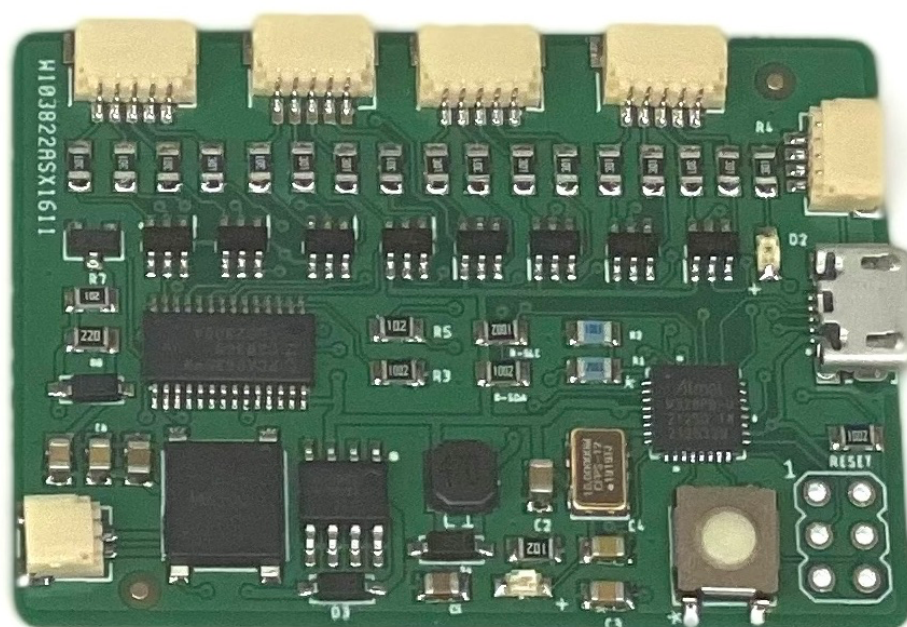




# Model Train™ TECHNOLOGY

## 16 Port LED Lighting Controller – LLC-5 LLC MICRO-5 USER MANUAL



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WE APPOLOGIZE FOR ERRORS IN THIS MAUAL – IT'S A WORK IN PROGRESS



# INTRODUCTION

The **MICRO-5** LLC (LED Lighting Controller) is a significant upgrade to our original MICRO board. The only way to configure the original MICRO board was with DCC. Now, the MICRO-5 can be configured by connecting it to our LLC Main Unit via a USB cable. The LLC Main Unit was also upgraded with an LCD text display. These new features make deploying sophisticated animations anywhere in your layout easy and fun!

Although connecting the **MICRO-5** to the Main Unit is certainly the easiest approach, you can still configure all the capabilities using a DCC system by writing CV's

There are three version of the MICRO-5: Solder Pads (PADS), JST connectors (JST) or LED. The LED board allows you to test animation configurations in a live manner.

All **MICRO-5** boards have a 4-pin JST socket that is used to connect to the 16 channel **Sensor Hub**. The **Sensor Hub** allows you to connect remote switches and sensors (like our Precision Detectors) to turn any one or more of the **MICRO-5** ports on and off.

The animation capability of the **MICRO-5** and the LLC-5 Main Unit are identical.

The **MICRO-5** board can supply up to 2amps of LED output, provided your power supply is also rated to 2A(12 VDC). Each Port is rated up to 250ma (milliamps) but you must stay within the total of 2000ma (2amps) for the whole board.

The **MICRO-5** can be powered from The MTT Power Module, a 12VDC power supply or DCC rails.

Here are the special effect behaviors for reference.

- Adjust each LED for individual “brightness”
- Flickering
- Blinking with individual pin on/off speeds
- Rotating Beacon (simulation)
- MARS simulation
- Fade on and off (timing adjustable to 18 hours)
- Random on/off with adjustable pace (all pins or one pin)
- Step, Chase, Race – each LED on/off in sequence
- Flashing – alternate two port
- TV Simulation (use 2,3 or 4 LEDs)
- Arc Welding
- Lighting

*\* Some speed settings apply to all LEDs whereas blinking and brightness settings apply individually to each LED (they can be different). If you have multiple boards with the same DCC address but you program them separately, they will perform based on the board specific configuration.*

You can configure and control the MICRO-5 from your DCC system. That also means you can use jmri ([www.jmri.org](http://www.jmri.org)) or Railroad Automation (RRAuto.com) software.

The MICRO-5 is a customized, purpose-built circuit that has been pre-programmed, so you don't have to.

**NOTE:** *Digitrax user must operate the speed control with the train direction FORWARD. NCE and other operate the speed control with the direction in REVERSE.*

## OVERVIEW

Your board comes configured as address 3 per NMRA® standards.

The **MICRO-5** has a DCC onboard decoder that allows you to both configure and control your lights remotely.

There are two types of decoder in the DCC eco-system:

- Multifunction decoder (Default Setting)
- Accessory decoder.

The **MICRO-5** can operate as either of these which gives you great flexibility in how you want to set up your lighting animation. This means you can set up switch to control that turn specific lighting effects on and off.

With this newest release of the **MICRO-5-a** we have added triggers that can be activated by your DCC system or by external switch or sensors via the **SENSOR HUB**. They only work in Accessory mode.

## QUICK SET USING THE BUTTON

There are Five options using the onboard push button. They are listed below:

PUSH BUTTON OPTIONS	
4	Accessory Mode
5	MultiFunction Mode
6	FastBoot ON
7	FastBoot OFF
8	RESET to Default

**In order to program CV's using the Programming Track of your DCC system, you must set the board FastBoot to OFF.**

# SETTING THE BOARD ADDRESS

There are two ways to change the board address:

1. Connect the board to a programming track and set the Address CV (#2) for short addresses up to 255, Or, to whatever address you like. Long and Short addresses work just as they do with locomotive decoders.
2. Connect the board to the main line DCC power and use the built-in programming mode to set an address that borrow from the switch addresses. This is highly dependent upon the make and model of your DCC system. For example, the Digitrax® DT400 goes to 999 but the DT500 can reach to 2044. Above that you will need to use the programming track.

The board has four "modes" of operation:

1. Connected to a DCC line the LSC II can operate in:

Operator Mode. In this mode each pin can be turned On or Off, Fade On and Off or Random to On and Random to Off. There is also an ALL on/off option.

Configuration Mode (F1). In this mode individual LED and board level setting can be configured and saved. (Note: all the settings can also be activated by setting CV's (configuration variables) using the programming track.

Animation Mode (F5). In this mode the simulation of Blinking, Flashing, Always On and Random On/OFF and TV Simulation on each pin of the board (based on your configuration) is activated.

