock loop.																
	Bit 8: Overvoltage or Undervoltage lockout occurred. Please bring supply voltage to a valid range																
interpretation 1:	The error byte is given as a ASCII HEX number. Each bit has the meaning mentioned in the following table:																
Bit	7		6		5		4		3		2		1		0		
Error	High Power (Phoxx, LEDMOD only)		Relais K1 (PhoxX only)		internal com error		CDRH Error (only laser systems)		reserved		reserved		reserved		soft interlock		
explanation:	Bit 7: High Power Head connected to Low Power Controller not allowed																
	Bit 6: Relais K1 is not closed																
	Bit 5: A internal communication error occurred																
	Bit 4: If CDRH-Bit is set and no CDRH-Kit is connected or CDRH-Bit is not set but a CDRH-Kit is connected or if settings changed																
	Bit 0: Soft interlock: If an interlock occurs, this bit is set. It can only be reset by resetting the whole system, even if the interlock is not present anymore.																
	All indicated errors from Bit1 up to Bit 15 send the system into an interlock state. To set back the system from interlock state clear all faults, then toggle key switch or toggle power or reset system. Then the soft interlock flag will be cleared, too. This command always returns the CURRENT error status. If an error occurred and is now fixed again use GLF command to check.																

command type:	GLF
function:	Get Latched Failurebyte
explication:	Ask for the last error byte

byte number:	1	2	3	4	5	6	7										
command:	?	G	L	F	cr												
answer 1:	!	G	L	F		e1		cr									
interpretation 1:	The error byte is given as a ASCII HEX number. Each bit has the meaning mentioned in the table above. This command is to see the reason of a failure, even if it is not available anymore. E1 is only reset if whole system resets.																

command type:	MDP (except LightHUB ULTRA)
function:	Measure Diode Power
explication:	Measure the emitted laser power

byte number:	1	2	3	4	5												
command:	?	M	D	P	cr												
answer 1:	!	M	D	P		p1		cr									
interpretation 1:	Measure the diode power value with the internal photodiode. The value displayed is the diode power in milliwatts (two post decimal positions). In LEDMODv2 systems the Diode Power is not measured using a photodiode. The current through the diode is measured and from this value the Diode Power value is calculated.																

command type:	MID (except LightHUB ULTRA)
function:	Measure Diode Current
explication:	Measure the actual current through the diode

byte number:	1	2	3	4	5												
command:	?	M	I	D	cr												
answer 1:	!	M	I	D		p1		cr									
interpretation 1:	Measures the diode current. The value displayed is the diode current in milliampere																

command type:	MTD
function:	Measure Temperature diode
explication:	Measure the temperature of the diode

byte number:	1	2	3	4	5	6										
command:	?	M	T	D	cr											
answer:	!	M	T	D												
interpretation:	The temperture is given as a decimal value in degrees centigrade. The value has 1 post decimal position.															

command type:	MTA
function:	Measure Temperature ambient
explication:	Measure the value of ambient temperature

byte number:	1	2	3	4	5											
command:	?	M	T	A	cr											
answer 1:	!	M	T	A												
interpretation 1:	The temperature is given as a decimal value in degrees centigrade. The value has 1 post decimal position.															

command type:	CLD (except LEDMODv2)
function:	Calibrate Laser Diode
explication:	Calibrates the Laser Diode maximum power and bias offset

byte number:	1	2	3	4	5	6										
command:	?	C	L	D	cr											
answer 1:	!	C	L	D	>	cr										
answer 2:	\$	C	L	D			c1		cr							

interpretation 1:	The calibration function is executed after sending this command. Immediately you get answer1. Then the calibration is executed. It can last about 2 minutes. The laser is not responding in the meantime. After successful calibration or failed calibration you get answer2 containing C1, which gives you information on the calibration result. In case you initiated calibration from RS232, you will get the adhoc-answer2, too. In this case the adhoc-answer is necessary to inform you, that calibration is finished.															
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	0: Calibration ok															
	1: Spec power could not be reached (max possible value has been set)															
	2: Key switch is off															
	3: Laser enable input is low															
	4: Interlock occured during calibration															
	5: Temperature Error															
	6: communication Error during calibration															
	7: original Bias setting out of range															
	8: no bias point found															
	9: new I_op < 0,95xI_op last															
	10: Laser is in OFF status															

command type:	SLP (not recommended for new designs, use SPP if available)														
function:	Set Level Power														
explication:	Set the emitted laser/led power														

byte number:	1	2	3	4	5										
command:	?	S	L	P		p1		cr							
answer 1:	!	S	L	P	>	cr									
interpretation 1:	Set the diode power value as a ASCII HEX number ranging from 0x000 to 0xFF F representing 0% to 100%. Value set with SLP/SPP is default value after RESET/POWERUP. It is stored in nonvolatile memory.														

