Intelligent Lighting Systems

Multifunction Digital RGBW LED controller

Comprehensive User Manual
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1.0 - SPECIFICATIONS

Controller (General):

- Processor/CPU:
  - ARM-Cortex M0+
- Wireless:
  - Bluetooth: Nordic: nRF51822 chipset (Rev. 1.0 not yet enabled)
- Power:
  - Input: 12 - 14v VDC
  - 5V 5A switching power supply.
- Circuit protection:
  - Reverse polarity protection
  - 6V 5A self-resetting fuse
- Capability:
  - Control up to 4 zones (Right Front, Left Front, Right Rear, Left Rear).
  - Front zones:
    - 50 “Pixels” per side
  - Rear Zones:
• 50 “Pixels” per side
• Controller is able to safely power ~100 LEDs on its own.
  • Additional LEDs will need supplemental 5V power supplies. I.L.S. offers additional 5V 5A or 5V 10A switching power supplies with remote on/off.
• Sensors:
  • Adjustable gain microphone with low-frequency filtering, maximum sensitivity @ 67 Hz.
• User Interface:
  • 132 x 28 px OLED display
  • 3 x momentary pushbuttons
  • 1 x force reset button (recessed)
  • 1 x potentiometer – Flasher R/C circuit
  • 1 x potentiometer – Microphone sensitivity
• Connectors:
  • 1 x 6 pin (Beige/Natural – Rear Turn Signals)
  • 1 x 6 pin (Black – Front DRL/Mirror Signals)
  • 1 x 8 pin (Vehicle Interface)
  • 1 x Micro USB (programming)
1.1 - DRL SPECIFICATIONS
(The following apply to products/mods supplied by Intelligent Lighting Systems ONLY)

Yamaha:

2017+ YZFR6
- DRLs (per side):
  - 5V 5A switching power supply with remote on/off.
  - ~ 5 mA current draw while in shutdown mode.
  - 50x digital RGBW LEDs (SK6812)
  - Data in (from controller), and Data out (to mirrors)

2015+ YZFR1
- DRLs (per side):
  - No Power supply
  - 19x digital RGBW LEDs (SK6812)
  - Data in (from controller), and Data out (to mirrors)
2015+ YZFR1 & 2017 YZFR6 Mirrors

- Mirrors (per mirror)
  - 3 x RGBW 1W LEDs
  - 2 x 0.5W White LEDs (Turn Assist Lighting)
    - Controlled by outer most RGBW LED.
2.0 - INTRODUCTION

Thank you for purchasing Intelligent Lighting System’s individually addressable LED controller! This controller may come bundled with a DRL kit, or can be purchased separately if a headlight retrofit professional or D.I.Y-er wishes to create their own LED modules. (See section #.# for installer specific information)

Our controller uses 3 wires per strip/array, 5V+, Data, and Ground. When using this controller with your own custom setup, please make sure to use RGBW digital LEDs (SK6812). They can be purchased either on eBay, Amazon, or directly from ILS. ILS also carries and can design custom high output digital RGBW LED circuits for you if your build requires them.

Most RGB/W controllers on the market today use individual “channels” for each color, and (therefore: n+1 wires, in an RGB setup - 4 wires. In an RGBW setup - 5 wires), meaning that whatever strip it is connected to it will control the entire strip/halo/array, you can change colors, but you are unable to control each individual LED for advanced animations. Other controllers are essentially banks of programmable switches. So while they may be able to react to inputs, their animation capability is limited with respect to addressable/digital LEDs.
Recently, there are some controllers that are starting to utilize individually addressable LEDs, but these controllers are unable to be re-programmed, nor do they have inputs to detect vehicle condition and react accordingly (such as turn signals, brakes, or reverse).

The ILS controller is able to react to vehicle inputs as well as any sensors embedded within the controller. Currently a microphone is provided for audio support. Future planned sensors include, accelerometers, gyroscopes, ambient light sensors etc.