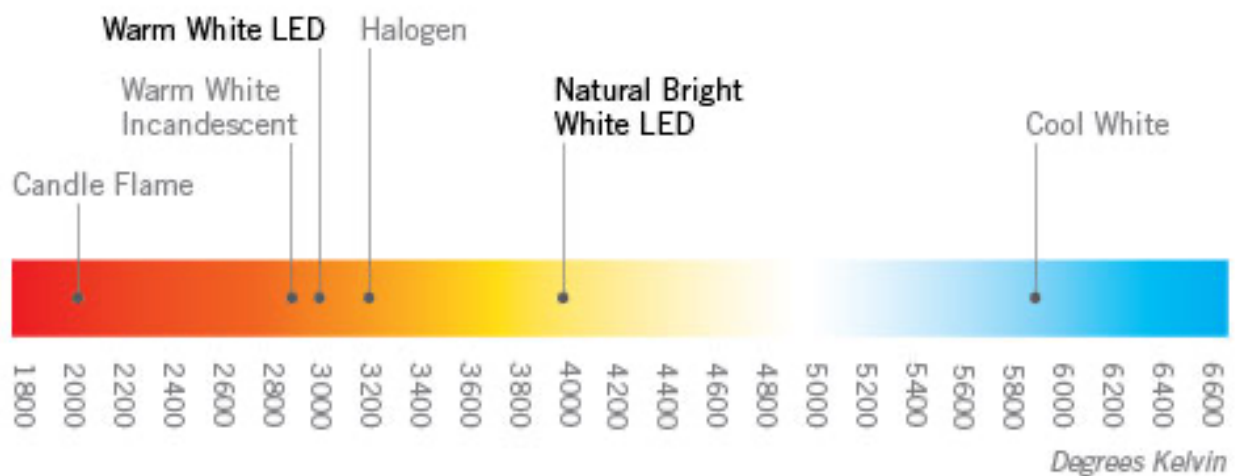
## 2. Non DCC Powered Mode. (this is cool)

DCC Track power is precious, particularly if you have a big layout or are part of a club. To accommodate the requirement to have accessories run off non-DCC sources we have built that capability into the board.

Once you have decided what you want each of the 16 pins on the board to do and you have configured the board via your DCC hand controller or Ops mode, you can unplug it from the DCC line and plug in a standard 12DC 2A supply. After a few seconds (configurable) the board will determine that it has power but no DCC signal. At that point it will automatically kick into Animation Mode just like F5 above.

One thing to note about SMD LEDs, they are very sensitive to heat from say, a soldering iron. They melt very easily. That is why we solder the LEDs onto the "chip" board for you. You can buy these from us wired or un-wired and you can solder the wires onto the "chip" yourself. It's easy. We have 4 white "colors" available labeled with "K" (Kelvin) to indicate the "temperature" of the light. They don't actually get hot, but light is measured by its temperature. For example, there is "warm" white and "cool" white. The lower the value the more yellow it will be, whereas a higher value will have a bluer color. We also have a TV Sim "chip" that has a blue and white LED and an RGB "chip" for a Color TV Sim – or anything else you can dream up. Below is a color chart for your reference:





Note: Everyone knows that the blue part of flame is hotter than the orange part. With that in mind I can see that the blue area of the above chart should be “hotter” and have a higher degree Kelvin associated with it. Then why is it called “cool” and the cooler part down near 3000k called warm? We found out that it is described by the way it **looks** that makes it “cool”, not the physics. Just thought you might like to know. Confusing, but we’re stuck with it.

NOTE: This board has a DCC Auto-sensing circuit. If there is power to the board but NO DCC signal – either because you didn’t connect it or the DCC system is off – after 5 seconds the board will switch into Animation Mode (discussed further below). The default Mode setting for all ports is ON. You can change that in the configuration process.

1. Plug in wired LEDs into the sockets labelled P1-16
2. Press F0 ON to test that all LED pins light.

## A few things to keep in mind:

We will be using the function keys and the speed control of the DCC hand controller to set the configuration of the LED controller board. This causes a few weird behaviors in particular

with the speed control switching from one mode to another. My advice is to go slow and follow the steps one by one. Additionally, there will be a few sequences where you might get stuck. In that case, turn off all the function keys and use F0 to turn All the LEDs on and off. This doesn't do anything more than confirm that the board is working and that you are back at the start.

We primarily use the Digitrax system for the reason that we can "see" the status of the first 12 function keys on the main controller. NCE systems only show the first 6 so you have to toggle the EPXN key to check the status of others. The ESU controller shows the function keys but the current firmware doesn't allow you to show the function number. Instead they want you to assign icons – but there are not enough, and I can't remember what icon is what number. As crazy as that is, they say that they are going to fix it in a future version.

## PORT behavior description and options

Each pin is assigned a MODE. The default Mode is On [1]. 1 is the value of the CV that you store for that pin to make it exhibit a special effect when in Operation, Animation or Non-DCC modes.

Each port can be assigned only ONE behavior at a time. Of course, you can change that behavior anytime. In fact, one of the by-products of how we use the function keys and throttle of the DCC controller is that you can both control the board (the LED scene) AND configure the board via software such as Railroad Automation or jmri without disconnecting the board from the layout or using the programming "track".

To change the configuration of a pin you have to stop Animation mode (F5 OFF) and then make sure all other function keys are also off. This is explained further in this manual.

The port behaviors and their CV values:

Value	Behavior	Notes:	Animation
0	disabled	No output on this pin during animation.	No
1	Always on	On during animation; ignore Random	Yes
2	Flicker	Simulates oil lamp or fire	Yes
3	Blink	Blink speed On/Off configured for each pin	Yes
4	Beacon	Simulates a rotating beacon	Yes
5	Fade	Fade on and off to a timed cycle	Yes
6	Random	Default mode	Yes
7	Step	Sequentially turn LEDs On/Off with F0	Yes
8	Flashing	Use to create alternate pin Flashing	Yes
9	TV Sim	Simulate a TV (using Blue & White LEDs)	Yes
10	MARS	Simulate a MARS style light.	Yes
11,12,13	Arc Welder	13,14,15 – different time gaps between cycles.	Yes
14,15,16	Lightning	16,17,18 – different time gaps between cycles	Yes

## Operator Mode versus Animation Mode

If you use software to control your layout and if it supports controlling Function keys, then you can control the LED Scene Control board using software – which is one of the several ways we control the animation on our demo layout.

There are also a few animations that are possible to activate in Operator mode. See the chart below:

The available Functions in Operator Mode (F1 OFF) are:

Function Key	Behavior	Comments
F0	All Pins On/Off	Also used to check everything works.
F4	Adjust all Pin Bright level	Forces all pins to same Dim level; use F2 to save
F8	Alternate pin Flashing	Overrides individual mode setting; all pins

## Use of Function Keys

Function Keys are used to both configure the board and to control its operation. Therefore, keeping track of which functions are on and off is important to keep things running smoothly. The F1 key is used to switch into Configuration mode. When F1 is On, the other function keys will behave differently than when it's Off.