command type:	GLP (not recommended for new designs, use GPP if available)														
function:	Get Level Power														
explication:	Get the value set with SLP command														

byte number:	1	2	3	4	5	6	7	8							
command:	?	G	L	P		cr									
answer 1:	!	G	L	P		p1		cr							
interpretation 1:	Get the power value set by SLP command as a ASCII HEX number.														

command type:	SPP (LuxX+, LEDMODv2, Phoxx since Controller FW V2.83 and Head FW V2.15, Brixx since FW 1.6, BrixxPS)														
function:	Set Power Percent														
explication:	Set the emitted laser/led power in percent														

byte number:	1	2	3	4	5										
command:	?	S	P	P		p1		cr							
answer 1:	!	S	P	P	>	cr									
interpretation 1:	Set the diode power value as a ASCII DEC float number ranging from 0.0% to 100.0%. This command is recommended to be used instead of the SLP-command. Value set with SPP is default value after RESET/POWERUP. It is stored in nonvolatile memory.														

command type:	GPP (LuxX+, LEDMODv2, Phoxx since Controller FW V2.83 and Head FW V2.15, Brixx since FW 1.6, BrixxPS)														
function:	Get Power Percent														
explication:	Get the emitted laser/led power in percent														

byte number:	1	2	3	4	5										
command:	?	G	P	P		p1		cr							
answer 1:	!	G	P	P	>	cr									
interpretation 1:	Get the diode power value as a ASCII DEC float number ranging from 0.0% to 100.0%. P1 is the value from the nonvolatile memory and not necessary the actual setpoint. Use ?TPP to query the actual setpoint. This command is recommended to be used instead of the GLP-command.														

command type:	TPP (LuxX+, LEDMODv2, Phoxx since Controller FW V2.83 and Head FW V2.15, Brixx since FW 1.6, BrixxPS)														
function:	Temporary Power Percent														
explication:	Set the emitted laser/led power temporarily. The value will not be saved to internal memory														

byte number:	1	2	3	4	5										
command:	?	T	P	P		p1		cr							
answer 1:	!	T	P	P	cr										
interpretation 1:	Set the temporary diode power value as a ASCII DEC float number ranging from 0.0% to 100.0%. Use command without parameters to query the actual setpoint. NOTE: Value is not saved in nonvolatile memory. Value set with SPP command is used after RESET/POWERUP														

command type:	GUS
function:	General User Settings
explication:	Get/Set a set of userdefined settings

byte number:	1	2	3	4	5	6	7										
get command:	?	G	U	S	cr												
get answer:	!	G	U	S	e1		cr										
set command:	?	G	U	S	e1		cr										
set answer:	!	G	U	S	>	cr											
interpretation:	The integer value is e1 is given in hexadecimal notation. The encoded bits are interpreted as follows:																
Bit	7	6	5	4	3	2	1	0									
Actual Status	reserved	reserved	reserved	reserved	reserved	Auto reset	Undervoltage protection	CDRH (only for laser devices)									
explanation:																	
	Bit2: 1: the device will automatically reset itself after an open interlock loop failure is cleared (possible with devices < laser class 4 only), 0: device needs to be resetted manually																
	Bit1: 1: the device falls into interlock state if the input voltage is not in the specified range; 0: undervoltage protection disabled (since fw																
	Bit0: 1: CDRH mode enabled, 0: CDRH mode disabled (only available for laser devices, not for LED devices)																

command type:	CDRH (only for laser systems)
function:	Change CDRH Configuration
explication:	Set Undervoltage Protection ON/OFF

byte number:	1	2	3	4	5	6	7	8	9								
command 1:	?	C	D	R	H	O	N	cr									
command 2:	?	C	D	R	H	O	F	cr									
answer 1:	!	C	D	R	H	>	cr										
interpretation 1:	Switch CDRH mode ON and OFF using command 1 and 2. Use command without parameter b1 to query.																

