Technical Specification

RS-232 interface: CTR-50/51 control commands
Installation and customizing

REV 08, 25. January 2023

1. General description

This description refers to the MBJ Imaging GmbH LED controller. Depending on the controller type and hardware, various functions are supported.

2. Firmware version history

Controller	Firmware version	Changes
CTR-50	1.1	Dim funcionality enhanced. More accurate & EMI resistent. LED off implemented. New command “J”
	1.0	Initial release
CTR-51	1.2	WP0 → Ploss default deactivated
	1.1	Initial release

3. RS-232 settings

The controller supports low-speed (default) and high-speed communications. If changing to the higher baud rate make sure that your software and cable connection supports it.

Baud rate	Data bits	Parity	Stop bits
9600 (default)	8	N	1
57600	8	N	1

4. Behavior if no LED connected

- The CTR-50 controller first needs an LED connected if it should be controlled via RS232.
- The CTR-51 can be controlled via RS232 without an LED connected.

5. Protocol and method of operation

- The controller operates in slave-mode (except for when control command “X” = on)
- Each action (read, write or store commands) has to be initiated by the master device (e.g. PC or PLC)
- Communication between the master device and the controller is based on ASCII codes
- Upper- and lower-case characters have the same meaning
- 0x0a for LF (“\n”) ASCII control characters are not used, however command “Z” can be used to end the controllers response with 0x03 (ETX)
- After a command has been sent, wait for the reply command before sending the next one

Default settings, valid after system boot, are stored in the EEPROM memory, but they can be redefined and overwritten by dedicated EEPROM write commands. RAM write commands are temporary and only valid until system shutdown.

6. Example: commands (with echo-mode “Y” = 1)

Command	Type	Reply of controller (command “Q” = 1)	Reply of controller (command “Q” = 0)	Meaning
RC\n	read	700\n	runtime: 700\n eeprom: 150\n	configured current setting at 700mA, eeprom current setting at 150mA
WB50\n	write	OK\n		write RAM target brightness to 50% → successful
EB\n	Save to EEPROM	SAVED\n		Write RAM data to EEPROM → successful

7. Command set (with easy parameter display, “Q” = 1)

Description	Possible Values	Read/write and/or store	Explanation/remark	Sample command	Controller reply
Operating mode (M**)**	0, 1, 2, 3	R, W, E	0: OFF (LED always off) 1: AUTO (LED follows trigger) 2: FLASH (LED flash depending on delay, length, gap) 3: STEADY (LED always on) **CTR-51: If not in RS232-control, the mode will automatically switch to FLASH**	RM\n WM1\n EM\n	1\n OK\n SAVED\n
Brightness (B**)**	0.0 – 100.0 [%]	R, W, E	Desired percentage of adjusted current via rotary switches. **Note: CTR-50 only, set current for CTR-51 with WC command**	RB\n WB50.5\n EB\n	51\n OK\n SAVED\n
Flash delay (W**)**	10us – 59s [s]	R, W, E	Delay time before flash pulse. (prewait) Note: For “µs” write “us”. **CTR-51: max. 3s prewait for FLASH-mode**	RW\n WW9.5ms\n EW\n	100us\n OK\n SAVED\n
Flash duration (L**)**	1us – 59s [s]	R, W, E	Length (on-time) of flash pulse. **CTR-50: 2ms – 59s / 10µs step** **CTR-51: 1µs – 3s / 1µs per step**	RL\n WL10ms\n EL\n	500us\n OK\n SAVED\n
Gap zone after flash (G**)**	10us – 59s [s]	R, W, E	trigger dead zone (forced off-time) after flash. **CTR-50: 10µs – 59s** **CTR-51: 10µs – 3s** **Note: Only in use, if lower rotary switch at 0. Gap zone turned off with value 0.**	RG\n WG99us\n EG\n	10ms\n OK\n SAVED\n
Read or set data string (H**)**	ASCII 20 – 7F	R, W, E	Any data string to for example clearly assign/identify the device in your production line **Note: maximum string length is 32 characters** **CTR-50 preset string: CTR-50 V4** **CTR-50 preset string: CTR-51 V2**	RH\n WHxxxx\n EH\n	CTR-50\n OK\n SAVED\n
Firmware version (F**)**	‘maj’,’min’, ’build’	R	Currently flashed firmware version.	RF\n	1.0;854;p\n
Tune target current (TUNE**)**	–	–	Finetune the target LED-current. Automatically happens at reboot or “**C**” command.	TUNE\n	…\n

			Note: CTR-51 only. If finished, success or errors are possible.		
Analogue dim level (D)	0 – 1023	R, W, E	Analogue dimming via voltage at Pin 3. **Note: CTR-50 only** ▪ Dimmer switched off by factory default ▪ adjusted value (e.g. WD670) defines 10V ▪ 10V=100% of sel. current ▪ 0V= 0% of sel. current	RD\n WD670\n ED\n	0\n OK\n SAVED\n
Error (E)	0 – 65535 16bit-coded	R, W	Error messages, see 7 **Note: All errors can be cleared with WE command or after reboot.**	RE\n WE\n	0\n OK\n
Target LED current (C)	50 – 30000 [mA]	R, W, E	Read or write the LED target current. Triggers "**TUNE**". **Note: CTR-51 only. Set current for CTR-50 with rotary switches and "B" command.** **CTR-51 min.: 150mA** **CTR-50 min.: 50mA**	RC\n WC800\n EC\n	1600\n OK\n SAVED\n

