SPL-3

DIODES and RGB LED STRIP DRIVER

works alone or controlled by:

DMX-512 / 2 buttons / 2 analogue signals 0-10V

MANUAL

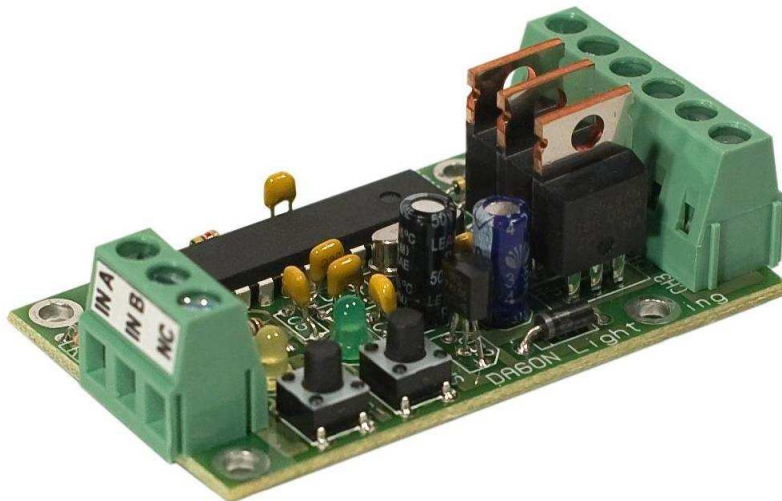**Table of Contents.**   Page:

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1. Main description about SPL-3 controller.

Driver (controller) SPL-3 is very functional and easy-to use tool designed for control colorful diodes or RGB LED strips, as well as the monochrome LED diode in 3 independent channels.

LED Lighting Control using the SPL-3 can be done in several different ways (depending on the selected mode driver):

- via DMX-512 signal
- with two buttons BRIGHTNESS and COLOR
- with analogue signals 0-10V
- independent work SPL-3 – different sequences of color changes specified by the user's speed and brightness of light

Particular modes of driver SPL-3 work are described in the further parts of manual.
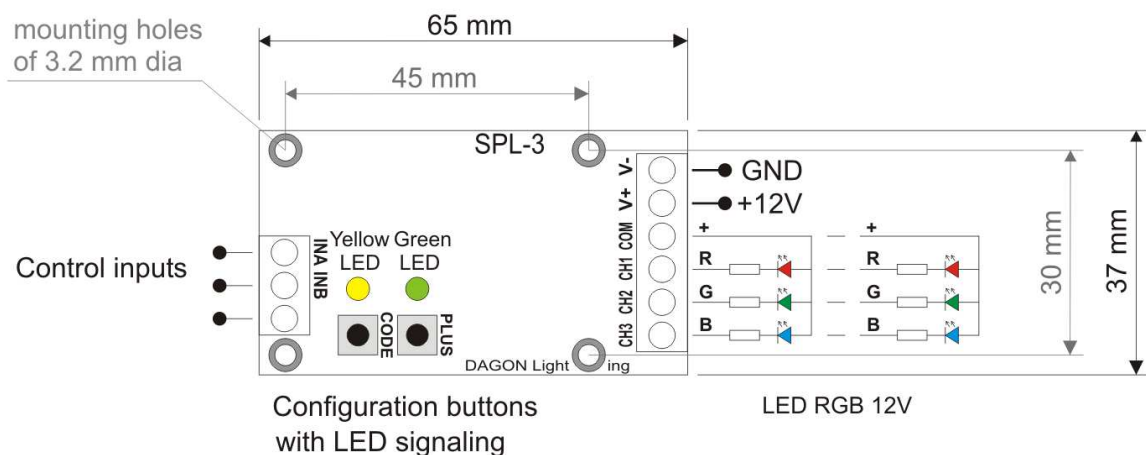
Fig.1. Main draft and dimension of SPL-3.

Inputs function IN A and IN B depends on mode of SPL-3 work, for example:

IN A = DMX+ / button BRIGHNESS / button CODE / analogue signal 0-10V
IN B = DMX– / button COLOR / button PLUS / analogue signal 0-10V

The SPL-3 controller output marked as CH1, CH2 and CH3 correspondent to three basic colour – RED, GREEN, BLUE. On this outputs the controller generate the tension signals PWM which regulate brightness every of three basics colours, allows for any colour and brightness of lights.

Current capacity of every output is 4A, while supplying 12V can give almost 50W on every output. If you need to power diodes, or LED strips to be used more current an additional degrees of power or additional SPL-3 driver.

2. Configuration SPL-3.

The main rule of SPL-3 controller is that the way of work is decide by "controller codes" which can be set in by a user in any time. The set of "controller codes" (see table 1 and 2.4 point) is very wide, which ensure the high variety of the way of work and to control the LED lightning using SPL-3 driver. At the same time the configuration of controller, which means signing in the controller codes to SPL-3 controller is very simple and doesn't require any technical skills.

The controller codes always compose from 3 digits (from 0 to 9), which have to be sign in to SPL-3 controller which will activate the function realized by this controller. Usually complete and correct SPL-3 controller configuration to work in requested way demands entering in few controller codes.

To enter the controller codes are used 2 buttons marked as CODE and PLUS and 2 signalization diodes – yellow and green, see Fig. 1.

2.1. HV CONTROL function.

HV CONTROL function is use to enter the controller codes to the SPL-3 controller without using buttons CODE and PLUS. Then uses the external controls buttons PLUS and CODE, which user can connect to the inputs control – IN A and IN B. A prerequisite for the operation of external buttons and the buttons CODE PLUS is connected to one voltage greater than 18V (18V do 32V) – Fig.2. The driver SPL-3 while working in every way of LED control, detects the pressing of external buttons Code and Plus and reacts in the same way as if the CODE and PLUS build in has been pushed. Please remember to previous disconnect the controller inputs line A and B different equipment (installations) for example DMX-512 controller, because the highest voltage for those lines may destroy those equipment (installations). To sum up - the configuration of SPL-3 controller using the HV CONTROL function should be carry out while complete disconnection from every others controller's signals.