command type:	UVP
function:	Undervoltage Protection
explication:	Set Undervoltage Protection ON/OFF

byte number:	1	2	3	4	5												
command:	?	U	V	P	b1	cr											
answer 1:	!	U	V	P	>	cr											
interpretation 1:	Switch undervoltage protection on or off for the system by setting b1 to 0=OFF or 1=ON. Use command without parameter b1 to query.																

command type:	ARs
function:	Auto-Reset
explication:	Set Auto Reset ON/OFF

byte number:	1	2	3	4	5												
command:	?	A	R	s	b1	cr											
answer 1:	!	A	R	s	>	cr											
interpretation 1:	Switch Auto-Reset function on or off for the system by setting b1 to 0=OFF or 1=ON. Use command without parameter b1 to query. If Auto-Reset is active, the Device resets automatically after an external interlock error has been cleared. There is no need for a Reset-command or a keyswitch toggle anymore. NOTE: Auto-Reset only works, if the external interlock error is the only one that causes the interlock status. All other errors hold the system in soft interlock state after clearing.																

PhoxX specific command list																
command type:	ROM for PhoxX															
function:	Recall Operating Mode															
explication:	Recall an Operating Mode (Standby, CW, Digital, Analog, Analog + Digital)															
byte number:	1	2	3	4	5	6										
command:	?	R	O	M	a1	cr										
answer 1:	!	R	O	M	>	cr										
explanation:	Set a1 as a decimal integer to activate the different operating modes in the following way															
	0: Standby															
	1: CW															
	2: Digital															
	3: Analog															
interpretation 1:	4: Digital + Analog															
	Wrapped command to simplify the setting of operating modes. Also possible via bit manipulation in SOM. Use without parameter to query.															
command type:	MTB															
function:	Measure Temperature board															
explication:	Measure the value of temperature on pcb of the controller															
byte number:	1	2	3	4	5											
command:	?	M	T	B	cr											
answer 1:	!	M	T	B	temperture						cr					
interpretation 1:	The temperture is given as a decimal value in degrees centigrade. The value can have up to 2 post decimal positions. For PhoxX systems the vaule is the controller temperature															
command type:	GFH															
function:	Get Firmware Head															
explication:	Ask for the head's model code, device-ID and firmware version															
byte number:	1	2	3	4	5											
command:	?	G	F	H	cr											
answer 1:	!	G	F	H	Model code				\$	Device-ID			\$	Firmware		cr
interpretation 1:	The answer contains the the model code of the laser head. After a "\$" a Device-ID is displayed. After another "\$" the firmware version is displayed. Max byte length for model code and firmware is 14byte, for Device-ID 7byte.															
command type:	GSH															
function:	Get Serialnumber Head															
explication:	Ask for the head's serial number.															
byte number:	1	2	3	4	5											
command:	?	G	S	H	cr											
answer:	!	G	S	H	serial number				cr							
interpretation:	The answer contains the the serial number of the laser head. Max byte length is 14 byte.															

LuxX specific command list																
command type:	ROM for LuxX															
function:	Recall Operating Mode															
explication:	Recall an Operating Mode (Standby, CW-ACC, CW-APC, Digital, Analog, Digital + Analog)															
byte number:	1	2	3	4	5	6										
command:	?	R	O	M	a1	cr										
answer 1:	!	R	O	M	>	cr										
	Set a1 as a decimal integer to activate the different operating modes in the following way															
explanation:	0: Standby															
	1: CW-ACC															
	2: CW-APC															
	3: Analog															
interpretation 1:	Wrapped command to simplify the setting of operating modes. Also possible via bit manipulation in SOM. Use without parameter to query.															

BrixX specific command list																
command type:	ROM for BrixX															
function:	Recall Operating Mode															
explication:	Recall an Operating Mode (Standby, CW-ACC, CW-APC, Digital, Analog, Digital + Analog)															
byte number:	1	2	3	4	5	6										
command:	?	R	O	M	a1	cr										
answer 1:	!	R	O	M	>	cr										
explanation:	Set a1 as a decimal integer to activate the different operating modes in the following way															
	0: Standby															
	1: CW-ACC															
	2: CW-APC															
	3: Digital															
	4: Analog															
	5: Digital + Analog															
interpretation 1:	Wrapped command to simplify the setting of operating modes. Also possible via bit manipulation in SOM. Use without parameter to query.															