This user manual will explain how to use the controller, explanation of settings, modes, and patterns available that come pre-programmed with the controller.

Please note: By swapping (with LEDs) or removing your OEM indicator bulbs/lamps/housings you will cause a fast blink condition on your vehicle. **This controller and system does not and cannot cure fast blink symptoms of OEM indicators**

To cure fast blink symptoms on your vehicle, load resistors must be installed where the OEM indicator bulbs/lamps/housings were.

Intelligent Lighting Systems, Inc. is not responsible for improper installation of the controller or hardware. Under no circumstances will Intelligent Lighting Systems, Inc. be liable for any damages, direct or indirect,
consequential or compensatory, from the use of our products. It is up to the installer and/or operator of the vehicle to determine what is allowed by law where the vehicle will be operated! Intelligent Lighting Systems ALWAYS recommends running the DRLs with WHITE running lights, and AMBER turn signals! Other modes are for off-road use only!!!
2.1 - THE CONTROLLER:
The controller has several features as illustrated over the next two pages:

TOP VIEW

BOTTOM VIEW

Reset (push with pen or paperclip)

Controller Display

Constant State Circuit Adjustment
(No adjustment necessary)

Microphone Sensitivity
(Use small flat head screwdriver)
3.0 - Modes

The firmware of our controller contains 4 main “modes”: Road, Visualizer 1, Visualizer 2, and Demo. The “A” button can cycle through the modes as follows. (There are several different options available within each of the modes):

- Road
- Visualizer 1
- Visualizer 2
- Demo
  - (to Exit demo, scroll down to the bottom of the Demo menu and select “Exit”), you will return to “Road” mode.
- Setup Mode (accessed by holding the C button for 10+ seconds while in Road Mode)

There are also other special functions in the following sections which will be highlighted in YELLOW. For further explanation of these particular functions please see section 4.0.

The controller will always start in “Road” mode, the user will need to manually change the mode anytime the controller is restarted. This is for safety as “Road” mode is the only mode in which the controller is capable of reacting to vehicle inputs.

i.e. If the controller is in any other mode, the controller will not be able to animate appropriate turn signal animations in response to vehicle status.
Buttons A, B, and C have different functions depending on which mode or menu they are in and how long they are pressed, for more information please read the following sections, or the “quick guide” (separate from this manual).

Also when holding buttons for other functions please make sure to count slowly, in testing we have found that humans will usually overestimate the amount of time that a button has been pressed leading to premature release… (button release that is.)

Visualizer 1 and 2 are sound reactive modes which have varying patterns, animations, and color schemes depending on the values chosen. The mic sensitivity can be set via the adjustment hole labeled “MIC” on the bottom of the controller (See page 10). The controller has special filtering circuitry to filter audio and reacts best to low frequencies. **For best results an audio source capable of bass is recommended.** Using a cell phone or laptop’s speaker(s) will not produce good results. Even using a small portable Bluetooth speaker is preferable to a cell phone's speaker. Exhaust noises also work well.

Demo mode is a special dedicated demonstration mode in which there are several different animations that will play, ranging from running through the start-up sequences, to various turn signal modes, to rainbow or color chasing animations depending on which option is selected. In this mode, the selected option will continue to play until either the user manually exits or power is turned off to the controller, which case it will re-boot into Road mode.
Default settings, varies per model of vehicle applied:
See Section 3.5.2 (Page 32)
3.1 - Modes: Road

Road mode is the default operating mode of the controller. In this mode, the controller will respond to vehicle inputs via the vehicle interface harness. In this mode the controller will respond to turn signal, brake, and reverse. In this screen the user can quickly select between different DRL colors, turn signal animations, startup animations and access the Auto-Learn function if so desired.