F2 has a special role and since it is configured 99.9% of the time as a momentary Horn, we will use it to the SAVE configuration options. You press the F2 key when you want to save something and then the LEDs will flash to tell you it worked. If the LED's don't flash, something is not right.

F2 is also used to send the board into Address Configuration mode. This is a little trick we designed into our LED light boards for passenger cars and we implemented it here as well. I was never a fan of having to move my trains to a programming track to change their configuration. Instead, with some minor limitation we invented a way to change the address of a board while it is connected to the live DCC track – without impacting or changing any other decoder on the layout. Check out the Address Programming section but for now, just note that F2 is "special".

The LSC II uses Function F0 through F8 to configure and control the pins on the board when in MultiFunction mode. This mode allows very basic configuration options. The full range of configuration are only possible via the LLC-5 Main Unit or via DCC programming mode.

## Use of the Speed Control

We primarily use the Digitrax® system so there will be some variation with your system when it comes to how the speed controller behaves. We support NCE and ESU and any other NMRA compliant DCC system. And while we have been testing the controller with as many different systems as we could, we are sure there will be a few hardware configurations we haven't seen yet. If you have an issue like this, please contact us so we can update the design to support you.

If there is anything that will confuse you as you configure the controller it will be the behavior of the speed control. After a LOT of consideration, we decided that putting more functionality and flexibility into the controller was more important than super simple. Here is why you might get confused as we did the first time.

We give you the option to configure each pin individually. The way you select a pin to configure is with the speed controller. Press F1 and then turn the **speed** dial to any value between 1 and 16. As long as no other function keys are on, the LEDs connected to each pin will light. If you select 8 on the speed control, pin 8 will light. (consider our LED test board to simplify setup)

If you are a Digitrax user, you will notice a slight idiosyncrasy when you turn the speed controller. Occasionally you may feel two “clicks” of the dial when the lit LED only moved by one. This is because the range of speed in DCC is 0-127 (128 speed steps) but the dial on the Digitrax hand controller is only two digits to represent 0-100%, not the actual internal speed step. Actually, it only goes to 99 on the Digitrax system. That means each click is 1.28 not an even 1. So, we have to do some math to make sure that when the dial says “5” – it really is 5 on the inside.

Since we also support the NCE Power Cab and others, we had to figure out a way to easily control this behavior and determine if you have the full 128 Speed steps or the simulated 0-99% for Digitrax.

**DIGITRAX SPEED CONTROL – Set the LOCO Direction to FORWARD.**

**NCE and all OTHERS – Set the LOCO Direction to REVERSE.**

That part is simple. If you dial a value above 16 no LEDs will light. Likewise, if you choose zero. Now that you have pin 8 dialed in, press F4. This is the key to activate adjusting the LED brightness. The moment you press F4, the LED on that pin will light to a value of 8 – since that is where the speed dial was when you selected pin 8. It will be fairly dim. Now adjust the speed control to brighten the LED. You can go all the way to 99! Is that the brightness you want for that pin? Ok, then press F2 – SAVE. The LED on pin 8 will flash a few times letting you know that it saved your brightness setting. Done. Right? Ok, now turn F4 OFF – this deactivates the brightness adjustment mode. What happened – no LED’s are lit and pin 8 LED went off! Yep, because the SPEED control is still set at 99 or whatever your last setting was if it is above 16.

If you now dial the speed control back to 8, the LED will go back on and you will see the new, adjusted and probably a brighter setting for pin 8. Now you can use the speed dial to pick another pin and adjust its brightness and other configurations and so on.

If you followed that then you are all set! You can only pick a pin from 1-16 but you will use speed controller to adjust for **Values** that are usually above that. This will occur for each instance where you want to set the Mode, adjust the Brightness setting or change the speed of Blinking for individual pins. This will not happen when you set the speed for Flashing, Fade, Random or Step since those are board-specific and affect all pins identically. We usually set the brightness to between 25 and 50. Above 50 isn't necessary because your eyes can't distinguish the difference.

## Setting the LSC II Address

The LSC II default address is 3. If your board is acting flaky or you can't remember the board address, you might need to resort to a RESET. There are two methods. The first is to set CV8 to 1 via the programming track – if you have to resort to that. By the way, this method does NOT reset your configurations of the pins. If you need to flush the pin settings use the next method.

The other way is as follows:

**RESET (LSC II with CASE):** Refer to the KEYPAD manual.

**RESET** – press the reset button briefly on the controller board. After 5 seconds ALL the LEDs that are connected to pins will flash a few times. When the LEDs go out, your board will be

back to factory defaults. We recommend that you power down the board for 5 seconds (just unplug the power) and then restart it. Everything should be back to normal and the address for the boards is back to 3.

As mentioned, you can always use the programming track methods, otherwise known as DCC Ops mode - to program the address. In that case, the pin configurations will not be set back to defaults.

## Setting the board Address with F2

1. Connect the board to a DCC layout and turn the power on.
2. Turn OFF all function keys.
3. Press and hold F2 for ~ 5 seconds. NCE use the HORN button.
4. Wait for ALL the LED's connected to the board to flash
5. The board is now waiting for a SWITCH address.
6. Press the SWITCH key on your controller or ACCY for NCE.
7. Select a switch number ( 1-2044 based on your system)
8. Press either Close or Thrown (1 or 2 – it doesn't matter). The LEDs will stop blinking.
9. Press EXIT to exit the switch mode and return to normal operations.

That's it. Now select the "Loco" for the address you just programmed into the board. Press F0 to test that it works by lighting all the LEDs.

If you chose an address for your board that is ALSO the address of a switch on your layout – don't panic! Although the switch was thrown or closed when you hit C or T on your hand controller – it did nothing else on your layout nor did it change the switch control address. (That is unless you somehow put your switch



controller into to “address setting” mode at the same time. That is not easy to do so we don't expect it to occur too often.)

For convenience, I use addresses for my **MICRO-5** that start at 1,000. That way I won't confuse myself with the layout switches. With 2044 possible addresses, it's unlikely that you will need to use the programming track but it's there if you do.

## CONFIGURATION MODE FUNCTIONS & SPEED CONTROL

Function Key	Use & Behavior	Comments
F0	Switch On/Off time for Flashing	Used with F3 Blink speed setting to switch from On time to Off time
F1	Enter Configuration Mode	Use F1 to activate Configuration mode, Animation will stop.
F2	Save Settings	Push once to save. LEDs will blink to confirm a valid settings was saved.
F3	Switch to MODE select	With F3 On, use the speed control to select a pin MODE number.
F4	Adjust pin Brightness level	



## OPERATOR INSTANT-FX FUNCTION KEYS

Function Key	Behavior	Comments
F0	All pins On/Off	Overrides all functions, except when F1 in on.
F4	Adjust All Pin Brightness	With F0 -forces all pins to the same bright level, use F2 to save
F5	Activate Animation	Turns on the system to animate as per settings.
F6	Random	Random On/Off. F6 OFF after having been on will turn off LEDs at Random till none.
F7	Step mode	Pins On/Off in sequence. Use with F0 to activate
F8	Alternate Flashing	All pins flash alternately odd/ even.