HV CONTROL function is helpful mainly when SPL-3 controller is fully built-up and there is no access to the buttons CODE and PLUS.

At the same reason SPL-3 controller during configuration duplicate the action of build-in signalization diodes on the exit channel, allowing observation of the LED driver outputs are connected to the SPL-3 exits as the signalization diodes.

CH1 RED – red LED signalization diode.

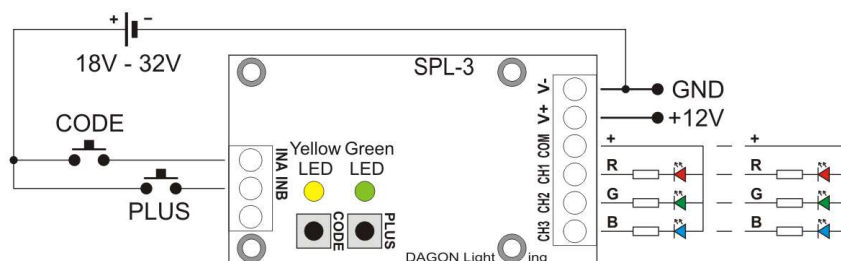CH2 GREEN – green LED signalization diode.

Fig.2 How to connect external configuration buttons.

2.2. Methods of entering the codes to SPL-3 controller.

To enter the code to SPL-3 driver press the button CODE.
Green diode will switch off, the yellow diode will switch on.

Entering the first digit of code:
Press shortly PLUS button as many times as the first digit of codes is – 0 to 9.
Every pressing the PLUS button is signalized by a short blink of green diode.
After setting in the first digit of code press CODE button one more time.
Yellow diode blinks (light off for half a second and light on again) it is the signal to set
in the second digit of code.

Entering the second digit of code:
Press shortly PLUS button as many times as the second digit of codes is – 0 to 9.
Every pushing the PLUS button is signalized by a short blink of green diode.
After setting in the second digit of code press CODE button one more time.
Yellow diode will blink (light off for half a second and light on again) it is the signal to set
in the third digit of code.

Entering the third digit of code:
Press shortly PLUS button as many as the third digit of codes is – 0 to 9.
Every pushing the PLUS button is signalized by a short blink of green diode.
After setting in the third digit of code press CODE button one more time.
Yellow diode light off and the green diode will light on – the code is already accepted.

After entering the code SPL-3 goes to regular work - to control the diodes LED RGB in the way described by actual configuration – via control codes.

If in order to enter another code, proceed similarly as described above.
The same code can be entered multiple times, as in no way affects the operation of the controller.

Not all the codes (from available range 000-999) are used. When the code which has not attributed any function is entered, no changes in work are noticed. This kind of code will be signalized as wrong with triple flashes yellow diode just after all three figures.

All codes are remembered in EEPROM memory of controller SPL-3. No power to the controller does not result in losing the settings made using the CODE and PLUS.

If at any time during setup (entering code) for 1 min button CODE or PLUS is not pressed, the SPL-3 configuration automatically stops and starts normal operation.

Driver configuration described above allows to enter configuration codes without the possibility of viewing them later, in order to check whether the function is active or not.
If you forget the function status re-enter the activation code.

However, if you read the DMX address of its value can be very useful, therefore, introduced the ability to view the DMX address in the driver SPL-3, see 2.3 point.

2.3. Preview of DMX address SPL-3 driver.

Viewing the address is possible only in mode of work SPL-3 with signal DMX-512, that is after the earlier set in one from the codes 554, 555 or 556 which activate mode of work with DMX-512.

To view the address of DMX button PLUS need to be hold on for more than 1 second, green diode will turn off and the yellow will turn on.

Viewing first digit of address DMX-512:
Green diode will blink as many times as the first digit of DMX address is – 0 to 5.
Than once blink the yellow diode which is the signal for reading the second digit.

Viewing second digit of address DMX-512:
Green diode will blink as many times as the second digit of DMX address is – 0 to 9.
Than once blink the yellow diode which is the signal for reading the third digit.

Viewing third digit of address DMX-512
Green diode will blink as many times as the third digit of DMX address is – 0 to 9.
Yellow diode will turn off - address is read and accepted.

After 2 seconds since the end of read and showing the DMX address, the SPL-3 controller goes to the regular work, means controlling RGB LED diodes in the way described by actual configuration – via control codes.

Tabel 1. List of configuration codes and their associated control functions for SPL-3.

CODE	Function / Parameter / Value
001 … 512	Address DMX controller SPL-3 in mode DMX or number of pallet and range of colors lightning in RANDOM mode
551	work SPL-3 in BUTTONS mode
552	work SPL-3 in ANALOGUE mode
553	work SPL-3 in RANDOM mode
554	work SPL-3 in DMX COLOR 1 mode
555	work SPL-3 in DMX RGB mode
556	work SPL-3 in DMX MIX mode (COLOR 1 + RGB)
560 ... 569	Speed changes of colors in RANDOM mode and display program while signal lost in DMX mode; 560 – analogue regulation of speed signal 0..10V IN A, RANDOM mode 561 = the slowest, 569 = the fastest – digital speed regulation, RANDOM and DMX
570 ... 579	The brightness of shinning in RANDOM mode and display program while signal DMX lost in DMX mode; 570 – regulation of brightness signal 0..10V, on input IN B, RANDOM mode 571 = the most dark, 579 = the most bright – digital brightness regulation, mode RANDOM and DMX
600 ... 610	Delay times after a brief blackout lights COLOR button BUTTONS mode: 600 = 0sec, 601 = 5sec, 602 = 10sec, 603 = 30sec, 604 = 1min, 605 = 3min, 606 = 5min, 607 = 10min, 608 = 30min, 609 = 45min, 610 = 60min.
620	DIMMER OFF – function DIMMER is off, in DMX mode
621	DIMMER ON 1 – function DIMMER is on – 0=min 255=max brightness
622	DIMMER ON 2 – function DIMMER is on – 0=max 255=min brightness
630	STROBO OFF – function STROBO is off, in DMX mode
631	STROBO ON 1 – STROBO function active with flashing effect = 1/2
632	STROBO ON 2 – STROBO function active with flashing effect = 1/4
633	STROBO ON 3 – STROBO function active with flashing effect = 1/8
650	WHITE BALANCE OFF – WHITE BALANCE function inactive
651	WHITE BALANCE ON – WHITE BALANCE function active – see codes 700 ... 999
660	No reaction on lack of signal DMX – hold in memory the last values RGB
661	After signal DMX fading – display program – changes in colours RGB fluently
662	After signal DMX fading – extinguish all LED RGB
663	After signal DMX fading – light on all LED RGB – white colour
664	After signal DMX fading – light on LED R – red colour
665	After signal DMX fading – light on LED G – green colour
666	After signal DMX fading – light on LED B – blue colour
667	After signal DMX fading – light on LED RG – yellow colour
668	After signal DMX fading – light on e LED RB – violet colour
669	After signal DMX fading – light on LED GB – light blue colour
700 … 799	WHITE BALANCE RED – percentage value of maximum red colour brightness
800 … 899	WHITE BALANCE GREEN – percentage value of maximum green colour brightness
900 … 999	WHITE BALANCE BLUE – percentage value of maximum blue colour brightness

2.4. Description of configuration codes control the operation of SPL-3.

The main code which need to be set in into SLP-3 controller is the code which determine mode of SPL-3 work. There are six different modes of SPL-3 work, so it means six different codes from 551 to 556.

If one of the DMX mode of work was chosen (code 554, 555 or 556) also the address of DMX SPL-3 controller have to be enter, so one code from 001 to 512. Chosen any code from 001 to 512 will change automatically previous code and remember new address DMX in memory controller.

Setting in the code form 001 to 500 is also necessary while setting SPL-3 in the RANDOM mode of work (code 553).
In RANDOM mode the meaning of codes form 001 to 499 is:
- First digit of code (digit of hundreds 0-4) is for number of active colour pallet.
- Second digit of code (digit of ten 0-9) is for the beginnings of colour on the colour's pallet.
- Third digit of code (digit of unity 0-9) is the last colour on the colour's pallet.

To sum up – when the code from 001 to 499 in the RANDOM mode is set in, there is chosen one from five available colour's pallet. This pallet has a range of the active colours which will be used by SPL-3 controller during the colour display and their changes. Additionally – code 500 in the RANDOM mode let the fluently changes in colours. The description of SPL-3 controller in the RANDOM mode the reader will find in 3.3 point.

The RANDOM mode is connected with codes 560 … 569 and 570 … 579.
Codes 560 … 569 determine speed of the colour changes, the codes 570 … 579 regulate the brightness of LED diodes.

Code 560 activate the regulation of speed colour changes, using signal 0-10V fed to the input IN A SPL-3 driver. For 0V analog signal IN A the speed colour changes is the smallest, the colour changes goes in every 40 seconds. While the growth of voltage the speed colour also increase, the colours changes more often until they blink really fast in 10V.

Code 570 enables adjustment of analog brightness LEDs, which is adjustable by means of the analog signal 0 to 10V on input IN B driver.
For 0V at input IN B is the lowest brightness, the LEDs are completely extinguished. As the voltage at the input IN B increase the brightness increases as well, until the maximum brightness at a voltage of 10V.

Besides regulation of speed colour changes and the brightness changes there is possibility of digital (discrete) regulation both of these parameters. For that function codes 561 … 569 and 571 … 579 are used.

When one code from 561 to 569 will be sign in – we will choose one from nine speed colour changes. Depends on the code which was sign in – the colour changes come with 41sec, 20sec, 10sec, 5sec, 2.5sec, 1.25sec, 0.6sec, 0.3sec, 0.15sec. These times regarding the step by step colour changes in RANDOM mode of work (codes 001 ... 499). When the fluently colour changes will be chosen (code 500) – 9 speeds in colour changes can be describe as: the slowest, barely notice the changes in colour for code 561, and the fastest, blinking for code 569.

When one of the code from range 571 to 579 will be sign in, we will chose one from nine of brightness level – from the lowest to the highest.

It is worth to notice that using codes from 561 to 569 and 571 to 579 in RANDOM mode let you for completely independent work of SPL-3 controller. Inputs IN A and IN B can be disconnect.

Codes 561 ... 569 and 571 ... 579 work also in DMX mode, in a display program, which is activated when the signal DMX-512 fail (when the display program was chosen as a reaction for signal DMX-512 fail – using code 661).

Codes 560 and 570 working only in RANDOM mode, as in the DMX mode there is no possibility to set in analogue steering signal on IN A and IN B inputs, because of the possibility of damages the other devices connected to main line DMX.

Codes 600 … 610 are connected with SPL-3 work with BUTTONS mode (code 551). While one code from 600 to 610 is entered - it set on one from the time-delay which is responsible for extension the lights short press the COLOR button. The time value which respond the particular codes are shown in table 1.
Description about SPL-3 in BUTTONS mode is in point 3.1.