Illustration of the screen in Road mode:
3.1.1 - Button Functions overview (Road Mode):

- A (<1s): Next Mode
- A (1-3s): Previous Mode
- A (>5s): Auto-Learn function

- B: (<1s) Cycle DRL color
- B: (1-3s): Cycle Animation color (Not recommended)
- B: (>3s): Manual Color Picker (Experimental)

- C (<1s): Next turn signal pattern
- C (1-3s): Next Startup Sequence
- C (4-6s): Save all road mode settings
- C (>10s): Setup Mode
Interface explanation in Road mode:

**Button A**
- Short press of A (< 1 second) will advance to the next mode (Road > Visualizer 1 > Visualizer 2 > Demo).
- Medium press of A (1-3 seconds) the controller reverse through the modes (Visualizer 2 > Visualizer 1 > Road).
  - In order to exit Demo mode, scroll down until you reach the bottom of the menu, and select “Exit”
- Long Press of A (5+ seconds) the controller will enter the **Auto Learn function**.

**Button B**
- Short press of B (< 1 second) will change the running light /DRL color by cycling through the available pre-programmed DRL colors:
  - Off/None
  - Red
  - Green
  - Blue
  - White
  - Warm White
  - Neutral White
  - Yellow
  - Light Green
  - Neon Green
  - High Viz Green
  - Teal
  - Skyblue
  - Aqua
  - Aquamarine
  - Pink
  - Purple
  - Magenta
  - Neon Pink
  - Manual
$$\begin{itemize}
  \item Default is White. Manual will pull the last saved color from memory.
  \item PLEASE CONSULT YOUR LOCAL LAWS FOR ALLOWABLE COLORS.
  \item Medium press of B (1-3 seconds) will change the animation color for turn signals.
    \begin{itemize}
      \item Amber>Red>Green>Blue>White>Lime>H.V. Green>Teal>Purple>Manual
      \item Default is Amber. Manual will pull the last saved color from memory.
      \item IT IS NOT RECOMMENDED TO CHANGE THIS SETTING! AMBER IS THE ONLY LEGAL COLOR ALLOWED FOR TURN SIGNALS ON THE FRONT OF VEHICLES!
    \end{itemize}
\end{itemize}$

**Button C**

$$\begin{itemize}
  \item Short press of C (< 1 second) cycles the turn signal pattern through the pre-programmed turn signal patterns, upon reaching 7, the controller will return back to 1.
    \begin{itemize}
      \item Pattern 1: Blink On – Blink Off (Standard/OEM)
      \item Pattern 2: Blink On – Wipe Off
      \item Pattern 3: Wipe On – Wipe Off (Default)
      \item Pattern 4: Chunk On – Wipe Off
      \item Pattern 5: Chunk On – Blink Off
      \item Pattern 6: Chunk On – Chunk Off
      \item Pattern 7: Double Pulse
    \end{itemize}
\end{itemize}$$
• Medium press of C (1-3 seconds) will advance through the pre-programmed start up sequences. When you select a new sequence, the controller will pause for 2 seconds, and then play the animation using the current DRL color.
  o Sequence 1: Ramp-Up – Lights will evenly ramp up to full brightness
  o Sequence 2: Wipe In – Wipe Out
  o Sequence 3: “Look”
  o Sequence 4: “Blink”
  o Sequence 5: “Wink”
• Long press of C (4-6 seconds) will save all road settings: Turn signal pattern, DRL/Animation color, Startup Sequence, On/Off timing.
• Super long press of C (10+ seconds) will enter Setup Mode for advanced options.
3.2 - MODES: VISUALIZER

There are two visualizer modes (1 and 2). The visualizer modes react to ambient sound levels via an adjustable onboard microphone. The controller has onboard audio filtering circuitry. This circuitry enables the controller to accurately react to bass noises (under 100Hz), even at low sound levels. Using a cell phone or laptop for music for the controller to react to is not recommended as it will produce poor results. Using an audio source capable of producing bass is recommended.