BrixXUHP specific command list

command type:	ROM for BrixX														
function:	Recall Operating Mode														
explication:	Recall an Operating Mode (Standby, CW-ACC, CW-APC, Digital, Analog, Digital + Analog)														

byte number:	1	2	3	4	5	6									
command:	?	R	O	M	a1	cr									
answer 1:	!	R	O	M	>	cr									
explication:	Set a1 as a decimal integer to activate the different operating modes in the following way														
	0: Standby														
	1: CW-ACC														
	2: RESERVED														
	3: Digital														
	4: Analog														
	5: Digital + Analog														
interpretation 1:	Wrapped command to simplify the setting of operating modes. Also possible via bit manipulation in SOM. Use without parameter to query.														

command type:	MTB														
function:	Measure Temperature board														
explication:	Measure the value of temperature of the Fiber Connector in Laser module														

byte number:	1	2	3	4	5										
command:	?	M	T	B	cr										
answer 1:	!	M	T	B		temperature		cr							
interpretation 1:	The temperture is given as a decimal value in degrees centigrade. The value can have up to 2 post decimal positions.														

command type:	MUD														
function:	Measure U Diode														
explication:	Measure the voltage for the laser diode														

byte number:	1	2	3	4	5										
command:	?	M	U	D	cr										
answer 1:	!	M	U	D		voltage		cr							
interpretation 1:	The voltage is given as a decimal value in volts. The value can have up to 2 post decimal positions.														

command type:	MOn														
function:	Monitor ON														
explication:	Switch ON monitor laser (if available)														

byte number:	1	2	3	4	5										
command:	?	M	O	n	cr										
answer 1:	!	M	O	n	>	cr									
interpretation 1:	This command switches the monitor/pilot laser on. Only valid, if monitor laser is available in device. Only possible if system power is on and key switch is on.														

command type:	MOF														
function:	Monitor Off														
explication:	Switch OFF monitor laser (if available)														

byte number:	1	2	3	4	5										
command:	?	M	O	f	cr										
answer 1:	!	M	O	f	>	cr									
interpretation 1:	This command switches the monitor/pilot laser off. Only valid, if monitor laser is available in device.														

LuxXPlus specific command list																
command type:	ROM for LuxXPlus															
function:	Recall Operating Mode															
explication:	Recall an Operating Mode (Standby, CW-ACC, CW-APC, Digital, Analog, Digital + Analog)															
byte number:	1	2	3	4	5	6										
command:	?	R	O	M	a1	cr										
answer 1:	!	R	O	M	>	cr										
explanation:	Set a1 as a decimal integer to activate the different operating modes in the following way															
	0: Standby															
	1: CW-ACC															
	2: CW-APC															
	3: Digital															
	4: Analog															
	5: Digital + Analog															
interpretation 1:	Wrapped command to simplify the setting of operating modes. Also possible via bit manipulation in SOM. Use without parameter to query.															

QuixX specific command list																
command type:	COM															
function:	Change Operating Mode															
explication:	Recall an Operating Mode (Standby, CW, Digital, Analog, Analog + Digital)															
byte number:	1	2	3	4	5	6										
command:	?	C	O	M	a1	cr										
answer 1:	!	C	O	M	>	cr										
	Set a1 as a decimal integer to activate the different operating modes in the following way															
explanation:	0: Standby															
	1: CW - ACC															
	2: CW - APC															
	3 : Pulse low power - Narrow Pulse															
	4 : Pulse high power - Wide Pulse															
	5 :Expert Mode (Future Option)															
interpretation 1:	Wrapped command to simplify the setting of operating modes.Use without parameter to query.															

command type:	ROM for Quixx (since FW 3.14)															
function:	Recall Operating Mode															
explication:	Recall an Operating Mode (Standby, CW-ACC, CW-APC, ...)															

byte number:	1	2	3	4	5	6										
command:	?	R	O	M	a1	cr										
answer 1:	!	R	O	M	>	cr										

Set a1 as a decimal integer to activate the different operating modes in the following way

- 0 - Standby
- 1 - CW ACC no modulation
- 2 - CW APC
- 3 - CW ACC with digital modulation
- 4 - CW ACC with analog modulation
- 5 - CW ACC with digital + analog modulation
- 6 - CW ACC with internal PWM
- 7 - CW ACC with internal PWM + Digital Gating
- 8 - CW ACC with internal PWM + Analog Modulation
- 9 - CW ACC with internal PWM + Digital Gating + Analog Modulation

explanation:

- 10 - Single shot low power pulse mode - triggered by digital input (sync in)
- 11 - Single shot low power pulse mode - triggered by digital input (sync in) + external analog modulation of the pulse height
- 12 - Continuous low power pulse mode
- 13 - Continuous low power pulse mode - gated by digital input
- 14 - Continuous low power pulse mode - externally modulated by analog input
- 15 - Continuous low power pulse mode - gated by digital input + externally modulated by analog input
- 16 - Single shot high power pulse mode - triggered by digital input (sync in)
- 17 - Single shot high power pulse mode - triggered by digital input (sync in) + external analog modulation of the pulse height
- 18 - Continuous high power pulse mode
- 19 - Continuous high power pulse mode - gated by digital input
- 20 - Continuous high power pulse mode - externally modulated by analog input
- 21 - Continuous high power pulse mode - gated by digital input + externally modulated by analog input
- 22 - Single shot pulse mode with adjustable pulse shape - triggered by digital input (sync in)
- 23 - Single shot pulse mode with adjustable pulse shape - triggered by digital input (sync in) + external analog modulation of the pulse height
- 24 - Continuous pulse mode with adjustable pulse shape
- 25 - Continuous pulse mode with adjustable pulse shape - gated by digital input
- 26 - Continuous pulse mode with adjustable pulse shape - externally modulated by analog input
- 27 - Continuous pulse mode with adjustable pulse shape - gated by digital input + externally modulated by analog input

interpretation 1: Wrapped command to simplify the setting of operating modes. Also possible via bit manipulation in SOM and COM. Use without parameter to query.

command type:	SPF														
function:	Set Pulse Frequency														
explication:	Set the frequency of the internal clock generator														

byte number:	1	2	3	4	5	6									
command:	?	S	P	F			I1			cr					
answer:	!	S	P	F			>	cr							
interpretation:	Set the frequency of the internal clock generator by sending an ASCII float value ranging from 0...100.000.000Hz. The value is valid for the actual selected operating mode. (note: the value may be given in scientific notation)														

command type:	GPF														
function:	Get Pulse Frequency														
explication:	Get the frequency set point of the internal clock generator														

byte number:	1	2	3	4	5	6									
command:	?	G	P	F	cr										
answer:	!	G	P	F			I1			cr					
ad-hoc:	\$	G	P	F			I1			cr					
interpretation:	Get the frequency value set with SPF command. The float value unit is Hz (note: the value may be given in scientific notation). An ad-hoc message is sent when the operating mode changes between cw, ps- and ns-pulse modes to give the actual corresponding value.														

command type:	CPF														
function:	Change Pulse Frequency														
explication:	Increase or decrease the frequency of the internal clock generator														

byte number:	1	2	3	4	5	6									
command:	?	C	P	F			m1			cr					
answer:	!	C	P	F			I1			cr					
interpretation:	Increase or decrease the frequency value set with the SPF command to the next possible value. Give a positive float value (in Hz) for m1 to increase the frequency to the nearest possible upper value. Use a negative m1 to decrease the frequency to the nearest possible lower value. At least one step will be increased/decreased (note: the value may be given in scientific notation).														

command type:	LPF														
function:	Limit Pulse Frequency														
explication:	Frequency limit and step size of internal clock generator														

byte number:	1	2	3	4	5	6									
command:	?	L	P	F	cr										
answer:	!	L	P	F			m1		\$	m2		\$	m3		cr
ad-hoc:	\$	L	P	F			m1		\$	m2		\$	m3		cr
interpretation:	Get the device specific limits and stepsize for the frequency of the internal clock generator. m1= lower limit, m2= upper limit, m3= step size. All values are given as float value in the unit Hz (note: the value may be given in scientific notation). This limits are related to the actual selected operating mode. An ad-hoc message may be send when the operating mode changes between cw, ps- and ns-pulse modes to give the actual corresponding limits.														

command type:	DTL														
function:	Digital Trigger Level														
explication:	Set/Get the trigger level of the external digital input														

byte number:	1	2	3	4	5	6									
get command:	?	D	T	L	cr										
get answer:	!	D	T	L			I1		\$	m1	cr				
set command:	?	D	T	L			I1		\$	m1	cr				
set answer:	!	D	T	L			>	cr							
interpretation:	Set the trigger level for the external digital modulation input by sending an ASCII integer value ranging from -5000...5000mV. Set m1='p' for positive logic or m1='n' for negative logic. Use the get command to query the actual value.														

command type:	SOL
function:	Sync out level
explication:	Set/Get the level for the sync output

byte number:	1	2	3	4	5	6										
get command:	?	S	O	L	cr											
get answer:	!	S	O	L	m1	cr										
set command:	?	S	O	L	m1	cr										
set answer:	!	S	O	L	>	cr										
interpretation:	Set the output level with the set command: m1 = 0 -> nim logic, m1 = 1 -> 0...1V, m1 = 2 -> TTL logic. Use the get command to query the actual value.															

command type:	SOD
function:	Sync out delay
explication:	Set/Get the delay for the sync output

byte number:	1	2	3	4	5	6										
get command:	?	S	O	D	cr											
get answer:	!	S	O	D		l1				cr						
set command:	?	S	O	D		l1				cr						
set answer:	!	S	O	D	>	cr										
interpretation:	Set the delay time with the set command: l1 = float value in seconds. The value needs to be given in scientific notation. The valid range is 6.6e-9 ... 35e-9 (6.6...35ns). The minimum step resolution is 10e-12 (10ps). Use the get command to query the actual value.															

command type:	LSD
function:	Limit Sync Delay
explication:	Delay limit and step size for the sync out delay generator

byte number:	1	2	3	4	5	6										
command:	?	L	S	D	cr											
answer:	!	L	S	D		m1	\$		m2	\$		m3		cr		
ad-hoc:	\$	L	S	D		m1	\$		m2	\$		m3		cr		
interpretation:	Get the device specific limits and stepsize for the sync out delay generator. m1= lower limit, m2= upper limit, m3= step size. All values are given as float value in the unit second (note: the value may be given in scientific notation). This limits are related to the actual selected operating mode. An ad-hoc message may be send when the operating mode changes between cw, ps- and ns-pulse modes to give the actual correponding limits.															

command type:	LEP
function:	Laser Enable Pullup
explication:	Set the Laser Enable Pullup/Pulldown Bit

byte number:	1	2	3	4	5	6										
get command:	?	L	E	P	cr											
get answer:	!	L	E	P	e1	cr										
set command:	?	L	E	P	e1	cr										
set answer:	!	L	E	P	>	cr										
interpretation 1:	Set e1 to "1" to activate laser enable pullup, set e1 to "0" to activate laser enable pulldown resistor. Use command without parameter to query. You may also change setting via ?GUS command bit6															

LEDHUB specific command list																
command type:	ROM[n] for LEDMODv2 when installed in LEDHUB combiner															
function:	Recall Operating Mode															
explication:	Recall an Operating Mode (Standby, CW, Digital, Analog, Analog + Digital)															
byte number:	1	2	3	4	5	6										
command:	?	R	O	M	a1	cr										
answer 1:	!	R	O	M	>	cr										
explanation:	Set a1 as a decimal integer to activate the different operating modes in the following way															
	0: Standby															
	1: CW															
	2: Digital															
	3: Analog															
	4: Digital + Analog															
	5: CW + internal clock generator															
	6: Digital + internal clock generator (internal signal gated through external TTL input)															
	7: Analog + internal clock generator (power level of internal signal set through external analog input)															
	8: Digital + Analog + internal clock generator (power level of internal signal set through external analog input, all gated through TTL in)															
additional LEDHUB operating modes	9: CW + Sync-In															
	10: Digital + Sync-In															
	11: Analog + Sync-In															
	12: Digital + Analog + Sync-In															
	13: CW + internal clock generator + Sync-In															
	14: Digital + internal clock generator (internal signal gated through external TTL input) + Sync-In															
	15: Analog + internal clock generator (power level of internal signal set through external analog input) + Sync-In															
	16: Digital + Analog + internal clock generator (power level of internal signal set through external analog input, all gated through TTL in) + Sync-In															
interpretation 1:	Wrapped command to simplify the setting of operating modes. Also possible via bit manipulation in SOM. Use without parameter to query.															
NOTE	Operating Modes 9 to 16 only available if LEDMOD is installed in a LEDHUB® system															
NOTE	use index in square brackets [n] to address ledmod channel															