Codes 621 and 622 activate function DIMMER which is available in all modes of DMX work. Function DIMMER let to regulate the brightness in all exits at the same time (CH1, CH2 and CH3) using only one channel DMX-512.
When the signal DMX-512 increased for code 621, the brightness of LED will also increased.
When the signal DMX-512 increased for code 622, the brightness of LED will decreased.
When function DIMMER is not necessary code 620 need to be sign in to turn this function off

Codes 631, 632 and 633 activate function STROBO which is available in all modes of DMX work. This function is responsible for blinking effect. The difference between these 3 codes rely on different length of blinking effect, which means different way of blinking LED diodes in the same level of DMX, and the same level of frequency blinking.
Function STROBO is activate when level of DMX >= 20, which is responsible for the slowest blinking, around 1 per second. The highest frequency is for DMX = 255 = several blinks per second.
Code 630 deactivate function STROBO and relieve DMX channel.

Allocation of the sequences DMX channels for function DIMMER and STROBO are in points 3.4, 3.5 and 3.6 of this instruction.

Code 651 activate WHITE BALANCE. This function have an important meaning in diodes LED RGB and tapes, where despite of the fully controls, it's not possible to receive white colour. It is also useful in few controllers SPL-3 which has a different shade of white color.

For example when despite of the fully controls in RGB, apart the white colour there is also red noticeable, the max lightness of red colour need to be decreased.

The maximum level for red colour is determine by signing in code 7xx, when xx = 0 to 99.

In the same way you can set the colors level for green, blue by entering 8xx and 9xx.

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The function WHITE BALANCE can be also used for changing hue of light colors eg. in RANDOM mode or to stronger or weaker lightning of defined color in freely mode of work SPL-3.

Code 650 turns off function WHITE BALANCE. This makes SPL-3 set for maximum brightness for RGB colors for 799, 899, 999 codes.

Function WHITE BALANCE works in all SPL-3 modes of work.

Codes 660 and 669 determine the way of SPL-3 reaction for lack of DMX-512 signal in all modes of work.
After one second of decay DMX-512 signal controller response in defined code entered.
The reemergence of DMX-512 signal at the inputs IN A and IN B causes an immediate return to the control outputs CH1, CH2, CH3 data from the received signal DMX-512.

2.5. An example of typical configuration of the driver SPL-3
   for working with DMX-512 signal:

001 - address DMX = 1 (address CH1/R = 1, address CH2/G = 2, address CH3/B = 3)
555 – work in DMX RGB mode
621 - active DIMMER on 4 canal DMX
630 – lack of STROBO function
650 – lack of WHITE BALANCE correction
661 – display program active while lack of DMX-512 signal
565 – medium speed of display program (colour changes)
575 – medium brightness of display program

Make sure these 8 codes are enter for requested work of SPL-3 controller.
The sequences is optional.

3. Modes of SPL-3 works.

SPL-3 controller can work in one from 6 different available modes after one of the code is sign in:

  1 – Buttons   – code 551
  2 – Analogue   – code 552
  3 – RANDOM   – code 553
  4 – DMX COLOR 1   – code 554
  5 – DMX RGB   – code 555
  6 – DMX MIX (COLOR 1 + RGB)   – code 556

Below you will find description of modes and possibility of light controls.

3.1. BUTTONS mode.

In BUTTONS modes the LED light control take place by using two buttons connected between IN A and IN B inputs, and the Voltage (V+) of SPL-3 controller is describe by draw on Fig 3.

The main function of these buttons is to change the brightness and the colour of LED diodes which are connected to the SPL-3 outputs. (BRIGHTNESS and COLOR).
The additional function of these 2 buttons is to turn on and turn off the lights, to start automatic and fluently changes these colours and to regulate the speed of these changes.

Below you will find the way to control the LED lights using buttons BRIGHTNESS and COLOR.