Illustration of the screen in Visualizer Mode:
Visualizer 1 has more complex and dynamic animations while Visualizer 2 has simpler animations:

Visualizer 1 has the following settings; any animation can be paired with any color palette:

<table>
<thead>
<tr>
<th>Animations</th>
<th>Color Palettes</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Pulse</td>
<td>• Rainbow – All colors</td>
</tr>
<tr>
<td>• Palette Pulse</td>
<td>• Sunset - Reds/Oranges/Yellows/Blue/Purples</td>
</tr>
<tr>
<td>• Traffic</td>
<td>• Ocean – Greens/Blues</td>
</tr>
<tr>
<td>• Snake</td>
<td>• Pina Colada – Whites/Yellows/Reds</td>
</tr>
<tr>
<td>• Palette Dance</td>
<td>• Sulfur – Greens/Yellows/Light Blues</td>
</tr>
<tr>
<td>• Glitter</td>
<td>• No Green – Red/Orange/Yellow/Blue/Purple</td>
</tr>
<tr>
<td>• Paintball</td>
<td></td>
</tr>
</tbody>
</table>

Visualizer 2 has the following settings:

<table>
<thead>
<tr>
<th>Animations</th>
<th>Color:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• VU meter – Draws a bar, length based on volume.</td>
<td>• Same color choices as the DRLs (See list on page 21)</td>
</tr>
<tr>
<td>• Brightness – Adjusts brightness based on volume.</td>
<td>• Same color choices as the DRLs (See list on page 21)</td>
</tr>
</tbody>
</table>
3.2.1 - Button functions overview (Visualizer Mode):

Button A
- Short press of A (< 1 second) will advance to the next mode (Road > Visualizer 1 > Visualizer 2 > Demo).
- Medium press of A (1-3 seconds) will retreat to the last mode (Road < Visualizer 1 < Visualizer 2).
  - In order to exit Demo mode, scroll down until you reach the bottom of the menu, and select “Exit”

Button B
- Short press of B (< 1 second) will cycle the animations in each Visualizer mode.

Button C
- Short press of C (< 1 second) will cycle color palettes or colors depending on Visualizer mode.
3.3 - Modes: Demo

Demo mode has several different options and animations which are designed to be played repeatedly until the user cancels the selected option. Demo mode is designed with the intent to be used at car shows, meets, or trade shows to showcase turn signal patterns and colors that the system is capable of. **Currently, Demo mode is in the experimental stage, and when in certain options, the controller may not react timely to user controls.**

Illustration of the screen in Demo mode:
3.3.1 - Button functions overview (Demo Mode):

**Button A**
- Short press of A (< 1 second) will either scroll up or adjust the secondary option.

**Button B**
- Short press of B (< 1 second) will select the current options.
  - Some demo functions will have secondary settings that can be adjusted. A short press of B while in a demo function will allow you to select and adjust those secondary options.
- Medium press of B (> 2 seconds) will back out of the secondary option or primary option.

**Button C**
- Short press of C (< 1 second) will either scroll down or adjust the secondary option.
When a Demo is active, the screen will turn white:

- Current Selection
- Secondary Option
  - A: ***
  - B: ColorWipe:Purple
  - C: ***
  - B. Select B - Back
- Extra Button Functions
Some demo modes will have extra options that the user can adjust such as timing, these extra options can be accessed by a short press of the “B” button again, the display will change, displaying the adjustable option below, and the A and C markers will also change to “+” and “-” for adjustment:

The current animation will usually freeze while adjustments are being made. Once you have made the adjustments, hold the B button for 2+ seconds to back out of the secondary option adjustment. To back out of the current demo hold the B button for 2+ seconds, some animations may cause the controller to lag when responding to user inputs. Holding the B button until the unit backs out of the demo is recommended.
Demo mode contains the following functions and explanations:

- **TS Patterns** – Will run through the pre-programmed animations, ~15 seconds of turn signal animations, ~3 seconds of idle time.
- **Start Ups** – Runs through pre-programmed start up animations
- **ColorWipe** – Simple animation that scrolls through the pre-programmed colors (see page 20 for color table), timing is adjustable.
- **Rainbow Cycle 1** – Scrolling rainbow across all zones.
- **Rainbow Cycle 2** – Scrolling rainbow across all zones, rainbow is compressed to fit within the length of the front zones.
- **Theater Chase 1** – Theater billboard style animation changing through pre-programmed animations, timing is adjustable.
- **Theater Chase 2** – Theater billboard style animation with a scrolling rainbow effect, timing is adjustable.
- **Exit** – Select this to Exit Demo mode, the controller will return to Road mode.
3.4 – Modes: Setup

Setup mode allows for in-depth adjustments of almost all controller and animation settings. Users can access the Setup mode by holding the “C” button for 10+ seconds while in Road Mode. Within the setup mode, users can also reset the controller’s options to predefined values.

Settings include:

- Front zone strip length (Up to 50 “Pixels”)
- Rear zone strip length (Up to 50 “Pixels”)
- Timing (On/Off, in 100milisecond steps)
- Turn Assist Lighting (Yes, No)
- Mirror Idle Mode: Idle, White 75%, Amber, DRL.
- “Pixels” per mirror (used to identify how many “pixels are in a mirror for turn assist lighting functions, mirrors must be at the end of the front zones.
- Cycles to On: # of turn signal cycles until the mirror’s white LEDs ramp up to full brightness.
- Cycles to Off: # of turn signal cycles until the mirror’s white LEDs ramp down and resume normal turn signal animations.
- Reset All – Reset all options to one of several pre-programmed sets.
- Exit
An example of the screen in Setup mode, note current option is not selected:

Screen in Setup Mode with the current option selected:
3.4.1 - Button functions overview (Setup Mode):

**Button A**
- Short press of A (< 1 second) will either scroll up or adjust the selected option.

**Button B**
- Short press of B (< 1 second) will select/deselect the current option.
  - Short pressing B again will then ‘release’ the option.
  - When an option is selected the screen will go white, when an option is deselected the screen will go black.
- Medium press of B (> 2 seconds) will save the option that is currently being adjusted. The display will confirm that the setting has been saved, then return to the options list. The option must be selected (white background) for this option to be work.

**Button C**
- Short press of C (< 1 second) will either scroll down or adjust the selected option.
3.4.2 - In-depth explanation of options within the Setup menu:

- “# of FRNT LEDs” – (0 – 50) Total number of “Pixels” in the front strip (one side, this number should include mirrors, currently the left and right sides must be symmetrical. i.e.: they must have the same number of “Pixels” per side. The term “Pixels” is used instead of LEDs due to the fact that an installer or DIYer can double or triple up LEDs into arrays to increase brightness. For example, the controller will animate a 1x10 LED strip the same as a 2x20 LED array. Currently the Controller’s animations work on ‘strips’.

- “# of REAR LEDs” (0 – 50) – Number of “Pixels” in the rear LED array (one side). Left and right rear sides must be equal/symmetrical.

- “TS, On time” (300ms – 2000ms) – Duration of the “On portion of the turn signal animation”, the controller will take this time, and adjust the timing of the turn signal animations to fit. For example: If the option is set to 1000ms (1 second) the controller will divide the animation into approximately .66 seconds of animation (turning it on) and hold the animations for .33 seconds of static “ON” time (full on).

- “TS, Off Time” (300ms – 2000ms) – Duration of the “OFF” portion of the turn signal animation, again with approximately 2/3rds of the time spent on the dynamic portion of the animation (turning it off) and 1/3rd of the time spent on the static portion (full off).

