TGLED and MIM-LED-LAMP-NR User Guide

Features

- Drives up to 4 High Luminous LEDs (MIM-LED-LAMP-NR)
- Up to 1.2A max current per LED
- Hot plugging safe, but need to respect ordering instructions below
- Brightness of each LED can be individually set
- High PWM Frequency of 97KHz
- LEDs can be controlled thru TTL, Serial commands, and Micro-Manager

TGLED is a Tiger(TG-1000) plug-in card that can drive up to 4 of ASIs MIM-LED-LAMP-NR (High Brightness LED Illuminators).

Connecting TGLED to MIM-LED-LAMP-NR

TGLED Connects to MIM-LED-LAMP-NR using a 3.5mm Mono Plug.

> WARNING: Connecting TGLED to MIM-LED-LAMP-NR with any other connector like a 3.5mm Stereo Plug might cause damage to the TGLED card.

Its safe to hot-plug LED illuminators to TGLED card as long as you never connect an "empty" cable to the TGLED card. For example, if you are going to change which LED illuminator is connected to a particular channel you should first unplug the cable from the TGLED card, then change the illuminator before plugging the cable back into the controller. This is because the regulator onboard the TGLED is programmed to keep a certain amount of current flowing as long as the cable is plugged in. When a cable plugged in with an open circuit the regulator attempts to increase the applied voltage to compensate, and the voltage might get high enough to damage some critical components. There is an overvoltage detection circuit that prevents damage to the card, but once it is engaged the controller will need to be power cycled for the card to work normally again. In contrast, if the plug to

the TGLED card is disconnected first, the card shuts off that connector and routes the current thru another path.
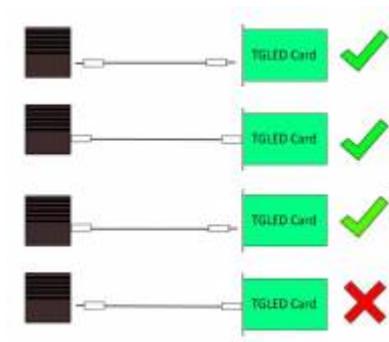

Figure 1: Proper way to disconnect LED illuminator is to disconnect plug attached to TGLED card first.

MIM-LED-LAMP-NR wavelength Options

Here are the options available for MIM-LED-LAMP-NR Lamps. Contact ASI if your required wavelength isn't yet listed and we will be happy to look into it.

Peak Wavelength in nm	Approx. Power in mW[1]	Spectral FWHW in nm	Manufacturer Part #	Manufacturer
365	TBD[2]	20	LZ1-00-UV00	LED Engin
385	TBD[2]	20	LZ1-00UB00 - U4 bin	LED Engin
405	TBD[2]	30	LZ1-00UB00 - U8 bin	LED Engin
455	330	20	LZ1-00B200	LED Engin
480	113	20	LXML-PB02	LumiLeds
490	57[3]	20	SMB1N-490	Roithner Lasertechnik
505	75	20	LXML-PE01-0070	LumiLeds
525	200	50	LZ1-00G100	LED Engin
560	136	100	LXML-PX02	LumiLeds
590	82	80	LXM2-PL01-0000	LumiLeds
590	TBD	14	SMB1N-590-02	Roithner Lasertechnik
625	114	20	ELSH-F5101-OLPNM-AR3R4	Everlight
630	120	20	ELSH-F51R1-OLPNM-AR5R6	Everlight
635	221	20	LZ1-00R102	LED Engin
640	200	25	LXM2-PD01-0050	LumiLeds
660	278	30	LZ1-00R202/200	LED Engin
680	TBD	25	SMB1N-680-02	Roithner Lasertechnik
740	145	30	LZ1-00R300/302	LED Engin
850	236	30	LZ1-00R400/402	LED Engin
940	330	40	LZ1-00R702-0000	LED Engin
Cool White (5500K)	272	na	LZ1-00CW00	LED Engin
Neutral White (4100K)	TBD[2]	na	LXML-PWN2	LumiLeds

1) LED powered with a TGLED card, 900mA current and 100% duty cycle
2) TBD - To be tested

3) Version without lens, expect lens to be brighter because of better capture efficiency
4) Lens assembly used to measure the Power mimics the condenser assembly on a microscope. This was done to better estimate the power the LED would deliver to the Objective.

Excitation Filters

Note that for fluorescence imaging the addition of an excitation filter is usually required to make sure that the LED illumination does not overlap with the fluorescence band. This can have the effect of greatly reducing the illumination intensity if the LED wavelength does not match well with the excitation bandpass.

ASI can place excitation filters inside the MIM-LED-LAMP-NR, inquire when placing the order. However, it is more common for the user to place an appropriate (often multi-band) excitation filter in the main microscope, e.g. just before the dichroic used to reflect the illumination to the objective. Some suggested filter sets can be found in the Lumencor SpectraX documentation.

TGLED-specific Serial Commands

Control of the TGLED card is similar to any other plug-in card of the TG-1000 system. This means most of the commands work (e.g. CDATE, BUILD X etc.). However as TGLED doesn't control an actuator, all of the motion commands are not implemented as they are not applicable incase of LEDs (e.g. MOVE,WHERE,SPEED etc)

Below are some TGLED-related commands, including some that are "recycled" for a different use than for motion axes.

- Command:LED   2016/02/22 14:57
- Command:RTIME (RT) 2016/02/22 16:30 asi
- Command:TTL   2017/07/26 10:03
- Command:WRDAC   2016/02/22 17:03 asi

Control thru TTL

All LEDs Turned ON , Mode #20

LEDs of the TGLED card can be turned ON/OFF thru TTL pulse on TTL IN connector. When serial command [Addr#]TTL X=20 is issued, TGLED will turn off all the LED channels, then on the Rising Edge of every TTL pulse received on TTL IN connector , TGLED card will turn on all the LED channels to their set values for a specific duration set with the [Addr#]RT Y command. Then when serial command [Addr#]TTL X=0 is issued. All the LEDs will turn ON to their set percentages.

Units of RT Y command are in millisec. Smallest acceptable value is 1millisec , and largest is 65000 millisec or 65sec. The timing may be off by around 0.25millisec to 0.5millisec. Maximum TTL frequency for which TGLED will reliably work is around 200Hz.

Example,

```
1LED X=30 Y=50 Z=0 F=0
```

Brightness of LEDs connected to Channel #1 and #2 is set to 30% and 50% respectively . LEDs connect to channel #3 and #4 will be turned off.

```
1RT Y=100
```

LED ON duration is set to 100millisec.

```
1TTL X=20
```

TGLED card is put in TTL mode , all LEDs channels are turned OFF. On the rising edge of Every TTL Pulse received on TTL IN connector, LEDs connected to channel #1 and #2 turn ON for 100millisec seconds for 30% and 50% brightness respectively. Channel #3 and #4 will remain OFF.

```
1TTL X=0
```

TGLED card TTL mode is disabled , LEDs connected to Channel #1 and #2 turn ON and stay ON at 30% and 50% brightness respectively. Channel #3 and #4 will remain OFF. TTL pulses received on TTL IN will be ignored.

One LED ON for each TTL Trigger, Mode #21

In this mode, for every TTL Trigger (Rising Edge Pulse on TTL IN connector). Only one LED channel turns ON for a fixed duration (Set with the RT Y command). Then On the next TTL trigger, the next LED channel turns ON for the same fixed duration. If a LED brightness is set to ZERO, then that channel is skipped and the next channel is turned ON instead. Example,

```
1LED X=30 Y=50 Z=0 F=0
```

Brightness of LEDs connected to Channel #1 and #2 is set to 30% and 50% respectively . LEDs connect to channel #3 and #4 will be turned off.

```
1RT Y=100
```

LED ON duration is set to 100millisec.

```
1TTL X=21
```

TGLED card is put in TTL mode #21 , all LEDs channels are turned OFF. On the rising edge of FIRST TTL Pulse received on TTL IN connector, LED connected to channel #1 turns ON for 100millisec seconds for 30% brightness. Channel #2,#3 and #4 will remain OFF.

On the Second TTL Pulse, LED connected to Channel #2 turns ON for 100millisec seconds for 50% brightness. Channel #1,#3 and #4 will remain OFF.

On Third TTL Pulse, As Channels #3 and #4 are both set to 0% brightness, routine skips then and instead turns ON Channel #1 instead for 30% brightness and 100millisec. Channel #2,#3 and #4 will remain OFF.

On the Forth TTL Pulse, LED connected to Channel #2 turns ON for 100millisec seconds for 50% brightness. Channel #1,#3 and #4 will remain OFF.

And So on…

```
1TTL X=0
```

TGLED card TTL mode is disabled, LEDs connected to Channel #1 and #2 turn ON and stay ON at 30% and 50% brightness respectively. Channel #3 and #4 will remain OFF. TTL pulses received on TTL IN will be ignored.

Auto Repeat

Starting v3.24, when RBMODE's mode byte is set to Repeat autoplay mode RM F=3, the TGLED card cycle thru the all LED channels without waiting for a TTL trigger. LED turns for the duration set by RT Y, the turns OFF, then the next LED channel turns ON.

Control thru MicroManager

TGLED card is supported onMicroManager 1.4.23 (or on Nightly builds built after 1st Dec 2015) as a shutter device under ASITiger.

Each TGLED card supports upto four LED illuminators. MicroManager automatically detects this , and implements them as 4 different shutter devices.

Below is a brief description of the device functions and properties,

Device Member Functions

`SetOpen(bool open = true)`, Use to turn ON or OFF the LED. Brightness is set according to the

`LED Intensity(%)` property. **True** for ON , **False** for OFF

`GetOpen(bool& open)`, Query the current LED state. ON or OFF.

`Fire(double /*deltaT*/)`, not implemented.

Device Member Properties

`LED Intensity(%)` , set the PWM dutycycle of the LED.

`State` , Can be set as **Open** or **Closed** to turn the LED ON or OFF respectively.

`Current Limit in milliamps` , Set the TGLED cards maximum current. This is a card wide settings , so it affects the brightness of all LEDs run from the same card. This property can also be used to adjust the LED brightness.

`SaveCardSettings`, a write only property , which lets the user save the current settings into the TGPMT cards's memory , or restore everything to factory defaults.

Troubleshoot

Listed below are some common issues when using the TGLED card and how to fix them.

LEDs are OFF , TGLED cards Green LED indicator is solid Green and TGLED won't respond to serial commands.

This happens when TGLED card detects an over voltage. It disables the power supply and shutdown to prevent damage. A system Reset or Restart will bring the TGLED card back on , however if the over voltage persists cards will shut off again. One of the causes of overvoltage is when a LED Lamp is disconnected from the TGLED card by unplugging the plug from LED Lamp end first. This is seen by the Regulator on the TGLED card as a open circuit or huge resistance. It tries to maintain the current flow by ramping up the voltage. To avoid this disconnect the Led LAMP by unplugging it from the TGLED card side first. Refer to Connecting TGLED to MIM-LED-LAMP-NR section for more details. To Fix this , unplug all the LED Lamp plugs from TGLED card , Restart the system , and plug in one LED LAMP at a time. If Plugging in a LAMP causes the issue , there might be a problem with the LAMP. Contact ASI to discuss a replacement.

LED Lamp's color changed over time

LED Lamps color changes when they experience high temperature for extended period of time. Running the LEDs at 100% brightness causes them to dissipate a lot of energy and generate heat. Contact ASI to discuss a replacement. Avoid running the LEDs at 100% brightness for extended period of time. Or turn them off when not in use.

Differences between MIM-LED-LAMP-NR and MIM-LED-LAMP

- MIM-LED-LAMP has an onboard LED Driver. It can be used stand-alone or as an addon to MS2000 controller or addon to some Tiger plug-in cards.
- The one available TTL OUT on MS2000 controller and Tiger Plug-in cards is used to generate a PWM to control the brightness of the illuminator.
- TTL Out will not be available for other uses, and adding more MIM-LED-LAMP isn't possible.
- TTL Out is a low frequency port , so PWM frequency is around 1KHz which sometimes produces a small camera flicker.

- Unlike the MIM-LED-LAMP which comes with an onboard LED driver , MIM-LED-LAMP-NR doesn't and will need TGLED card to drive it.
- TGLED has a dedicated PWM driver , so it frees up TTL out ports for other uses.
- A TGLED card can drive upto 4 MIM-LED-LAMP-NR
- PWM frequency is a high 97KHz

Tiger, LED, tgled, manual, micromanager

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