## Behavior of the “MODE” of a pin for Animation

Each of the 16 pins on the LSC II can be set to behave differently for the purpose of Animation Mode F5. When F5 is activated, the Mode setting of that pin directs its behavior with a few the exceptions that will be mentioned. The Mode can be set via the configuration mode F1 and F9 explained in the next section. There are 10 modes that will activate for the animation:

	Mode Value
• Always off	0
• Always on	1
• Flicker	2
• Blink	3
• Beacon	4
• Fade	5
• Random	6
• Step	7
• Alternate Pin Flashing	8
• TV Simulation	9
• MARS	10
• Arc Welder	11,12,13
• Lightning	14,15,16

The speed of Fade, Blink (time ON and time Off) for each pin can be adjusted separately.

The speed of Beacon, Random, Step and Flashing can be adjusted but that setting affects all pins equally.

Flickering and TV simulation are not configurable.

Blink - a single LED pin at its configured speed On/Off.

Beacon – the LED will fade up and down and flash briefly at the highest point of the fade cycle.

Random – turns LED pins on and off randomly. When in Operations mode – F10 - the F6 controls whether the lights sequence “spools” up or down. In other words, the sequence will randomly turn the lights On/Off to about 80% (default) of the pins being On at any one time when F6 is on. After the lights have been randomly on, turning F6 OFF will randomly shut off the lights until they (the pins with Random set = 6) are all off. The other Modes will continue to operate.

In non-DCC connected mode the default for F6 is On – which means the LEDs will keep randomly repeating.

Flashing – alternate flashes any Odd/ Even pins.

TV Simulation – randomly turns one or more LED pins on at varying light levels to simulate the changing scenes on a TV. An RGB LED “chip” is available to simulate a color TV. This requires four (4) LED pins – three for the RGB LEDs and one for a white (6500k) LED chip. For black and white TV simulation a single Blue and White TV “chip” is recommended. To make this work best you will want to adjust the bright level of each of the pins so that one color doesn't overwhelm the other.

Very likely you will want to adjust the light levels down so that the varying brightness that occurs randomly can be seen.

MARS – fades the pin up and down with a brief flash every other cycle.

Arc Welding – a random cycle of flashing with brief pauses – three settings are available that determine the length of time between cycles – or how fast the worker is working.

Lightning - as series of flashes with periodic sub-flashes - a random cycle of flashing with brief pauses – three settings are available that determine the length of time between cycles.

## STEPS TO CONFIGURE THE CONTROLLER

### 1.1 Setting the Pin MODE [ F1 ] [ F3 ]

- a) All Functions Keys OFF
- b) F1 [On] - enter configuration mode
- c) Select LED pin by using the speed dial (1-16) – Pin will light.
- d) F3 [On] - disables pin select mode; now select the MODE (0-12) with the speed control.
- e) F2 [Press Once] – selected pin LEDs will flash to confirm SAVE of new bright level for pin.
- f) F3 [Off] – Exit Mode Select adjustment; now in pin select mode.

This is where I mentioned you might get confused if the LED is not lit. Check the speed dial – is it between 1 and 16?

- g) Use the speed dial to select another pin to adjust OR,
- h) F1 [Off] Exit pin configuration mode.

## 1.2 Configure ALL LEDs Bright Level [ F4 ]

- a) All Function keys OFF
- b) F0 [On] – all LEDs should be lit
- c) F4 [On] - LEDs will dim to the setting on the speed dial.
- d) Adjust the speed dial 0-100% to your liking.
- e) F2 [Press Once] – all LEDs will flash to confirm SAVE.
- f) F4 [Off]

Note: This is the only configuration that can be made without using F1.

## 1.1 Configure a single LED pin Bright Level [ F1 ] [ F4 ]

- i) All Functions Keys OFF
- j) F1 [On] - enter configuration mode
- k) Select LED pin by using the speed dial (1-16) – Pin will light.
- l) F4 [On] - disables pin select mode; now adjust the brightness with the speed control.
- m) F2 [Press Once] – selected pin LEDs will flash to confirm SAVE of new bright level for pin.
- n) F4 [Off] – Exit brightness adjustment; now in pin select mode.

This is where I mentioned you might get confused if the LED is not lit. Check the speed dial – is it between 1 and 16?

**\*\* Make sure your speed DIRECTION is set: Forward for Digitrax and Reverse for all others.**

- o) Use the speed dial to select another pin to adjust OR,
- p) F1 [Off] Exit pin configuration mode.

- q) Test the selected pin by pressing the function key for that pin:  
F11 = pin 1, F12 = pin 2, F13 = pin 3, etc.
- r) OR, F0 will turn on all pins and you can evaluate the pin that you configured.

## 1.2 Adjust Individual Pin Blink Speed [ F1 ] [ F10 ]

Each of the 16 pins can be set to blink, and each can blink on and off a different rate. When you use F10 below to activate the adjustment of the blink rate, the MODE setting for the pin may or may not be set to Blink. In fact, the default for all pins is Random(6). However, when you press F2 to SAVE any adjusted blink rate, the controller will also set that pin's MODE setting to Blink (3). It assumes that is what you want to do so that when you activate Animation with F10 – the pin will, in fact, blink.

If you don't save the Blink settings with F2, the controller will abandon your adjustments and use whatever the set MODE setting is – which may not be Blink(3)

- a) All Functions Keys OFF
- b) F1 [On] - enter configuration mode.
- c) Select LED pin by using the speed dial (1-16) – Pin will light.
- d) F10 [On] – Pin will start blinking at the existing saved setting which could be the system default. Since F0 is Off, the blink rate you will adjust first is the OFF time. Use the speed dial to increase the time the LED is off.
- e) F0 [On] – Adjust the time for the LED to be on.

\*\* F0 Toggles between controlling the ON time and the OFF time.

- f) Use the speed dial to adjust the time the LED is on.

- g) F2 – Press once to save the settings. All the LEDs will flash to confirm the setting was saved.
- h) F10 [Off] – turn off adjusting the LED blink timing. If you still have F1 on, you will need to adjust the speed dial to get back in range 1-16 for any of the LEDs to light.

Note: if you turn F10 Off before you save the new settings, the pin will revert back to the system stored settings.

A good way to test this new setting is to press F5 On to activate the Animation mode.

## 1.4 Set the Fade Mode/Speed on individual pins

Set the pin to MODE = 5 to turn this pin to Fade on and off on a cycle. We use this to have the street lights go on and off for example. To adjust the time you will need to change the CV's for the time ON and the Time OFF for this pin. The CV's for blink time on and off and Fade mode timing are the same so. The Mode setting determines what FX the pin will exhibit.

The CV for Fade time On are 160-175. Pin one is 160, pin 2 is 161, ect.

The CV for Fade time OFF are 176-191, Pin one OFF time is CV 176, pin two is 177, etc.

The default time multiplier is 10 seconds. So, a CV value of 2 will result in a fade time On or Off of 20 seconds.

The time multiplier CV is 117. You can set this to a max of 255 and you can set the time On or Off to 255 which would result in a time On or Off of 65,025 seconds. That is 1,084 minutes or about 18 hours!

A characteristic of the fade behavior is that the number of “steps” that the fade will execute is directly related to the brightness – which can be set individually for each pin. That means that the pins will fade up and down at different apparent rates based on how many “steps” it has to take to get to or from the bright level. A pin set at bright level 25 will finish sooner than a pin set at 50 or 99.

Finally, the amount of light that the LED emits at 25%, 50% and 99% is not linear. It follows a curve which has the effect of making the fade more apparent between a bright setting of 10% and 20% than between 50% and 99%. It’s just the way the LEDs work and how our eye perceive it. You can speed this up or slow this down with CV 116 which is at a default of 25. You can increase it or decrease it but know that this CV affects ALL fade operations for all pins. Therefore, if the brightness level is different for different pins the Fade Speed CV 116 will affect all of them. To get the same fade speed among pins, adjust the brightness to match.

## 1.5 Adjust the Random Delay – All Pins - [ F1 ] [ F6 ]

The Random behavior affects any pin where Mode = 6. However, pins that have been individually turned on/off by a trigger will stay lit and will be skipped until they are “manually” turned off via the function keys. If you want your animation to turn on



certain LEDs and keep them On, set their MODE to 1 (always on). Mode 1 only activates during F5 – animation.

You can activate Random while NOT in Animation Mode by using F6. In this way the other animations such as always on, blink, flashing and TV will not activate. Only LED pins set to Random will activate.

In Animation Mode and DCC connected, once you turn F6 on and at least one LED has come on, the controller knows this. Then what happens when you turn F6 Off is that the controller will keep behaving randomly but it will turn the LED's off until eventually they are all extinguished, again, except for those you manual turned on with function F11, F12 ~ F26.

The Random delay setting has the effect of stretching out the pace of the "randomness". Since the whole behavior is random including the timing, we can't tell you exactly by "how much". The default setting is 5 so if you change that to 50, for example, it will really stretch the timing – which is what you might want. 5 is the setting where it changes enough to keep the scene interesting.

During Animation mode roughly 85% of the LEDs will be on. You can change this by setting CV 116 to a number lower than 60 (default) so that for example, only 20% of the LEDs are on at a time.

- a) All Functions Keys OFF
- b) F1 [On] - enter configuration mode.
- c) F6 [On] – activate Random delay control – nothing visible will happen.
- d) Adjust the speed control to increase or decrease the value of the delay setting for all pins. 5 is the default and 1 is the

minimum. If you try to set it to 0 pressing F2 will not flash – meaning that it did not save the value.

- e) F2 – Press once to save the settings. All the LEDs will flash to confirm the setting was saved.
- f) F6 [Off] – Exit setting Random delay
- g) F1 [Off] – Exit Configuration mode.

## PROGRAMMING DIRECTLY TO CV's

When using your DCC System to write directly to CV location, the MICRO-5 does not know that. In other words, it can't see that a CV value has changed. When the MICRO-5 starts up it loads the CV values it needs from the chip memory. In order for the MICRO-5 to respond to changes you make, you must either reboot the device by disconnecting all power.

Alternately, and usually the preferred method is to use the following sequence to Reload the CV variables:

Press F4+F5+F6 while in operations mode. Then press F2 (Horn) momentarily. Any connected LEDs will flash. Then turn F4, F5, F6 off. F5 back on will activate animation.

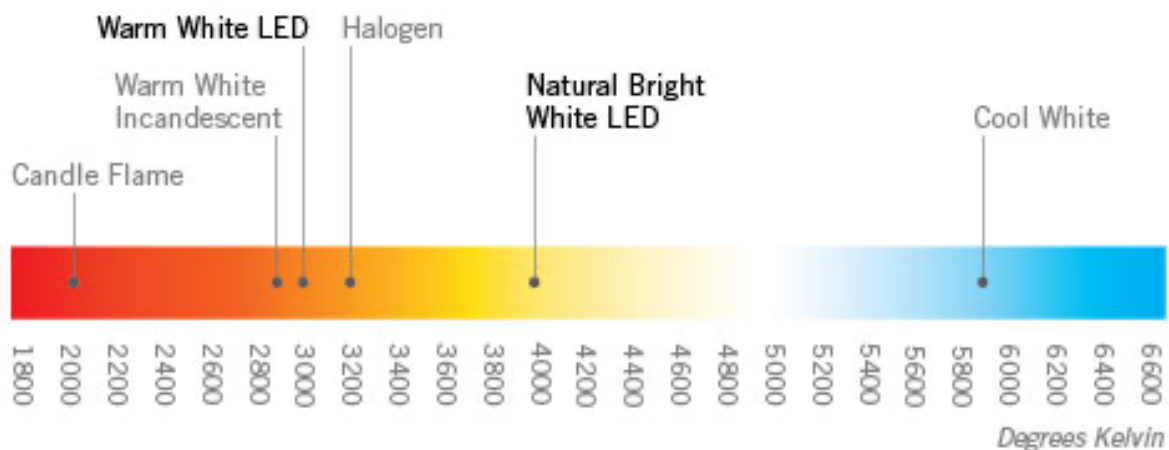
Digitrax: to write AND read CV's you must connect the MICRO-5 to the programming track.

NCE and most other system can use the Programming from Main (or equivalent) to Write CV's. This is the most convenient method when once the board is installed in the layout.

- Remember to use the CV Reload function after any change or group of changes you make directly to CV's. (F4+F5+F6; F2).

LED "chips" are available in the following colors:

- 2000K
- 3000K
- 5000K
- 6500K
- TV Sim (Blue & White)
- TV Sim (RGB)



## OTHER NOTES:

- Remember to Reload the CV Variables after using direct CV writes. (F4+F5+F6, then F2/Horn)
- Some FX work with several ports in unison. Step, Chase, Race and TV sim work this way by design. But you can also mix effects on different ports. For example, you might use an Arc Welding FX with a flicker effect on a red LED to simulate the hot metal.

On one of our displays we have a HO police car that we kit bashed from Woodland Scenic. We connect the headlights, rear lights and the top Red beacon to three different LSC II ports and three different effects.