- “Mirror Idle Mode: (Off, Amber, White, DRL)– Selects what the mirrors will do when idle:
  - Off – Mirrors will remain off and only turn on during turn signals
3.4 - Modes: Setup

- Amber – Mirrors will remain a dim amber color (like OEM Yamaha)
- White – Mirrors will remain on at approximately 60% brightness.
- DRL – Mirrors will copy the DRL color.
- “LEDs/Mirror” (Must be less than the # of FRNT LEDS) – How many “Pixels” do your Mirrors have. This will be used in Turn Assist lighting mode.
- “Turn Assist?”
  - Yes – Turn assist lighting will be enabled
  - No – Turn assist lighting will not be enabled.
- “Cycles to On?” - # of turn signal cycles till the turn assist lighting starts.
  - Example: if set to 4 – Turn assist lighting won’t turn on until 4 animation cycles (On->Off) have completed on the turn signals.
- “Cycles to Off?” - # of turn signal cycles until turn assist lighting turns off.
  - Example: if set to 10 – Turn assist lighting will remain on for 10 cycles before turning off and resuming normal turn signal animations.
  - Note – Depending on how your mirrors and Turn Assist lighting is designed, setting this too high/long may burn out your LEDs. It is up to the user/installer to select the appropriate turn signal lighting duration.
- “Reset All” – Enters sub menu to reset all settings to predefined values.
For further explanation on the Turn Assist Lighting function, please see section 4.2.

The Turn Assist Lighting function was originally intended for motorcycles with LEDs in the side mirrors. However other setups may benefit from this function as well. It is up to the installer/user to determine the correct settings for their setup.

Automotive headlight installers could incorporate these “Mirror” LEDs into their headlight if they wish for their build to have a cornering light.

Motorcycle headlight installers can also incorporate this feature into their headlight builds even if their client does not have mirrors by having auxiliary high power LEDs acting as the Turn Assist Lighting. The only requirement is that these LEDs be at the end of the LED chain.

Intelligent Lighting Systems has developed circuits and PCBs to control high power LEDs that work with the WS2812b/SK6812 data protocol. For more information, please contact us at info@intelligentlighting.systems.
3.5 - RESET ALL: SUBMENU

Within the Reset All submenu (accessible by entering the Setup menu, and scrolling down to “Reset All”) there are several different options available allowing for a quick reset of all settings to factory defaults.

Example screen of the “Reset All” Submenu:
3.5.1 - Button functions overview (Reset All):

**Button A**
- Short press of A (< 1 second) will scroll up.

**Button B**
- Short press of B (< 1 second) will apply the current preset.
  - When an option is selected the screen will confirm “SAVED”
- Medium press of B (> 1 second) will back out of the Reset All submenu, returning the user to the Setup Menu.

**Button C**
- Short press of C (< 1 second) will scroll down.
### 3.5.2 - Pre-Programmed settings chart:

The pre-programmed settings in the controller are as follows: **Note, model specific presets are designed for Intelligent Lighting System’s products and mods and may not work for all setups. However, they may be a good starting point for installers.**