When turn on the SPL-3 controller LED diodes will light on with the colour and brightness which were memorized last time in EEPROM memory.
One short press the button BRIGHTNESS or COLOR cause fluently extinction of all LED diodes. It is possible to set the delay time of turning off the lights, while the short pressing the COLOR button. If for various reasons the user want the LED diodes went out with delay after pressing the trip the light (for example in order to safety remove themselves form the source of the light) then enter the SPL-3 driver control code in the field of 601...610 (see table 1). Then the COLOR button will not cause an immediate exclusion of light, just after deduction of the SPL-3 driver selected time delay. Range of delay times of light extinction COLOR button is from 5 sec to 60 min. The green diode LED signalize by short blinking counting the delay time. If during this counting any button will be press on, counting the delay will stop. When the code 600 will be sign in, it means that the time = 0 second is chosen and than pressing the COLOR button will turn off the light with delay. Pressing the BRIGHTNESS button always put out the light without delay no matter which codes from 600 …610 is sign in.
  Again short pressing BRIGHTNESS or COLOR (when the LED diodes exinction) cause turn on the LED diodes smoothly in the colour and brightness from before the turn off.
The codes 600 … 610 doesn't concern turning on the LED diodes, it is always take place without delay after a short press one of the buttons BRIGHTNESS and COLOR.
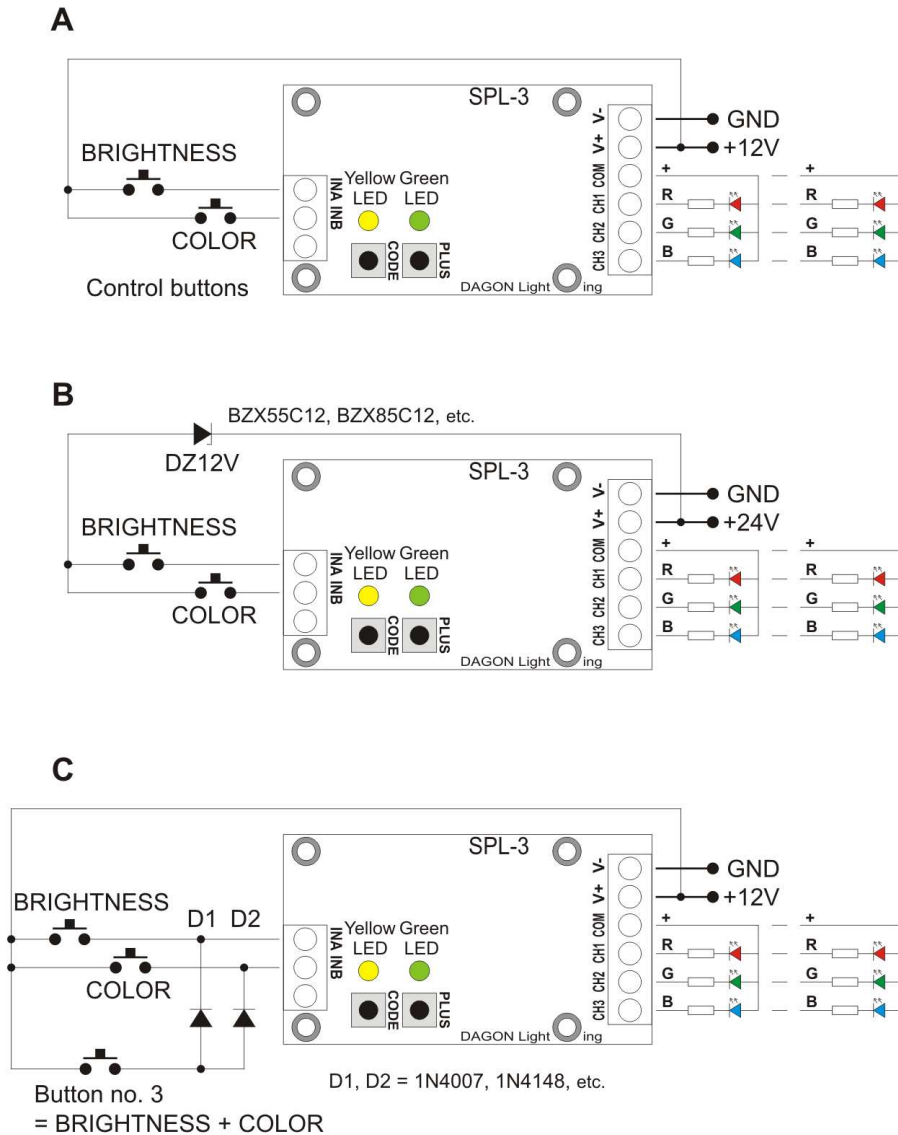
Fig.3. The method of connecting BRIGHTNESS and COLOR buttons to SPL-3 in BUTTONS mode.
   A – basic system
   B – Zener diode circuit for high power voltage SPL-3 to 24V
   C – circuit with additional no. 3 button which replaces simultaneously keys pressing the
       BRIGHTNESS and COLOR (D1, D2 - any low-power diodes)
       - for example, the automatic color change after the hold button no. 3

Ad. Fig. 3B – The Zener diode limits the voltage at the inputs IN A and IN B after BRIGHTNESS
               or COLOR pressing of the value applied voltage Zener diode.

    Not using the Zener diode in case of increased voltage SPL-3 to more than 18V will cause the
action of controll buttons as external configuration buttons – see the description of
HV CONTROL function in point 2.1.

Holding down the button BRIGHTNESS causes the smooth change brightness LEDs - brightening or dimming alternately in successive pushes of a button.
Lighten the color follow from 0 (completely extinguish of LED diodes) till the maximum intensity of colour in 5 seconds of continuous holding on the BRIGHTNESS button. While the further pressing the intensity of color also increases, all the diodes RGB lighten until they reach the brightness white color.

Holding down the button COLOR causes the smooth change color LED light, until you release the button - the selected color will shine constantly, until again no color change is activated by holding down the COLOR.

Colors changes fluently form white, through yellow, orange, red, violet, blue, light blue, green, yellow and again white. Or in inversely order depend on the next press the buttons, which provide light turn back the color.

Apart the smooth changes in colour it is possible to set in the step-by-step changes one of the basic colours. It is make by simultaneous pressing buttons COLOR and BRIGHTNESS. (button no 3 can be press with the same result - see draw Fig. 3C).

After the simultaneous pressing both buttons – the colour of LED change from white to yellow, red, violet, blue, light blue and green.

This option let comfortable and fast setting-in favourite or requested color, and than the brightness or hue can be smoothly change while short holding- on the COLOR button and then BRIGHTNESS button.

Force automatic color changing.

After a simultaneous hold on buttons BRIGHTNESS and COLOR for more than 1 second, the SPL-3 driver starts automatic, smoothly colour changes. Colors will change in the same way as during the continuous holding-on the COLOR button. Automatic colour change will go on since another simultaneous hold on two buttons, which stop the color changes.

While the automatic colour changes the button BRIGHTNESS works the same as while the static lightning LED diodes, so it means that it is possible to regulate the brightness – this time brightness the color changes.
One short press the BRIGHTNESS cause smoothly, complete extinction the LED.

The action of COLOR button while the automatic colour changes is slightly different. Another press COLOR button create the speed – color changes.
It is possible to set the speed form 1- 10, form the slowest till the fastest (fast flashing).

Memorizing the favourite colour in driver memory.

During continuous SPL-3 supplying there is no needs to make additional tasks to remember favourite color. The color will be remembered as long as the button COLOR is hold on for a longer moment while the new color will be set in.
Turning off and turning on the LED diodes by pressing the BRIGHTNESS button or pressing the COLOR button will not change the color settings.

The color memorize looks different when it is use an additional power supply switch. To memorize favourite color and brightness which should appear when the power supply is on, the button PLUS need to be pressed on. It will memorize in EEPROM memory actual color and brightness of diodes. Then the lights off and switching on the power switch driver will not change just memorized the color and brightness.

Temporary or periodic lack of voltage in power supply will not causes the changes in colors and brightness. That's why pressing PLUS at least once after the color setting is recommended.

Please remember the function memorizing the color and brightness through the button PLUS press works only during SPL-3 work in BUTTONS mode, and only where there is no automatic color changes.

Selection of control buttons.

Both buttons BRIGHTNESS and COLOR works as switches. When the SPL-3 driver works as a decoration lightning controller for example in the furniture, windows – display, it is recommend to use miniature buttons of any types.

Table 2. List of functions SPL-3 controller - BRIGHTNESS and COLOR.

Lp.	Activity of steering buttons	SPL-3 reaction
1	Short press of buttons BRIGHTNESS or COLOR	smoothly, fluently turn on / turn off LED RGB diodes
	Short press of button COLOR when the code 601 ... 610 is active	delay in extinguish the light - see description in point 3.1
2	Holding on button BRIGHTNESS	fluently lighten / darken LED RGB
3	Hold on the COLOR button	fluently changes in colours LED RGB
4	Short press two buttons BRIGHTNESS and COLOR simultaneously	Step-by-step color changes LED RGB on next with 7 basic colours
5	Hold on two BRIGHTNESS and COLOR simultaneously	start the automatic colour changes
6	Short holding on the COLOR while self-acting colour changes	change of speed colours - 10 available speeds
7	Press the button PLUS in SPL-3 - configuration button	memorize in SPL-3 memory colour and brightness (starter color and brightness after turn on the SPL-3 controller)

3.2. ANALOGUE mode.

In the ANALOG mode, LED light control is using two analog 0-10 V inputs connected between IN A and IN B, and the ground supply (screw terminal V-) driver, SPL-3 according to the diagram in Figure 4.
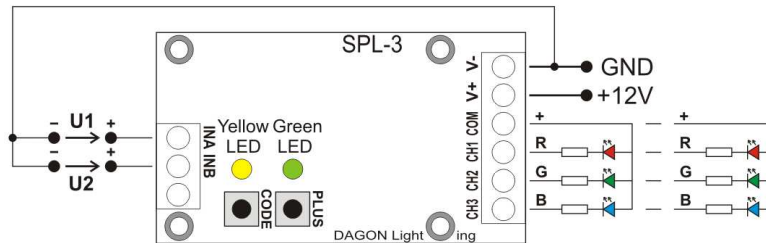

Fig.4. Method of connection the analogue signals to SPL-3.
U1 = 0-10V - regulation of color light LED diodes
U1 = 10-15V - regulation of automatic speed color changes
U2 = 0-10V - regulation of LED diodes brightness

Light color sets the value of the analog signal voltage at the input IN A range of 0V to 10V. For 0V light is extinguish.

When the voltage value increased the colour which will appear are: red, orange, yellow, green, light blue, blue, violet, pink, white and around 100 hues of middle colors.

It is possible to give the voltage higher than 10V. The result is activation of automatic and fluent color changes (as it is in BUTTONS mode of work). Changes the voltage from 10V to 15V regulate the speed of color changes form the slowest till the fastest (blinking effect).

Brightness level for every color change form 0 (completely extinguish the LED diodes) till maximum for the changes in steering voltage in IN B entry from 0V to 5V. For voltage 5V brightness of every color is the highest. When the voltage increase more than 5V the light intensity also increase until it reaches the brightest white color during 10V, irrespective of analogue signal.

The analogue signals can comes from different sources, eg. in the simplest case of the divider resistance or potentiometer setting the brightness and color of light. You can also connect to the inputs of SPL-3 drivers for issuing various types of analog signals 0-5V, 0-10V, 1-10V, 0-15V, for example, PLC or PC with built-in analog output card.

In the ANALOG mode should not be used for input SPL-3 control voltage higher than 16V, as they are reserved for HV CONTROL function (2.1 point).

3.3. RANDOM mode.

RANDOM mode allows for the completely independent work of SPL-3 controller without using any additional steering signals (DMX-512, analogue, buttons). The way of steering the LED diodes is decided by steering codes: 001 ... 500, 560 ... 569, 570 ... 579. These codes are describe in 2.4 point.

In SPL-3 controller there are defined 5 color pallets. Every pallet contains 10 different colours: black (LED diodes extinguish), red, orange, yellow, green, light blue, blue, violet, pink, white. Accurate hues of this colors depends on the types of diodes and LED tapes. Additionally the hues of the colors can be changes by using WHITE BALANCE which is available in all modes of work.
Every from 5 pallets in SPL-3 controller has the same colors, by there are arranged in different sequences – see table 3.

Table 3. Color pallets for RANDOM mode.

No of pallet	Number of color in pallet									
	0	1	2	3	4	5	6	7	8	9
0	Black	Red	orange	yellow	green	light blue	blue	violet	pink	white
1	Black	orange	green	blue	pink	red	yellow	light blue	violet	white
2	Black	yellow	blue	white	orange	light blue	pink	red	green	violet
3	Black	green	pink	orange	blue	red	light blue	white	yellow	violet
4	black	light blue	red	blue	orange	violet	yellow	pink	green	white

Palette selection is made by entering the first digit code from **0**00 ... **4**99 – digits 0, 1, 2, 3, 4 define color palette choice in RANDOM mode.
The second digit code from the above range 0**0**0 ... 4**9**9 – specifies the initial number of color, or color of the driver starts the LEDs light up.
The third digit code from the above range 00**0** ... 49**9** – specifies the number of final color, the color in which the controller has completed the LED lights up.
After reaching the final color of the driver goes back to the original color and the whole cycle repeats itself. Colors outside the selected range will never light up.
Final color number may be smaller than the initial color number, which will light up the color of the selected range in reverse order.

Colors of a selected palette and a selected range of lights are one after the other at a rate of change defined codes 561 ... 569.
For code 561 color changes occur approximately every 40 seconds (slowest changing colors).
For code 569 color changes occur several times per second, giving the effect of flashing LEDs (the fastest color change).
Additionally, code 560 to control the speed of color changes using analog 0-10V input given to IN A the driver SPL-3.
Codes 560… 569 are described more in the instructions point.2.4.

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The brightness of colours is determined by codes 571 ... 579.
For code 571 is the lowest brightness and highest for code 579.
Additionally, code 570 allows control the brightness of light by means of an analogue signal 0-10V given to input IN B to the driver SPL-3.
Codes 570 ... 579 described in the instructions point 2.4.

The above-described properties of the driver SPL-3 in RANDOM mode allows control of the large diversity of LEDs. With a lot of drivers SPL-3, you can configure each one differently to give the effect of diversity in color and brightness of individual points of light.

RANDOM mode also provides a smooth color transitions. After entering code 500 the driver's SPL-3 RANDOM mode will change colors in a smooth manner over the entire range of color (palette is irrelevant or range of colors).

During a smooth change of color in RANDOM mode, there also works features speed control and brightness changes, the work described above codes 561...569 and 571...579, and 560 and 570 codes to control analog 0-10V at the inputs IN A and IN B SPL-3 driver.

3.3.1 Example configuration of the controller SPL-3 for RANDOM mode.

553 - RANDOM mode operation
019 - chosen color palette number 0 and the color range from 1 to 9 – see tab.3.
650 - no white balance correction
561 - rate of change of color at approximately 40 sec
576 - slightly reduced brightness

These five codes must be entered into the controller SPL-3, to work in a desired manner.
The order of input codes is optional.

3.3.2. Example configuration of the controller SPL-3 for RANDOM mode.

553 - RANDOM mode operation
425 - chosen color palette number 4 and the color range from 2 to 5 – see tab.3.
   (red, blue, orange, violet)
650 - no white balance correction
566 - rate of change of color at approximately 1 sec
579 - the maximum brightness

These five codes must be entered into the controller SPL-3, to work in a desired manner.
The order of input codes is optional.

3.3.3. Example configuration of the controller SPL-3 for RANDOM mode.

553 - RANDOM mode operation
500 - smooth color change
651 - active white balance correction
   760 - reduced to 60% shade of red R
   899 - shade of green G max
   999 - shade of blue B max
565 - average speed of the smooth change of color
570 - the brightness control by signal 0-10V analog in input IN B

These 8 codes must be entered into the controller SPL-3, to work in a desired manner.
The order of input codes is optional.

Adjust the brightness of LEDs using the analog signal at input IN B can be used to make a simple light sensor controls the brightness of the LEDs connected to the SPL-3 - Figure 5. Included light dependent resistor should be exposed to daylight. When night falls light dependent resistor resistance increases and the voltage divider at the output of the R-LDR also increases. The result is a brightening of the LED at dusk and at night, and the dimming or total extinction of light in the day (at the time when around LDR is clear).

Using this solution in many cases, you can save electricity that would be wasted during power LEDs in the day when the glow is not necessary.

Choosing the type of light dependent resistor LDR and R-value resistor should be remembered that the input impedance input IN B is approx 16.7kΩ point GND system and, therefore, it is still attached to the parallel resistance LDR.
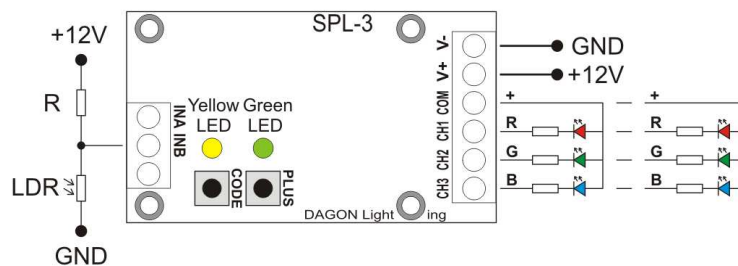

Fig.5. The realization of light sensor in the SPL-3.

R – resistor with a fixed value, LDR – light dependent resistor

3.4. DMX COLOR 1 mode.

To control the light in DMX COLOR 1 mode just 1 channel of DMX-512 signal. This is the DMX channel address (0 to 512) set in the SPL-3 driver.

For values from 0 to 20 in the channel control all the LEDs connected to the controller outputs SPL-3 are dimmed.

Values from 21 to 160 determine the color of the LED. Smooth change of value in this field causes a smooth change of color tone, the transition of one color into another. Appear in red, orange, yellow, green, cyan, blue, purple, pink, white and more than 100 shades of intermediate colors.

161 value activate automatically smooth change of colors. Increasing the value in the DMX channel from 161 to 255 user controls the speed of color changes from very slowly till the highest giving effect of flashing.

If there is a need to adjust the brightness of the LED, you must activate the DIMMER, which will be assigned another DMX channel address that is about more than one control channel address of the color of glow.

Similarly, you can activate the STROBE, which will be assigned another DMX channel address that is by 1 larger than the channel address DIMMER function.

If you activate the function STROBO without function DIMMER, an active channel for the STROBE function is DMX control channel again after the color of glow.

Thus, SPL-3 driver working in DMX COLOR 1 mode, one can use the COLOR of 1, 2 or 3 channel DMX-512, those sequence is as follows:

  1 – channel COLOR
  2 – channel COLOR + channel DIMMER
  2 – channel COLOR + channel STROBE
  3 – channel COLOR + channel DIMMER + channel STROBE

3.5. DMX RGB mode.

To control the light in DMX RGB mode uses 3 to 5 DMX channels, depending on the configuration of the controller.

The first 3 DMX channels (from the driver set the DMX address) always determine the brightness of colors R, G, B for the three outputs CH1, CH2 and CH3.