Step, Chase and Race require a group of adjacent pins to make sense. The effect will turn each light on in sequence with a small timing gap between them.

- The MARS effect uses the Beacon Timing. Therefore, to set the speed of the MARS effect, set the PORT to the Beacon setting that corresponds to the desired speed. Save it. Then change the Port FX to Mars.
- Fade – Fade timing is by default in 10 second increments. This can be increased or decrease via CV #127. The range is 1-255. The duration of the ON time and OFF time are set via the keypad or CV's. (see the chart). The range is 1 to 255. Thus with 255 set to a port ON and the seconds increment set to 255 you can have a timer that is 65,025 second or 18 hours long! That is extreme but this wide range allows you to set your layout animation to turn the lights on and off to a

24-hour cycle. For example, ON for 12 hours and then OFF for 12 hours, or On for 18 hours and OFF for 6. The LSC II does not have a real time clock (RTC) so it's only counting seconds from when the device is powered and animation is activated. It doesn't know what time of day it is.

- Welding 1,2 and 3 use different time gaps between activity. 1 is the shortest and 3 is the longest. Combine these on different Ports so that one activity FX is the white-hot arcing and the longer period could be a RED led meant to show the red-Hot arcing.
- Lighting – setting them Mode to 14 follows the value in CV 125 which is a 1-minute delay by default. Lighting 17 divides this by  $\frac{1}{2}$  and Lighting18 doubles the value.
- The Step FX turns on and off LEDs in sequence starting at Port 1 (if it is set to a 7 series) through to 16. It will skip Ports that are not set to a 7 series 71-79)
  - The Race sequence repeats by starting at 1
  - The Chase sequence repeats by going backward from 16, then forward at 1, so back and forth.
  - Each LSC II can either Race or Chase but not both simultaneously.
- DCC Signal Scan is the amount of time that the **MICRO-5** waits after power on to switch into animation mode if it does not detect a DCC Signal. You can select ANY Port since it affects the entire device, select the value for the delay option and press SAVE. The previous FX behavior for that Port will NOT change.

To see the effect, you must switch OFF the LSC II. After it's start up cycle you will be able to detect a change in time that it takes to start the animations – assuming you are not connected to DCC. If you are connected to DCC, you must press F5 (Animation ON/OFF) to activate the device animation.

- TV Simulation works with a White and Blue LED on separate Ports or in Color with a 3 separate Ports connected to an RGB (Red-Green-Blue) LED. The LED type is common Anode. (You can buy the proper RGB LED chip from our store.) The different settings are meant to simulate different types of TV activity. It's not perfect but it is effective, nonetheless. You can mix the FX on each color line if you want. This effect is a Random-on-Random effect so it may be very difficult to track the differences.

## USING SWITCHES TO SIMULTATE TRIGGERS

The **MICRO-5** will let you set triggers so that a port only displays when its trigger is tripped or "active". You can assign any valid switch address within the 16 addresses starting with the first address set for the **MICRO-5**. By default, your **MICRO-5** is set the address 3. That means that all the switch addresses from 3 to 18 are available to assign to ANY of the **MICRO-5** ports. By doing so you can have one or more ports by triggers simultaneously and you can have multiple **MICRO-5** on the layout react in parallel.

When trigger #1 is tripped, the trigger will stay activated as long as the switch is Thrown (ON). After the switch is Closed

(OFF) the port lights will continue to Animate for 5 seconds and then turn off. The trigger Timeout STARTS after the detector is OFF.

You can change the duration of the Trigger Timeout as described below.

## Trigger Timeout Settings (pending)

Trigger Timeout is the amount of time that Animation continues AFTER a detector has stopped detecting – by whatever means you have set up.

When you activate a trigger, the trigger stays on for five seconds by default. Then the trigger shuts. The trigger will stay on until the switch or function key is turn off, and then for five seconds more. You can shorten or lengthen the amount of time that the trigger stays active after the sensor has stopped. The shortest time is immediately, the longest time is 255 seconds ( 4 ½ minutes).

### DECODER TYPE: CV50 (1=MF, 0 = Accessory)

In the DCC universe there are two types of decoders: Multi-Function Decoders and Accessory Decoders.

A multifunction decoder is what you use in your engines. It responds to a single DCC address. Additionally, there is a speed control and function keys. Typically, the function keys turn on the headlights and sound the horn. The **MICRO-5** uses these same capabilities to respond to your commands via your

DCC hand controller. You can turn on all the lights, only one light, flash all lights and put the **MICRO-5** into animation mode.

An Accessory decoder has a single "master" address and then can have any number of sub address. Some Accessory decoders only have one address. Some have 4. The **MICRO-5** has eight – one for each Trigger. Unlike the Multifunction decoder that can do many things for one DCC address, the accessory decoder can really do only one. It's either Thrown or Closed for any given address. On or Off. But that's fine. We'll use eight sequential addresses to trigger each of the eight Trigger ports.

When the **MICRO-5** boots up with power it has to pick one or the other mode to operate in. When you change the Decoder Type CV47, when you switch back to Animate mode the display will show the active type either 1111 or 2222. This only appears if you change the decoder type.

Set CV50 = 1 for Multi- Function Operation

Set CV50 = 0 for Accessory Decoder operation



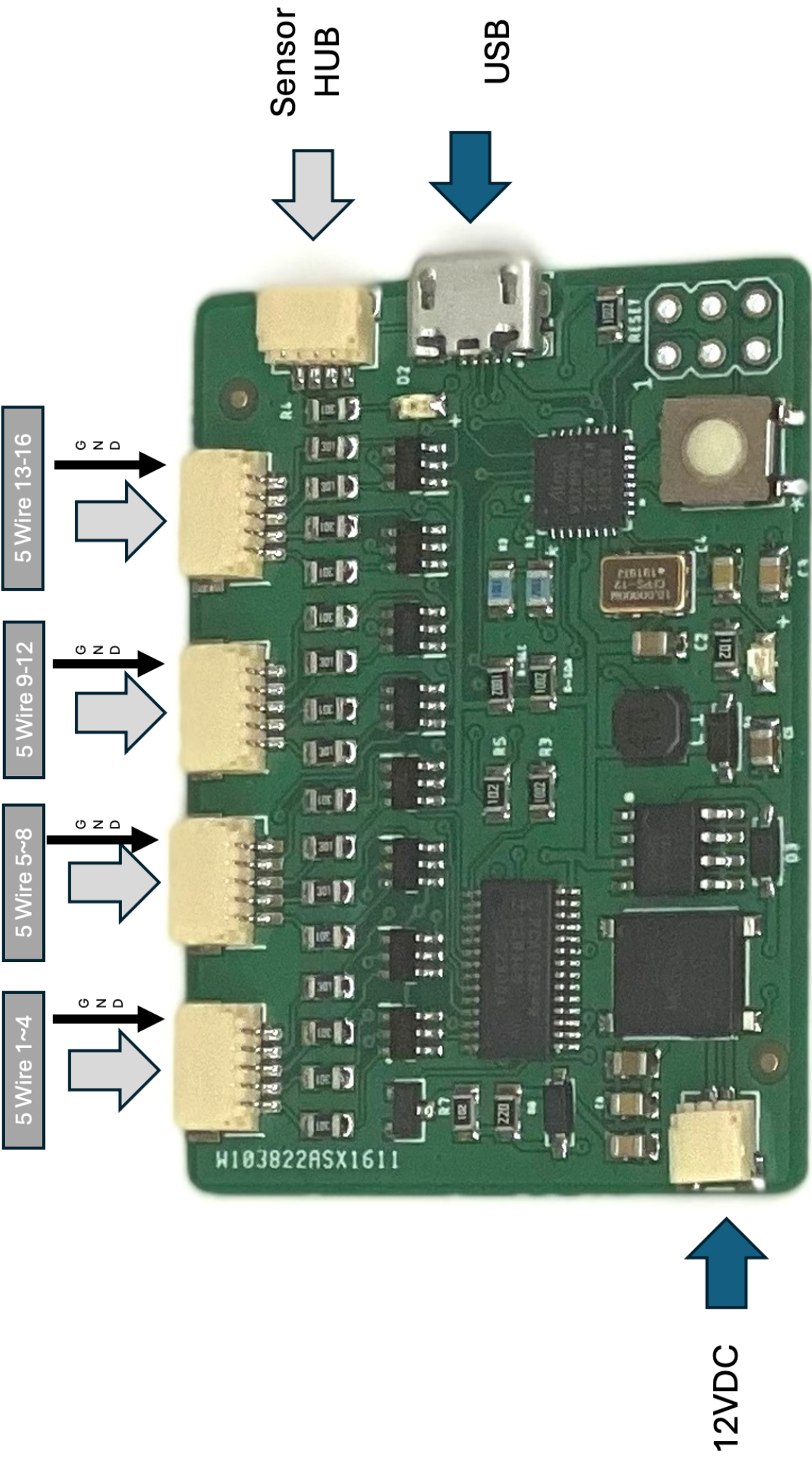
# A word about SLOTS

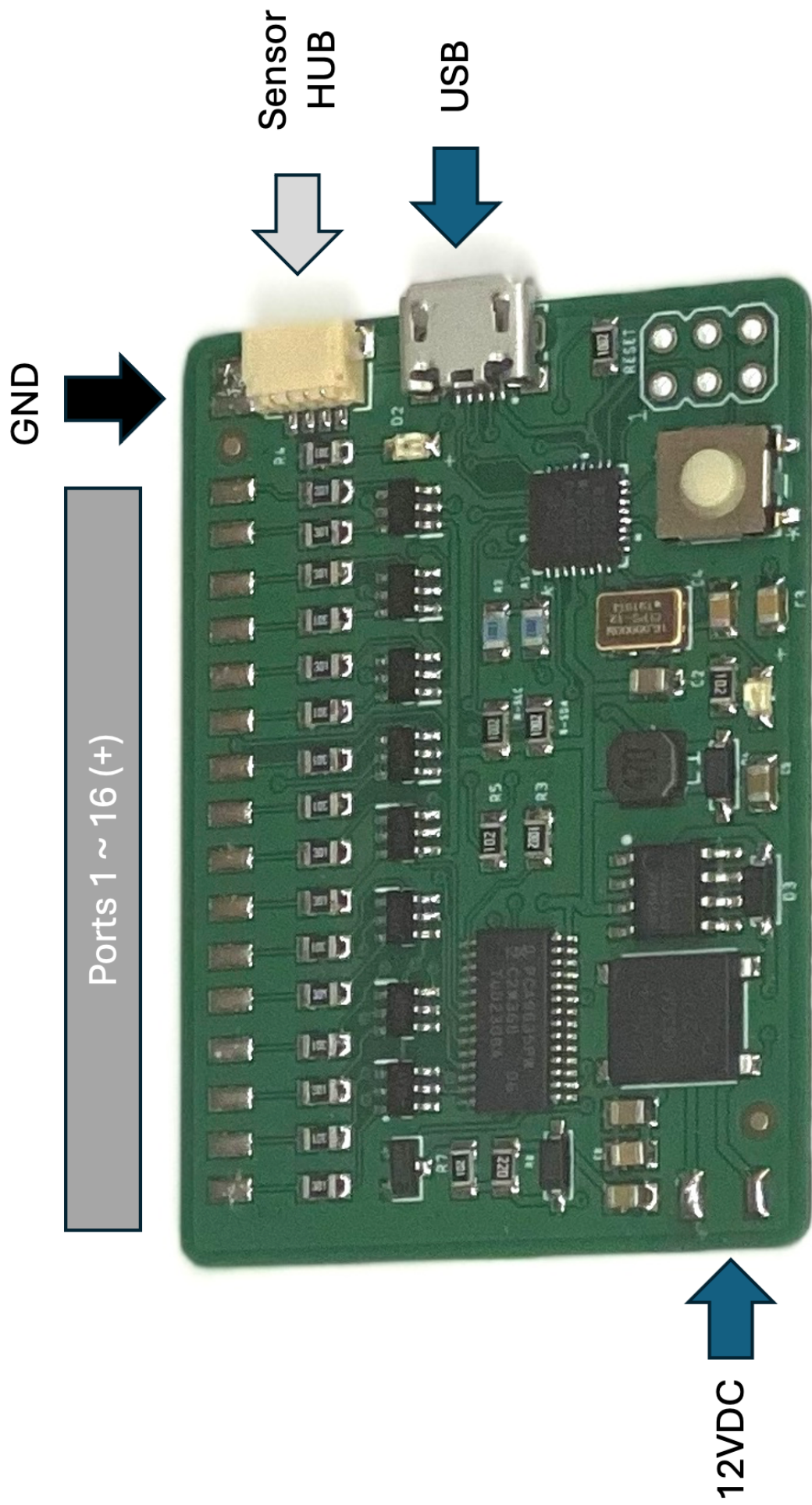
## (Multi-Function Decoder mode)

Not technically a power issue, it is still worth mentioning something about **Slots**. All DCC systems have a certain number of slots that they maintain – one slot per loco. The LSC II uses the same slots that engines use. Therefore, you must be thoughtful about how to allocate slots to the lighting animation and the locos.

What seems to work best is to configure each controller separately by giving it a “fresh” address out of the box. I use 88 as a habit. Then I connect the building, streetlights, etc. and begin the configuration. Once I am satisfied with how it looks and runs, I use the BUILT-IN Addressing mode to change it to match the group of other controllers I previously installed – without disconnecting or moving it or them from the layout!