<table>
<thead>
<tr>
<th>Field</th>
<th>All Zero</th>
<th>2017 YZFR6 w/mirror</th>
<th>2017 YZFR6 w/o mirror</th>
<th>2015+ YZFR1 w/mirror</th>
<th>2015+ YZFR1 w/o mirror</th>
<th>2006-2009 CBR600RR</th>
<th>All Max</th>
</tr>
</thead>
<tbody>
<tr>
<td># Front LEDs</td>
<td>0</td>
<td>28</td>
<td>25</td>
<td>22</td>
<td>19</td>
<td>33</td>
<td>50</td>
</tr>
<tr>
<td># Rear LEDs</td>
<td>0</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>12</td>
<td>50</td>
</tr>
<tr>
<td>Mirror Idle Mode?</td>
<td>Off</td>
<td>Off</td>
<td>Off</td>
<td>Off</td>
<td>Off</td>
<td>Off</td>
<td>Off</td>
</tr>
<tr>
<td># of LEDs per Mirror</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Default Brake Pattern</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
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<tr>
<td>Start Up Sequence</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Turn Signal Animation</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>DRL Color</td>
<td>White</td>
<td>White</td>
<td>White</td>
<td>White</td>
<td>White</td>
<td>White</td>
<td>White</td>
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<tr>
<td>Animation Color</td>
<td>Amber</td>
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<td>Amber</td>
<td>Amber</td>
<td>Amber</td>
<td>Amber</td>
<td>Amber</td>
</tr>
<tr>
<td>On Time</td>
<td>500 ms</td>
<td>500 ms</td>
<td>500 ms</td>
<td>500 ms</td>
<td>500 ms</td>
<td>500 ms</td>
<td>500 ms</td>
</tr>
<tr>
<td>Off Time</td>
<td>500 ms</td>
<td>500 ms</td>
<td>500 ms</td>
<td>500 ms</td>
<td>500 ms</td>
<td>500 ms</td>
<td>500 ms</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Field</th>
<th>All Zero</th>
<th>2017 YZFR6 w/mirror</th>
<th>2017 YZFR6 w/o mirror</th>
<th>2015+ YZFR1 w/mirror</th>
<th>2015+ YZFR1 w/o mirror</th>
<th>2006-2009 CBR600RR</th>
<th>All Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turn Assist Lighting</td>
<td>0</td>
<td>On</td>
<td>0</td>
<td>On</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Cycles to ON</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Cycles to Off</td>
<td>0</td>
<td>15</td>
<td>0</td>
<td>15</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

It is recommended to reboot the controller once the settings are saved to make sure they load properly.
4.0 - SPECIAL FUNCTIONS:

4.1 - Auto Learn Function:

The Auto Learn function lets the controller sense the actual blink rate of the vehicle, then calculates how fast the animations must be in order to match the vehicle’s original blink speed. This may be desirable to some if they are using the controller in addition to their vehicles OEM indicators. But if you are getting rid of your OEM markers entirely, then this feature is somewhat irrelevant. To access the Auto Learn Function, while in Road mode, press and hold the A Button for 5+ seconds.

Before entering the Auto Learn function:

- The vehicle should be in an idle state (no turn signals or brakes applied).
- The slide switch on the side of the controller must be flipped towards the connector end of the unit. Use a small flat head screwdriver, or ballpoint pen (See Page 15).

Once the user has entered the Auto Learn Program, the controller will prompt for the user to start the vehicle’s right blinker. Once started, the controller will then monitor the right blinker input, after approximately 5
ON/OFF cycles, the program will finish collecting data. The controller will then show the averaged ON/OFF times (in milliseconds) on the display.

It will then calculate and save the necessary values into memory and the controller will return to ROAD mode, and the ON/OFF times will be applied to the turn signal animations.

The small slide switch that was slid to the connector side of the controller may now be switched back to the opposite side (side closest to the buttons/micro USB header). This slide switch bypasses a smoothing circuit built into the controller allowing the program to precisely sense the timing of the vehicle’s inputs. The controller and its animations are designed to operate correctly with the smoothing circuit enabled. If the smoothing circuit is bypassed, erratic turn signal behavior may result.

Note: If this controller is being installed in an application where Turn Assist Lighting is not required, leaving the slide switch on the bypass setting may provide better syncing between the animated turn signals and OEM turn signals. (However, Auto learn must first be done).
4.2 - Turn-Assist Lighting:

Turn assist lighting was designed to provide the rider/driver with additional lighting on the indicating side of the vehicle. The function will take a user defined number of LEDs at the end of the front zones and allocate them as the additional lighting. The controller will allocate the number of pixels in the “LEDs/Mirror” field, and depending on the # of cycles the turn signal has completed, animate the mirror LEDs accordingly.