Another DMX channel can adjust the brightness of all colors at once, if the function DIMMER is activated during driver configuration.

The last DMX channel can activate the blinking of all LEDs flashing by adjusting the speed by changing the value of DMX in this channel, if STROBE function is activated during driver configuration.

If you activate the function STOBO without function DIMMER, an active channel for the function is the fourth STROBE DMX channel, that is, again after three channels.

Number and sequence assignment of DMX channels controller features SPL-3 in DMX RGB mode is as follows:

  3 – channel R + channel G + channel B
  4 – channel R + channel G + channel B + channel DIMMER
  4 – channel R + channel G + channel B + channel STROBO
  5 – channel R + channel G + channel B + channel DIMMER + channel STROBO

3.6. DMX MIX (COLOR 1 + RGB) mode.

Operating mode driver SPL-3 **DMX MIX** is a combination of modes **DMX COLOR 1** and **DMX RGB.**

To control the light in DMX MIN mode, is used from 4 to 6 DMX channels, depending on the configuration of the controller.

The first DMX channel (from the driver set the DMX address) works as a DMX COLOR 1 mode, which controls the color of the LED, after crossing the 20 and activates an automatic, a smooth change of color after crossing the 160 in the channel.

Another 3 channels, ie 2, 3 and 4 work as DMX RGB mode, or independently control the brightness of colors R, G, B. However, the work of channels 2, 3 and 4 is blocked if the value in channel 1 exceeds the fifth.

Therefore a priority in the DMX MIX mode is to control LED color value in the channel no.1. Channels 2, 3 and 4 are then inactive. Only after reducing the value in channel 1 to a value between 0 and 5 control of LED lighting control take over channels 2, 3 and 4.

As in previous DMX modes can activate functions DIMMER and STROBE, which will activate the channel number 5 and 6.

The number and sequence of assignments to channels DMX controller features SPL-3 in DMX MIX mode is as follows:

  4 – channel COLOR + channel R + channel G + channel B
  5 – channel COLOR + channel R + channel G + channel B + channel DIMMER
  5 – channel COLOR + channel R + channel G + channel B + channel STROBO
  6 – channel COLOR + channel R + channel G + channel B + ch. DIMMER + ch. STROBO

3.7. Additional information about the SPL-3 controller operation in all modes of DMX.

After connecting the power supply controller starts SPL-3 signal reception and DMX-512 control outputs CH1, CH2 and CH3.
Green LED indicates the presence of DMX-512 signal blinking fast.
In the absence of DMX-512 signal green LED does not blink, just lit continuously.
Yellow LED is off during normal operation in DMX mode.

Input IN A of driver SPL-3 corresponds to the DMX+ signal.
Input IN B of driver SPL-3 corresponds to the DMX- signal.

The ground of the GND (shield wire) DMX-512 can be connected to the input terminal of free SPL-3 (Fig. 6.) or to the power supply terminal V-, if there is a need to compensate for the potential ground of the transmitter DMX-512 signal and controller SPL-3.
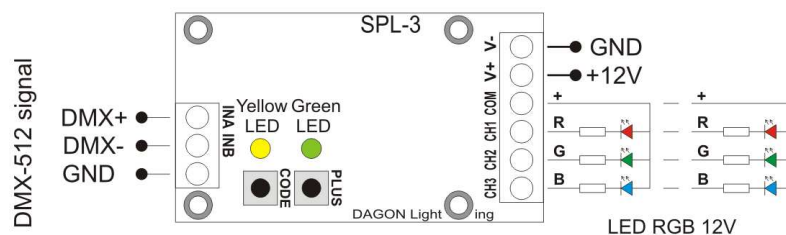

Fig.6. How to connect a DMX-512 signal to the SPL-3.

4. Conditions of safety and correct use of SPL-3 controller.

- comply with power supply conditions according to technical datas
- for connection diodes and power supply to outputs CH1, CH2, CH3 have to be use wires with the diameter huge enough, depends on electric current
- to connect the DMX-512 should be used special DMX shielded cable or shielded UTP
- all wires need to be protect against mechanical damages
- all the operation while connecting wires, assembly have to be carry out with disconnected power supply
- all the equipments need to be protect against water and humidity
- do not use lighting controlled by SPL-3 near the rapidly rotating machinery and equipment or rotating parts; the strobe effect gives the illusion of stillness rotating components illuminated with light-controlled pulse, which can lead to a situation hazardous to health and life, and even cause accidents

5. SPL-3 Technical data.

Power supply:	9-24V DC
Current consumption without load:	max 30mA
Number of PWM outputs:	3 – CH1 R, CH2 G, CH3 B
Output type:	OC (open collector, N-MOSFET)
Polarization of outputs:	common plus (common anode)
Load capacity of each output:	4A
Resolution of PWM signal:	16 bit
Frequency of PWM signal:	244 Hz
Method of control:	depends on mode of work SPL-3
- BUTTONS mode	2 buttons or joints
- ANALOGUE mode	2 analogue signals 0-10V to 15V
- RANDOM mode	stand-alone SPL-3 work
- DMX COLOR 1 mode	DMX-512 signal
- DMX RGB mode	DMX-512 signal
- DMX MIX mode	DMX-512 signal
Number of DMX occupied channels:	1 to 6 depends on configuration
Range of temperature and work condition:	+5°C - +45°C, dry place
Dimensions:	65 x 37 x 25 mm

16-bit PWM output resolution used in the SPL-3 provides a linear signal for the human eye, adjust brightness RGB LEDs connected to the outputs CH1, CH2, CH3.

High frequency of PWM signal (244Hz) causes the flicker effect (generated by controlled RGB LED PWM pulse signals) is not visible to the human eye, the light is seen as stable (continues).

However user should, always remember to keep safety conditions of SPL-3 using - see point 4 - the last text reference.