Let’s say my group of existing controllers are all address 500. When I change the new controller from 88 to 500 – it just “joins the group” so to speak. Then I dial in 500 and hit F10 (Activate Animation) and all the controllers and their associated LEDs do their thing. I have roughly a dozen groups of controllers on my layout but my DCC system has 400 slots – more than enough!







## OPERATOR INSTANT-FX FUNCTION KEYS

Function Key	Behavior	Comments
F0	All pins On/Off	Overrides all functions, except when F1 is on.
F4	Adjust All Pin Brightness	With F0 -forces all pins to the same bright level, use F2 to save
F5	Activate Animation	Turns on the system to animate as per settings.
F6	Random	Random On/Off. F6 OFF after having been on will turn off LEDs at Random till none.
F7	Step mode	Pins On/Off in sequence. Use with F0 to activate
F8	Alternate Flashing	All pins flash alternately odd/ even.



## MODE CONFIGURATION VALUES [ F3 ]

Value	Behavior	Notes:
0	Pin disabled	No output on this pin during Animation.
1	Always On	Pin will turn On during animation & ignore Random
2	Flickering	Flickering to simulate an oil lamp or a fire
3	Blink	The pin will blink On and Off at the configured speed for each pin
4	Rotating Beacon	Simulate a rotating beacon.
5	Fade	Fade the pin up and down on a timer.
6	Random	Randomly turn LEDs On and Off
7	Step	Sequentially turn LEDs on/Off. Activate with F0
8	Flashing	Equally timed On/Off Flashing on alternate ports
9	TV Simulator	Simulate B&W or Color TV. 2 pins for B&W, 4 for color
10	Mars beacon Simulation	Simulates a MARS style headlight
11	Mimic F11 (Pin 1)	Operator control only - any number of pins can be set to mimic
12	Mimic F12 (Pin 2)	Operator control only - any number of pins can be set to mimic
11,12,13	Arc Welding simulation	Random flashing bright, 3 speed of delay between work.
14,15,16	Lightning Simulation	Random Flash, then smaller flashes, 3 time delays

## CONFIGURATION MODE FUNCTIONS & SPEED CONTROL

Function Key	Use & Behavior	Comments
F0	Switch On/Off time for Flashing	Used with F3 Blink speed setting to switch from On time to Off time
F1	Enter Configuration Mode	Use F1 to activate Configuration mode, Animation will stop.
F2	Save Settings	Push once to save. LEDs will blink to confirm a valid settings was saved.
F3	Switch to MODE select	With F3 On, use the speed control to select a pin MODE number.
F4	Adjust pin Brightness level	



## LED Lighting Controller 5 - GLOBAL CV LIST

Description	CV #	Default	Type	Min	Max	Comments
Decoder Mode Setting	50	0	integer	0	1	MultiFunction = 1, Accessory = 0
Detect Absolute or On Change	111	0	integer	0	1	Setting for Sensor Hub inputs
Default MODE for RESET	112	0	integer	1	16	sets all ports to this value on reset.
BOOT UP delay	113	15	seconds	0	255	wait time after no DCC signal when connected
Flicker Random time range Lower	114	40	x100 Milli second	10	255	Random value between ranges
Flicker Random time range Upper	115	80	x100 Milli second	10	255	Random value between ranges
Fade Speed	116	25	x100 Milli second	10	255	Dependent upon light level setting
Fade Tme Multiplier	117	10	10 Seconds	10	255	Multiplier to Time On/Off CV160-191
Random Delay	118	25	x100 Milli second	1	255	time between apparent changes
Random Percent On	119	60	Percentage	10	80	Control mostly On or mostly Off
Random - One Pin On/Off	120	0	Integer	0	1	Random on one pin at a time
Random Mode Fade	121	0	Integer	0	1	Activate Fade on Random Ports
Step Delay	122	10	x100 Milli second	5	255	Time between each port LED on
Step Type	123	0	Integer	0	2	0-Normal, 1-Chase, 2-Race
Flash (Alternating Pins) Speed	124	15	x100 Milli second	5	255	Flashing of alternating Pins
Lightning Delay	125	1	Integer	1	255	Minutes



## PORT Configuration Variable Address Map

CV Range	Value	PORT NUMBER															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
LED light level	128-143	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143
Animation Mode	144-159	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159
Time On (Blink, Fade)	160-177	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
Time Off (Blink, Fade)	176-191	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191
Timer On	192-207	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207
Trigger Port assignment	208-215	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223
Tigger Timeout	224-239	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239
Beacon Speed	240-255	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255

Disabled	0
Always On	1
Flicker	2
Blink	3
Beacon	4
Fade	5
Random	6
Step	7
Flashing	8
TV Simulation	9

Mars	10
Arc Welding 1	11
Arc Welding 2	12
Arc Welding 3	13
Lightning 1	14
Lightning 2	15
Lightning 3	16
TBD	
TBD	



## Software Updates

We constantly receive feedback from customers about new features and we add them as we can and seem appropriate. That means that your **MICRO-5** will eventually have “old” software. Therefore, here is our upgrade policy:

### Free Upgrades:

For two years from date of purchase you can upgrade the software of your MICRO-5 by mailing the board back to us and we will upgrade the software for free. You must pay for return shipping. If you live in the U.S., you can choose BASIC or EXPIDITED shipping. These are listed in the online store: type “REPAIR” in the search box. Then select Software Upgrade LLC-5. If you live outside the U.S. select the international version of the upgrade.

We have Patents Pending for our products.

**ONE YEAR MANUFACTURER WARRANTY:** We warrants this **product** to be free from defects in workmanship and materials, under normal residential use and conditions, for a period of one (1) year for the original invoice date. Shipping and handling fees are to be paid for by the customer.



LIMITATION OF LIABILITY. UNDER NO CIRCUMSTANCE SHALL COMPANY OR ITS AFFILIATES, PARTNERS, SUPPLIERS OR LICENSORS BE LIABLE FOR ANY INDIRECT , INCIDENTAL, CONSEQUENTIAL, SPECIAL OR EXEMPLARY DAMAGES ARISING OUT OF OR IN CONNECTION WITH YOUR USE, OR INABILITY TO USE THE PRODUCT, WHETHER OR NOT THE DAMAGES WERE FORESEEABLE AND WHETHER OR NOT COMPANY WAS ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. WITHOUT LIMITING THE GENERALITY OF THE FOREGOING, COMPANY'S AGGREGATE LIABILITY TO YOU SHALL NOT EXCEED THE AMOUNT OF THE PRODUCT. THE FOREGOING LIMITATION WILL APPLY EVEN IF THE ABOVE STATED REMEDY FAILS OF ITS ESSENTIAL PURPOSE.



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