<table>
<thead>
<tr>
<th>To Disable Turn Assist Lighting, set the options to the following:</th>
<th>To Enable Turn Assist Lighting set the options to the following:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• “Turn Assist?” - No</td>
<td>• “Turn Assist?” - Yes</td>
</tr>
<tr>
<td>• Mirror Idle Mode - Off</td>
<td>• Mirror Idle Mode - Off</td>
</tr>
<tr>
<td>• LEDs/Mirror - 0</td>
<td>• LEDs/Mirror – User-chosen</td>
</tr>
<tr>
<td>• Cycles to On? - 0</td>
<td>o (must be less than # of FRNT LEDs)</td>
</tr>
<tr>
<td>• Cycles to Off? - 0</td>
<td>• Cycles to On? - User-chosen</td>
</tr>
<tr>
<td></td>
<td>• Cycles to Off? - User-chosen</td>
</tr>
</tbody>
</table>
If Turn Assist Lighting is enabled, the controller will take the following parameters of the setup into account:

- # of FRNT LEDs
- “Turn Assist?”
- Mirrors Y/N
- LEDs/Mirror
- Cycles to On?
- Cycles to Off?

Take the following example:


The controller will take the last 5 LEDs on the front LED strips and allocate them as the “Mirrors”. These Mirror LEDs will play the turn signal animation normally. Once 3 cycles of the animation have completed, the Mirror LEDs will turn full white and stay full white for 10 turn signal animation cycles. After 10 cycles the Mirror LEDs will return back to normal turn signal animation.

If the turn signal is canceled while the Turn Assist Lighting is active, the mirrors will return to their normal, OFF state. If the Turn Assist Lighting has returned to normal turn signal animation (i.e.: finished its 10 cycles) to re-enable the turn assist lighting, the vehicle's indicator must be canceled and restarted.
5.0 - Installer Information

The following section advanced information for headlight retrofitters, DIY-ers and other individuals who want to use Intelligent lighting system’s controller in their own builds. This section will include generalized wiring diagrams, pin outs and other technical information. This section also assumes the reader has basic electrical knowledge.

The controller has the following headers:
Vehicle Interface Header Pinout

- **Right Signal**
- **Left Signal**
- **GND**
- **CKT 2**
- **CKT 1**
- **12+ VIN**
- **LAST CKT**
- **Reverse Signal**
- **Brake Signal**
Front and Rear Header Pinout

Rear Right Data Out
Rear Left Data Out
GND
5V+

Rear Header (Tan)

Front Left Data Out
Front Right Data Out
GND
5V+

Front Header (Black)
The controller is natively set up to control digital RGBW LEDs that uses the SK6812 driver chip with 4 discrete diodes each (Red, Green, Blue, and White). A version of the controller for RGB LEDs will be available in the future.

The controller will only work with SK6812 (or WS2812B) LEDs, which use a 3 wire interface as shown below:
This controller will NOT work with LEDs using a 4 wire interface such as these:

APA102C

The controller has an onboard 5V 5A stepdown power supply with a self-resetting fuse. It is capable of powering approximately 200 LEDs in total. Please keep in mind that the 200 LED rating is dependent on the length of wiring between the controller and the LEDs, as the voltage drop of long runs of wire must be accounted for. **When connecting the LEDs to the controller please make sure to power the LED strips via 5V either from the controller or an auxiliary 5V power supply. Very few mass produced digital LED strips are designed to work above 5V.**

**Hooking up 12V to the LED strips that are connected to the controller will void the warranty on the controller!**

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Intelligent Lighting Systems does offer additional stepdown power supplies (5V 5A and higher) which include remote on/off functionality.

The controller is designed to animate strips or shapes which consist of strips (an array of 1 LED tall by X LEDs long). Halos do work, however some of the turn signal animations may be somewhat ambiguous. I.L.S. is planning on incorporating proper halo animations into the controller soon.

An installer may run strips or LEDs in parallel in order to increase light output, or branch off the LEDs if they wish to have separate areas on the vehicle for sequential/animated turn signals such as shown below: