CURRENT SOURCE FOR LED MODULES

100 mA – 2000 mA

User manual

atesystem
FOCUSED ON DETAIL

03/2018

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Document information

Revision No.	Author	Revision date	Description
0, 1	Navratil J.	10 March 2017	First version of the manual for a customer
2	Parez J., Navratil J.	13 June 2017	Changes in accordance with the firmware 1.3.2
3	Kebo M.	15 September 2017	Conversion to new graphic template
4	Navratil J.	22 January 2018	Proofreading after conversion
5	Parez J.	02 March 2018	Minor revision of English translation
6	Parez J., Jandasek V.	01 August 2019	Changes in accordance with firmware 1.3.6, corrections

Attachments

Notes

Electric parameters, description of the connectors and typical connections are listed in the data sheet.

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1 USED TERMS AND QUANTITIES

Quantity	Unit	Description
U_{OUT}	V	Output voltage for LED.
U_{INT}	V	Internal voltage in the current source; designated as Uin in the communication list.
U_{DROP}	V	The voltage drop inside the current source defined in volts as: $U_{DROP} = U_{INT} – U_{OUT}$; serves as the voltage reserve required for current regulation.
U_{LOW}	V	Output voltage – low limit.
U_{HIGH}	V	Output voltage – high limit.
U_{MIN}	V	Minimum measured output voltage since the last setting of the source.
U_{MAX}	V	Maximum measured output voltage since the last setting of the source.
I_{SET}	A	Output current setpoint.
I_{MEAS}	A	Actual measured value of output current.
I_{RMIN}	A	Minimal output current given by the range of the current source
I_{MAX}	A	Maximum measured output current since the last setting of the source.
I_{LIM}	A	Output current limit.

2 INSTRUCTION SET FOR SOURCE CONTROL

Each command sent to the system via the virtual serial interface implemented over the TCP/IP protocol in the Ethernet network must always end with termination characters <CR><LF> (carriage return and line feed). The same termination characters are also used in the system response.

The individual commands are categorized according to the function they perform. For each command, the system responds in the following form: “OK,0;...” or “ERROR,x,...”, where x is a numeric error indicator. A positive system response may contain additional return parameters depending on the command function. A negative response usually carries only numerical information (error code).

New commands have the minimal required firmware version mentioned in the left column of the table, under the name of the command.

2.1 SYSTEM FUNCTIONS

Command	Syntax (example -> response)	Description
Identification	**ID**	Lists the firmware version and its release date.
	ID-> OK,0;version:1.3.2, release:2016/11/28	Version 1.3.2 released 28 November 2016.
Reset to factory setting	**ID**	Returns all settings to the default values and resets the source.
	SF!->OK,0	Reset to factory settings was successful.

Okomentoval(a): [LU1]: přidána jedna tečka, aby bylo stejné jako dříve, v české verzi není opraveno

Okomentoval(a): [n2R1]: OK

Okomentoval(a): [LU3]: zde bych pro názornost nechala tento přepis, aby bylo jasné, co je z datumu den a co měsíc.

Okomentoval(a): [n4R3]: OK

Command	Syntax (example -> response)	Description
Checking "alive ticks" status	**GB**	Lists the state of the internal counter incremented every 250 ms since the system start. It allows to determine how long the source is in continuous operation since its turning on or restart.
	GB->OK,0;live_ticks:60	The counter status is 60. The source is running 60/4 = 15 seconds.
Reading the result of the system test	**GS**	Lists the result of the system test. The test is run only once when the system is started.
	GS-> OK,0;selfcheck:3	0b00000011 – test was successful with OK result.
	Bit interpretation of the selfcheck variable: Bit 0 – set after the test is complete, Bit 1 – set if the test result is OK, Bit 2 to bit 7 – reserved for later use.	
Checking device status	**MS**	Detects and lists the status of limits monitored by the system: overcurrent, overvoltage, undervoltage, timelimit, overpower, errconfig.
	MS-> OK,0;overcurrent:0, overvoltage:1, undervoltage:0,timelimit:0, overheat:0, errconfig:0	The output was turned off due to output overvoltage.
Reboot	**RBx**	Performs restart / system restart. If the command is followed by 0, the X-Port is NOT restarted.
	RB -> OK,0	Initializing reboot INCLUDING restart of X-Port.
	RB0-> OK,0	Initialized reboot WITHOUT restart of X-Port
Blinking with LEDs (1.3.6)	**BL**	For a period of 2.5 seconds, the source will flash all three LEDs at once. It is used for visual identification (e.g. in an electrical cabinet).
	BL -> OK,0	The source flashes with all LEDs for 2.5 seconds.
Reading device name (1.3.6)	**BN**	Reads the user-defined device name used to identify the device, e.g.: "Source LED1", "Source rack 2", "Source 3"
	BN -> OK,0;name:Source 1	The device name is "Source 1."
Setting device name (1.3.6)	**BNxxx**	Sets the user-defined device name. A maximum of 15 ASCII characters can be used, minimum is 1 character.
	BNSource 2 -> OK,0	The device name will be set to "Source 2".
Reading serial number (1.3.6)	**BS**	Reads the serial number of the source..
	BS -> OK,0;serial:12345678	The serial number is 12345678.
Reading HW revision (1.3.6)	**BR**	Reads the HW revision of the source.
	BR -> OK,0;revision:PPZPLS0001	HW revision of the source is PPZPLS0001.

Okomentoval(a): [JN5]: Označení verze FW ve sloupci syntaxe prostě není šťastné… přesunout hned do prvního sloupce s názvem příkazu.

2.2 SETTING THE CURRENT

The source controls the output current to this value. The specified current must be within the range <I_{RMIN}, I_{LIM}>, where I_{LIM} is set by the LC command of the current limit. I_{LIM} may be equal to or less than the maximum output current value defined in the data sheet (2 A). The maximal and minimal values can be read using the range reading command (2.9.4).

Command	Syntax (example -> response)	Description
Output current setting	**SCx**	"x" - current in amperes written with a decimal point.
	SC0.5 ->OK,0	Sets the output current to 0.5 A.
Reading the value of output current	**GC**	Lists the value of the current setpoint in amperes.
	GC ->OK,0;I_set:0.500	0,5 A

2.3 OUTPUT CONTROL

In addition to the OD command, the system can turn off the output based on the following flags: overcurrent, undervoltage, overvoltage, timelimit. **When the output is disabled (via command or system), there is always a short-circuit between the output terminals VOUT and GND.**

Command	Syntax (example -> response)	Description
Turning the output on	**OE**	Turns the output on based on predefined limits and settings.
	OE-> OK,0	Output is on.
Turning the output off	**OD**	Output is off.
	OD-> OK,0	
Checking output status	**OS**	Checks status of the output.
	OS->OK,0;output:1	0 – off, 1 - on

2.4 MEASUREMENTS

Command	Syntax (example -> response)	Description
Summary measurement	**MA** MA-> OK,0;I:0.497,Uin:39.532, Uout:15.029,Temp:37.187, Status:0,0,0,0,0,0,0	Measures the most important quantities and lists their values: I – actual current (A), U_{in} – internal voltage (V), U_{out} – output voltage (V), Temp – temperature of the source (°C), Status (overcurrent, overvoltage, undervoltage, timelimit, overheat, overpower, errconfig).

Command	Syntax (example -> response)	Description
Summary measurement of max and min values (1.3.6)	**MM**	Measures and lists the measured maximum and minimum current and voltage values. It serves as a replacement for obsolete commands MCH, MVH, MVL. Maximal and minimal values are always reset on settings change or output enabling/disabling.
	MM->OK,0;Imax:0.1,Umin:36.2,Umax:38,9	The maximum measured output current was 0.1A, the minimum output voltage was 36.2V and the maximum output voltage was 38.9V.
Measurement of binning resistor and NTC	**MRx**	Measures and lists the value of binning resistor or NTC connected to the "x" channel: x = 1 for RBIN, x = 2 for NTC. The value is shown in kΩ.
	MR1->OK,0;res1:10.026 MR2->OK,0;res2:38.938	RBIN = 10,026 kΩ. NTC = 38,938 kΩ.

2.5 DIGITAL INPUTS AND OUTPUTS

Command	Syntax (example -> response)	Description
Setting digital outputs	**SD***xy*	Sets the digital output: x (output number) = 0 or 1, y (state) = 0 or 1.
	SD01->OK,0	Sets the first digital output (D0) to logical 1 (ON)
Reading digital inputs	**GD**x	Reads the digital input: x (input number) = 0 or 1.
	GD0->OK,0;DI0:0	Digital input 0 has a logical value of 0.
Reading digital outputs (1.3.6)	**GO***x*	Reads digital output. *x* (number of output channel) = 0 or 1
	GO0->OK,0;DO0:0	Digital output channel 0 is set to logical 0.

2.6 VOLTAGE DROP AND ADAPTATION OF INTERNAL VOLTAGE

2.6.1 Automatic adaptation of internal voltage

This mode ensures that internal voltage of the source is automatically maintained at the value U_{OUT} + U_{DROP}, while U_{DROP} is approximately constant and set by the user. U_{OUT} may vary during the current is supplied to the load. The mode is suitable for long-term operation, during which there are no radical changes in load impedance (short-circuiting of some or all connected LEDs, etc.). It is ensured that the energy inside the source is not wasted due to a decrease in the load impedance (output voltage), and the source does not heat excessively. The downside may be current overshoot when switching from voltage to current mode. This can occur in case of a sharp increase in impedance accompanied by an increase of output voltage at the source, which cannot be compensated from the U_{DROP} voltage. If the output voltage exceeds the limits specified in the U_{LOW} and U_{HIGH}, the source turns off the output.

Okomentoval(a): [LU6]: Prosím o kontrolu překladu, není mi úplně jasný český originál.

Okomentoval(a): [n7R6]: Upraveno.

Okomentoval(a): [LU8]: Prosím o kontrolu překladu, v české větě je asi chyba (Při překročením...)

2.6.2 Fixed value of the internal voltage

The internal voltage setting of the source is no longer derived from the actual output voltage, but it is regulated to the fixed level corresponding to U_{HIGH} + U_{DROP}. The internal voltage of the source thus exceeds the limit of the maximum output voltage by the specified drop. In case of changes in the load impedance which result in changing the output voltage, internal voltage remains at the same value. By significantly reducing the impedance, the source is forced to waste the remaining energy in the form of heat and, as a result, it can also heat up to a significant extent. The mode is suitable for cases where there are significant changes in output impedance (short-circuiting some or all LEDs, PWM use), rather for short-term tests than long-term use. If the output voltage exceeds the limits specified by the U_{LOW} and U_{HIGH}, the source turns off the output as in the mode with automatic adaptation.

Okomentoval(a): [LU9]: zde si nejsem jistá, zda v české verzi nechybí čárka za závorkou, tzn. že jsou to vlastně dvě věty, tzn. před "rather for..." by patřila čárka.

Okomentoval(a): [n10R9]: S čárkou to vypadá lépe.

Command	Syntax (example -> response)	Description
Setting voltage drop U_{DROP}	**SVx**	Sets the required voltage drop between internal and output voltage in volts.
	SV7.0 ->OK,0	The voltage drop is set to 7.0 V.
Reading voltage drop U_{DROP}	**GV**	Lists the set voltage drop between internal and output voltage in volts.
	GV ->OK,0;U_drop:7.0	The voltage drop is set to 7.0 V.
Setting adaptation of internal voltage	**SHx**	Sets the method of controlling voltage drop, or the adaptation of the internal voltage: x = 0 or 1.
	SH1 ->OK,0	1 = Internal voltage is regulated automatically according to the output voltage so that the set voltage drop is maintained.
	SH0 ->OK,0	0 = Internal voltage is constant; it is set on a one-time basis according to the maximum output voltage (limit).
Checking status of internal voltage adaptation	**GH**	Reads the method of controlling the voltage drop, or adaptation of the internal voltage. The statuses of 0 and 1 are identical to the command for the setting.
	GH ->OK,0;dropcontrol :1	The adaptation of internal voltage is turned on.

Okomentoval(a): [LU11]: V originále je zde velkém písmeno, ale vzhledem ke zbytku textu se asi jedná o překlep.

Okomentoval(a): [n12R11]: Upraveno, velké počáteční písmeno.

2.7 OUTPUT CURRENT REGULATION

In the standard operating mode, automatic regulation of the output current is turned on. For special purposes, it is possible to deactivate it and use manual control. However, the stated accuracy of the output current and adherence to the voltage limits may not apply! From this point of view, the mode without regulation is only suitable for debugging and load tests, for which the failure to meet the electrical parameters will not result in immediate destruction. Internal voltage is set the value of U_{HIGH} + U_{DROP} immediately after sending the command with corresponding parameters (LUH, SV); the current is set after sending the SC command. The automatic adaptation of the internal voltage cannot be used (2.6.1).

Okomentoval(a): [LU13]: Nechybí tu slovo sending i v češtině? - po zaslání příkazu?

Okomentoval(a): [n14R13]: Chybí, ale to už je drobnost.

Command	Syntax (example -> response)	Description
Reading regulation status	**RC**	Lists the current regulation status: 0 = off, 1 = on
	RC->OK,0;feedback:1	Regulation is on.
Regulation on/off	**RC**x	Sets the current regulation: 0 = off, 1 = on
	RC0->OK,0	Turn the regulation off.

2.8 MANUAL CONTROL WITHOUT REGULATION

The SP1Dx and SP2Dx commands allow you to manually set the internal voltage and the output current in percent from the maximum values (principally as PWM duty cycle). Their use is determined by turning off the current regulation, otherwise the manually entered values will be overwritten. Due to the deactivation of the feedback, the output values are not guaranteed, and it is necessary to proceed cautiously with the setting.

Command	Syntax (example -> response)	Description
Manual setting of the PMW of the internal voltage	**SP2D**x	Sets the voltage in percent. (0.0 ≤ x ≤ 100.0)
	SP2D100.0->OK,0	Sets the voltage to the max. (52 V)
Manual setting of the PWM of the current	**SP1D**x	Sets the voltage in percent. (0.0 ≤ x ≤ 100.0)
	SP1D25.0->OK,0	Sets the output current to 25%.
Reading manual setting of current (PWM1) **(1.3.6)**	**GP1**	Reading the manual setting of the PWM of the current in percent.
	GP1->OK,0;PWM1:25.00	Output current manually set to 25%.
Reading manual setting of voltage (PWM2) **(1.3.6)**	**GP2**	Reading the PWM of the voltage in percent.
	GP2->OK,0;PWM2:100.00	Voltage is set manually to 100% - max (52V).

2.9 LIMITS

2.9.1 Voltage

If the high limit of the output voltage is exceeded, the source disconnects the output and stops generating the current. This is indicated by the system as “overvoltage”. If the output voltage is less than the set low limit, the source also disconnects the output and signals “undervoltage”.

Command	Syntax (example -> response)	Description
Checking present voltage limits	**LU**	Lists present voltage limits in volts.
	LU-> OK,0;Ulow:0.000,Uhigh:45.000	Low limit 0.0 V and high limit 45.0 V.
Setting output voltage – high limit	**LUH**x	Sets the maximum output voltage limit as x parameter in volts.
	LUH24.5->OK,0	Limit 24.5 V.
Setting output voltage – low limit	**LUL**x	Sets the minimum output voltage limit as x parameter in volts.
	LUL0.5->OK,0	Value 0.5 V.

2.9.2 Current

Sets the output current limit. The measured output current of the source is compared to this limit, and when exceeded, the source's output is disconnected and the source's run suspended. Exceeding the limit is indicated by the system as “overcurrent”.

Command	Syntax (example -> response)	Description
Checking output current limit	**LC**	Lists actual limit of the output current in amperes.
	LC->OK,0;Ilim:1.300	Limit 1.3 A.
Setting output current limit	**LC**x	Sets the output current limit – x parameter in amperes.
	LC1.2->OK,0	Limit 1,2 A.

2.9.3 Time

It allows to specify a time interval for which the source runs and generates output current. After this time (with resolution of 250 milliseconds), the output is disconnected and the source is turnd its output off. By setting it to 0, the function of this parameter can be blocked. Exceeding the time limit is indicated by setting the flag “timelimit”.

Okomentoval(a): [LU15]: Prosím o ověření přesnosti překladu, není mi úplně jasný originál.

Okomentoval(a): [n16R15]: Překlad OK.

Command	Syntax (example -> response)	Description
Checking the time limit	**LT**	Lists the time limit; the value is in seconds.
	LT->OK,0;time:1.000	Limit is 1 second.
Setting the time limit	**LT**x	Sets the time limit after which the output is turned off.
	LT1.0->OK,0	The limit of 1 second is set.

2.9.4 Range

Range is a special category of limits that is determined by the hardware construction of the source. These current and voltage limits are limit values that can be used to set the current and current limit commands, respectively, maximum and minimum output voltages and drops.

Command	Syntax (example -> response)	Description
Reading range of limits (1.3.6)	**LA**	Reads the current and voltage hardware ranges applicable to other commands in the limit category.
	LA -> OK,0;Imin:0.100,Imax:2.000, Umin:0.000, Umax:50.000	The source current range is 0.1A to 2A. The source voltage range is 0V to 50V.

2.10 EEPROM

Commands for working with EEPROM allow you to store source parameters in the permanent memory. The device will remember these parameters even after it is disconnected from the power supply. It is therefore appropriate to use the EEPROM in cases where the same source setting is repeatedly used or for the autonomous mode. All values stored by the user will be deleted with the command for the factory setting “SF!”.

Command	Syntax (example -> response)	Description
Reading the setting from EEPROM	**ER**	Reads the stored user-defined setting from the EEPROM permanent memory and overwrites with it the actual source setting.
	ER -> OK,0	
Saving the setting to EEPROM	**EW**	Saves all actual settings of the source to the EEPROM permanent memory.
	EW -> OK,0	

2.11 AUTONOMOUS MODE

Based on this setting, the source works in standard or in autonomous (trigger) mode. In the first case, the source promptly responds to the parameter being set and immediately adapts the output of the request. In the latter case, the source is only reset, but the output is enabled only after the trigger signal has been detected at the digital input DI0. The operation of the source can then be suspended (and the output disconnected) by exceeding one of the limit parameters (min./max. output voltage, max. current, time). Subsequently, the digital output DO1 indicating the end of the test is switched. If the cause of disconnecting the output is different from reaching set time limit, the digital output DO0 indicating the bad piece (NOK) is switched.

Command	Syntax (example -> response)	Description
Checking the autonomous mode status	**TM**	Lists the status of autonomous mode: 0 – not waiting for external trigger, 1 – waiting for external trigger.
	TM->OK,0;triggmode:0	Standard mode – does not wait for the external trigger.
Turning autonomous mode on/off	**TM**x	Sets the autonomous mode: 0 – not waiting for external trigger, 1 – waiting for external trigger.
	TM1-> OK,0	Turns the autonomous mode on. Output is only enabled when an external trigger signal is received.

Okomentoval(a): [LU17]: opravena pomlčka za delší, stejná drobnost i výše 1 - čeká na trigger

Okomentoval(a): [n18R17]: OK

2.12 DESCRIPTION AND MEANING OF NUMERIC ERROR CODES

Error code	Text description	Note
0	OK	Everything was all right.
1	Unrecognised command	The system failed to identify the command that was sent to it.
2	Bad command format	The system identified a command that for some reason cannot be processed further (e.g. does not contain the required parameters).
3	Bad parameter format	The command and its information were identified, but they have a bad format (e.g. the numeric parameter contains a non-numeric value).
4	Out of valid range	Some of the parameters or other input data are beyond the required limits.
5	Cannot perform operation	Some of the required conditions were not met (preconditions for execution) which prevents the operation from being executed.

3 OVERVIEW OF OPERATING MODES

3.1 DIVISION ACCORDING TO CURRENT AND VOLTAGE REGULATION

The following points only summarize possible operating modes and their major differences. A more detailed description is in chapters 2.6, 2.7 and 2.11.

- **With the output current regulation –** the source automatically maintains the output current at the set value with the accuracy specified in the data sheet.
    - **Automatic adaptation of the internal voltage** – the source maintains approximately constant voltage drop U_{DROP} as the value of internal voltage U_{INT} is adjusted based on the change in the output voltage U_{OUT}.
    - **Fixed value of internal voltage** – the source sets the internal voltage U_{INT} on a one-time basis and then maintains its constant value regardless of the actual U_{DROP}.

- **Without the output current regulation –** for special purposes only; internal voltage and output current values are manually entered in the range of 0 to 100%, not in physical units. The accuracy of the output parameters is not guaranteed.

3.2 DIVISION ACCORDING TO AUTONOMOUS BEHAVIOUR

- **Standard mode** – parameters of the source are set by a human operator or via SW command, which turns the output on or off. The evaluation of whether the tested LED module is good or bad is provided by the superior system.
- **Autonomous (trigger) mode** – source parameters such as current and voltage limits are permanently stored in the EEPROM; the superior system (such as PLC) turns on the current output via the digital input of the source. Based on the limits as well as measured voltage and current, the source evaluates whether the test piece is good or bad, and indicates this to the superior system through a digital output.

4 LED INDICATION ON THE FRONT PANEL

LED	Status	Meaning
Green (PWR)	on	The source is powered and ready for communication.
	blinking	Output is enabled and the source generates the current output according to the set parameters.
Red (ERR)	on	Unable to read calibration data - default data is used!
	blinking	The measured internal temperature of the source exceeds the allowed limit, or a failure is detected which prevents the source from being started (such as insufficient level of the source's internal voltage). The source has a blocked output and cannot be started. If the temperature of the source is exceeded, it is necessary to wait until it drops. This state is also indicated if the source's self-test is not error-free.
Orange (LIM)	on	Quantities exceeding the specified limits (voltage, current) were measured and the output of the source was disabled. Parameters need to be revised and the source restarted by enabling the output.
	blinking	Limits setting disables the output and current generation.

Okomentoval(a): [LU19]: prosím o kontrolu překladu, nejsem si jistá, jak je myšlen originál, zda je tím myšleno, že je je indikována porucha, která zabraňuje spuštění zdroje (to v češtině není uvedeno)

Okomentoval(a): [n20R19]: Překlad OK.

Okomentoval(a): [LU21]: Prosím o kontrolu překladu, z české verze jasně nevyplývá, jestli je nutné provést povolení výstupu, aby mohl být opětovně spuštěn zdroj.

Okomentoval(a): [n22R21]: Překlad OK.

5 EXAMPLE OF SOURCE CONFIGURATION

The following points summarize the usual steps to set up and run the source along with relevant commands in quotes and links to chapters. You can use the default (factory) setting and skip steps 3 to 5. **Parameter values are given as an example; they must always be adjusted to a specific application.**

1) Setting I_{LIM}, U_{HIGH}, U_{LOW} limits. (chapter 2.9)
   - I_{LIM} = 1,5 A: "LC1.5"
   - U_{HIGH} = 45 V: "LUH45.0"
   - U_{LOW} = 5 V: "LUL5.0"

Okomentoval(a): [L23]: V této části jsem měnila uvozovky za "anglické", které mají být nahoře, jen prosím o kontrolu, že je to takto v pořádku. Děkuji.

Okomentoval(a): [n24R23]: V pořádku.

2) Entering output current limit. (chapter 2.2)
    - I_{SET} = 1 A: “SC1.0”
3) Setting standard or autonomous mode. (chapter 2.11)
    - Standard mode: “TM0”
4) Setting the method of controlling internal voltage. (chapter 2.6)
    - Automatic: “SH1”
5) Setting the U_{DROP} value. (chapter 2.6)
    - U_{DROP} = 5 V: “SV5.0”
6) Enabling output (chapter 2.3): “OE”
7) Disabling the output by “OD” command or automatically - exceeding limits. (chapter 2.3)

Okomentoval(a): [LU25]: nemá tady být autonomní (tzn. autonomous)? s ohledem na to, že je v textu výše popsán standardní a autonomní režim.

6 FACTORY SETTING OF THE SOURCE

Ensures restoring the system to its default state (default setting). At the same time, it overwrites any calibration data applicable to a particular piece, which may result in reducing the accuracy of the generated current setting and voltage measurement.

Setting of the individual parameters after executing SF! command is described in the following table.

Parameter	Factory setting		Note
I_{SET}	0	A	Setting current of the source.
I_{LIM}	2	A	Output current limit 2 A.
U_{LOW}	0	V	Output voltage – low limit 0 V.
U_{HIGH}	50	V	Output voltage – high limit 50 V.
Autonomous mode	0		Disabled – the source runs in the standard mode.
U_{DROP}	4	V	Voltage drop 4 V.
Automatic adaptation U_{INT}	1		On.
Current regulation	1		On.
Time limit	0		No limit.