command type:	GSH[n] for LEDMODv2 when installed in LEDHUB combiner															
function:	Get Serialnumber Head															
explication:	Ask for the head's serial number.															
byte number:	1	2	3	4	5											
command:	?	G	S	H	cr											
answer:	!	G	S	H	serial number				cr							
interpretation:	The answer contains the the serial number of the laser/led head. Max byte length is 14 byte. Only important if installed in a LEDHUB LED combiner. For stand-alone LEDMOD system Serialnumber head is identical															
NOTE	use index in square brackets [n] to address ledmod channel															

command type:	MTB																
function:	Measure Temperature board																
explication:	Measure the value of temperature on pcb of the controller																
byte number:	1	2	3	4	5												
command:	?	M	T	B	cr												
answer 1:	!	M	T	B	temperature							cr					
interpretation 1:	The temperature is given as a decimal value in degrees centigrade. The value can have up to 2 post decimal positions. For LEDHUB systems the controller temperature is equivalent to the cooling air inlet temperature.																

expert command	SFL															
function:	Set Front LEDs															
explication:	Set Front LEDs active or inactive															
byte number:	1	2	3	4	5	6										
command:	?	S	F	L	s1	cr										
answer 1:	!	S	F	L	>	cr										
interpretation 1:	Set s1 to "1" to activate front status LEDs, set s1 to "0" to deactivate front status LEDs. Use command without parameter to query.															
NOTE:	Configuration is reset to default value "LEDs active" after powerup/reset of the system.															

expert command	FCo															
function:	Fan Control															
explication:	Set Fans active or inactive															
byte number:	1	2	3	4	5	6										
command:	?	F	C	o	s1	cr										
answer 1:	!	F	C	o	>	cr										
interpretation 1:	Set s1 to "1" to activate system fans, set s1 to "0" to deactivate system fans. Use command without parameter to query.															
NOTE:	Configuration is reset to default value "Fans active" after powerup/reset/standby of the system. Refer to chapter in LEDHUB manual for risks of deactivation.															

expert command:	PUS (since LEDHUB firmware 1.17)															
function:	Power Up Sequence															
explication:	Set and Query the status of power up sequence															
byte number:	1	2	3	4	5	6										
command:	?	P	U	S	s1	cr										
answer 1:	!	P	U	S	>	cr										
interpretation 1:	Set s1 to "0" to deactivate power up sequence (standard setting with older firmwares), set s1 to "1" to set power up sequence to level 1, set s1 to "2" to set power up sequence to level 2. Use command without parameter to query.															
NOTE:	Deactivated power up sequence starts all TEC-stages and LED-drivers as fast as possible. Level 1 power up sequence starts all TEC-stages with a delay of about 300ms. LED emission is switched on immediately after module is powered up. Level 2 power up sequence starts all TEC-stages with a delay of about 3 seconds. LED emission is switched on if diode temperature is near the setpoint for a minimum of 5 seconds. Use level 1 or 2 if power supply is clipping during power up.															

expert command:	CMM (since LEDHUB firmware 1.17)															
function:	Channel Modulation Mask															
explication:	Set a mask to activate and deactivate separate channels															
byte number:	1	2	3	4	5	6										
command:	?	C	M	M	b1	cr										
answer 1:	!	C	M	M	>	cr										
interpretation 1:	Set b1 as ASCII HEX byte. Bit0 (LSB) represents lambda1, Bit5 represents lambda6, Bit 6 and 7 are reserved. Set bits in mask to 1 to activate channels in channel modulation, set bits in mask to 0 to deactivate channels in channel modulation. Use command without parameter to query.															
NOTE:	Use the Channel Modulation mask to switch on and off single or multiple channels at the same time. Use in combination with channel modulation shutter command (?CMS) to shutter the defined mask. Use this command for fast switching between wavelengths. Settings are stored volatile. Default value after power-on is 0xFF (all channels ON).															
ATTENTION	This command is used to control single LEDHUB channels without using an index in square brackets as it is handled by the controller.															

expert command:	CMS (since LEDHUB firmware 1.17)															
function:	Channel Modulation Shutter															
explication:	Open or close the electronic shutter for the channel modulation mask															
byte number:	1	2	3	4	5	6										
command:	?	C	M	S	b1	cr										
answer 1:	!	C	M	S	>	cr										
interpretation 1:	Set b1 to "0" to close the shutter. All modules switch off. Set b1 to "1" to open the shutter. All modules defined with modulation mask switch on. Use command without parameter to query.															
NOTE:	Use the Channel Modulation shutter to switch on and off single or multiple channels at the same time. Use in combination with channel modulation mask command (?CMM) to shutter the defined mask. Use this command for fast switching between wavelengths. Settings are stored volatile. Default value after power-on is 1 (ON).															

LEDMOD specific command list																
command type:	ROM for LEDMODv2															
function:	Recall Operating Mode															
explication:	Recall an Operating Mode (Standby, CW, Digital, Analog, Analog + Digital)															
byte number:	1	2	3	4	5	6										
command:	?	R	O	M	a1	cr										
answer 1:	!	R	O	M	>	cr										
explication:	Set a1 as a decimal integer to activate the different operating modes in the following way															
	0: Standby															
	1: CW															
	2: Digital															
	3: Analog															
	4: Digital + Analog															
	5: CW + internal clock generator															
	6: Digital + internal clock generator (internal signal gated through external TTL input)															
	7: Analog + internal clock generator (power level of internal signal set through external analog input)															
	8: Digital + Analog + internal clock generator (power level of internal signal set through external analog input, all gated through TTL in)															
interpretation 1:	Wrapped command to simplify the setting of operating modes. Also possible via bit manipulation in SOM. Use without parameter to query.															
NOTE	Additional Operating Modes available if LEDMOD is integrated into a LEDHB® system. Refer to LEDHUB extended command list for details															
expert command	SPF															
function:	Set PWM Frequency															
explication:	Set PWM Frequency of internal clock generator															
byte number:	1	2	3	4	5	6										
command:	?	S	P	F		l1				cr						
answer 1:	!	S	P	F	>	cr										
interpretation 1:	Set the frequency of the internal clock generator by sending an ASCII float value ranging from 0...200000Hz.															
expert command	GPF															
function:	Get PWM Frequency															
explication:	Get PWM Frequency of internal clock generator															
byte number:	1	2	3	4	5	6										
command:	?	G	P	F	cr											
answer 1:	!	G	P	F		l1				cr						
interpretation 1:	Get the PWM frequency value set with SPF command.															
expert command	SDC															
function:	Set Duty Cycle															
explication:	Set Duty Cycle of internal clock generator															
byte number:	1	2	3	4	5	6										
command:	?	S	D	C		l1				cr						
answer 1:	!	S	D	C	>	cr										
interpretation 1:	Set the duty cycle of the internal clock generator by sending an ASCII float value ranging from 0...100Hz.															
expert command	GDC															
function:	Get Duty Cycle															
explication:	Get Duty Cycle of internal clock generator															
byte number:	1	2	3	4	5	6										
command:	?	G	D	C	cr											
answer 1:	!	G	D	C		l1				cr						
interpretation 1:	Get the duty cycle value set with SDC command.															

LightHUBultra specific command list

command type:	SFO
function:	Set Fiber Output
explication:	Set/Get the value of the fiber output setting mask bitwise

byte number:	1	2	3	4	5	6	7										
command:	?	S	F	O	p	\$	v										
answer 1:	!	S	F	O	>	cr											
interpretation 1:	Set bit on bit position p [0...7] of the fiber output mask to value v [0/1]. Use command without v to query single bit. Bit0 represents Fiber1, Bit1 represents Fiber2.																

command type:	FOP
function:	Fiber Output
explication:	Get the value of the fiber output setting mask

byte number:	1	2	3	4	5	6	7										
command:	?	F	O	p	cr												
answer 1:	!	F	O	p	m	cr											
interpretation 1:	Get the mask of the fiber output setting mask m. Bit0 represents Fiber1, Bit1 represents Fiber2. Only one fiber output could be active at the same time. The value is given as HEX integer value.																

command type:	FOS
function:	Fiber Output State
explication:	Get the actual state of the fiber output

byte number:	1	2	3	4	5	6	7										
command:	?	F	O	S	cr												
answer 1:	!	F	O	S	s	cr											
interpretation 1:	Get the mask of the fiber output actual status s. Bit0 represents Fiber1, Bit1 represents Fiber2. The value is given as HEX integer value.																

command type:	MTD
function:	Measure Temperature diode
explication:	Measure the temperature of the diode

byte number:	1	2	3	4	5	6												
command:	?	M	T	D	cr													
answer:	!	M	T	D	temperature							cr						
interpretation:	Temperature Diode in a LightHUB® ultra system is the stabilized temperature of the inner LightHUB-system. The temperture is given as a decimal value in degrees centigrade. The value has 1 post decimal position.																	