Description	Possible Values	Read/write and/or store	Explanation/remark	Sample command	Controller reply
Actual / last LED current (A)	0 – 65000 [mA]	R	Either the actual current (STEADY-mode) or the last current of the flash (FLASH-mode) at the LED. **CTR-51: not possible in AUTO-Mode**	RA\n	1500\n
Dead zone factor (K)	1 – 1200	R, W, E	Defines how many times longer the dead zone time is, than the flash duration. **Note: CTR-51 only. Effective in flash mode only and if lower rotary switch not at 0. Default = 10** 1 = factor 1 → (dead zone = flash duration, 50% Duty Cycle)	RK\n WK\n EK\n	30\n OK\n SAVED\n
Encoder status (S)	0 – 9 ; 0 – 9	R	Encoder status of upper and lower encoder. **Note: CTR-51 only**	RS\n	9 ; 3\n
Debug output (D)	–	–	Command only „D".	D\n	Settings and information at once.
Echo mode (Y)	0, 1	R, W, E	0: reply-echo of sent command off 1: reply-echo of sent command on (default)	RY\n WY1\n EY\n	0\n OK\n SAVED\n
Compat mode (Q)	0, 1	R, W, E	0: extended parameter display (default CTR-51, CTR-50) 1: easy parameter display	RQ\n WQ1\n EQ\n	0\n OK\n SAVED\n
Read ADCx (Rx)	0 – 1023	R	**Value** **Description** 0 – 1 CTR-50: ULED 2 CTR-50: UDIM 3 CTR-50: ILED 4 CTR-50/51: Temp 5 CTR-51: UCap 6 CTR-51: ILED 7 CTR-51: Timebase	R2\n	837\n
Calibrate device (CALIB)	–	–	Calibrates LED current to the adjusted current taken from the rotary switches. **Note: CTR-50 only, already done at factory**		
LED voltage (V)	0 – 24 [V]	R	Live measurement of the used LED+ voltage.	RV\n	18.4\n
Calibration values (I)	–	R,W,E	Results of the CALIB-command in RAM. **Note: CTR-50 only**	RI\n	All values of CALIB in RAM.

Async debug (X)	0, 1	R, W, E	0: off (default) 1: on **Note:** **Needs to be off for RS232 GUI control.**	RX\n WX1\n EX1\n	1\n OK\n SAVED\n
End of response (Z)	0,1	R, W, E	Sets the ending of the controller's output. 0: without (default) 1: with end of text (ETX) character	RZ\n WZ1\n EZ1\	0\n OK\n SAVED\n
XHIGH	57600	–	Switch to 57600 baud rate		
XLOW	9600	–	Switch to 9600 baud rate (default)		
Factory reset (XFACTORY**)**	–	–	Reset the controller to factory defaults.		

8. Overview reply commands

Reply	Description
OK	Command has been accepted
SKIPPED	Command not necessary, therefore skipped
SAVED	Setting stored in EEPROM
WAIT	Need time to execute the command
INVREAD	Invalid read command, probably wrong syntax
INVWRITE	Invalid read command, probably wrong syntax
INVEEPROM	Invalid EEP command, probably wrong syntax
ERR	Command not accepted, probably wrong syntax
ERR:ADMIN	Admin rights required for this command
ERR: VALUE TOO SMALL	Value out of acceptable range
ERR: VALUE TOO LARGE	Value out of acceptable range
ERR:USE 0 OR LARGER VALUE	Value out of acceptable range
ERR:ENCODERREALM	If a value is already set via the rotary switch and it should be changed via RS232. The set value is saved, but has only effect if rotary switch at 0.
ERR: CUR NOT REACHED	Reply of TUNE command, controller is not able to reach the target current
ERR: NOLED	Reply of TUNE command, no LED connected
ERR: VMAX	Reply of TUNE command, maximum LED voltage reached
WARN:ENCODERREALM	Not shown, but internally processed.

8.1 Overview error table

Sending the 'RE'-command will output one or more of the following listed messages.
The error bits remain until they have been cleared by the WE command. Multiple errors are possible.

Reply	Description	LED indicator - blinking pattern s=short, l=long
0000 0000 0000 0000 → 0	No error	Off
0000 0000 0000 0001 → 1	No current, no LED connected	s-s-l-l
0000 0000 0000 0010 → 2	Trigger received while in IRQ (during Flash & Deadtime), lost	s-l-l-l
0000 0000 0000 0100 → 4	Invalid command received	---
0000 0000 0000 1000 → 8	Incomplete command, Timeout probably noise on RS232	
0000 0000 0001 0000 → 16	Data received on RS232 while in IRQ (during Flash & Deadtime)	---
0000 0000 0010 0000 → 32	External trigger too long	---
0000 0000 0100 0000 → 64	Target current not reached	s-s-s-l

0000 0000 1000 0000 → 128	Exceeding maximum allowed power	s-l-s-s
0000 0001 0000 0000 → 256	Not used	---
0000 0010 0000 0000 → 512	System shutdown, max allowed temperature reached, Mode=0	s-l-s-l
---	“D” debug command	s-s-s-s