Operating Instruction

---------Apply to INV's Programmable Drivers

Content

1. Foreword

1.1 Objective

This manual is intended for operators expertly operate PRG-MUL2 programmer and program Inventronics' programmable drivers with its programming interface. Meanwhile, well understand some basic features of programmable drivers.

   Note: Except for DMX programmable driver

1.2 Technical Background

The traditional LED switched-mode power supply comprises pure hardware analog components and is designed for fixing electrical output, which include the constant current driver and constant voltage driver. The driver models should be changed as varying the output current/voltage for different projects, or slightly change output current for reaching the assessment standard of luminous flux/efficiency due to the performance difference of different batch LED chips, which will bring some inconvenience for customer's project and product inventory. The programmable drivers are born in order to solve these inconvenient cases. For these programmable drivers, the maximum output power will be constant when adjusting the output current in specification range, and realize different dimming functions (0~10V,PWM,Timmer,DALI) through setting them on the programming interface.

   Note: The 0~10/PWM/Timing and DALI programmable drivers are separate.

1.3 Programmable Driver (Constant Power Driver)

In Inventronics, there are different types of programmable drivers, which include LUD, EUD, EUG, EBD, ESD series drivers. The other name of programmable driver is constant power driver, constant power means that the maximum output power can be constant when programming output current (the maximum working voltage will be changed accordingly).

   Note: different constant drivers have the different current adjustable range and functions, the details please refer to specific datasheet.

Below graph is an example (EBD-100S105) for well understanding what constant-power driver is.
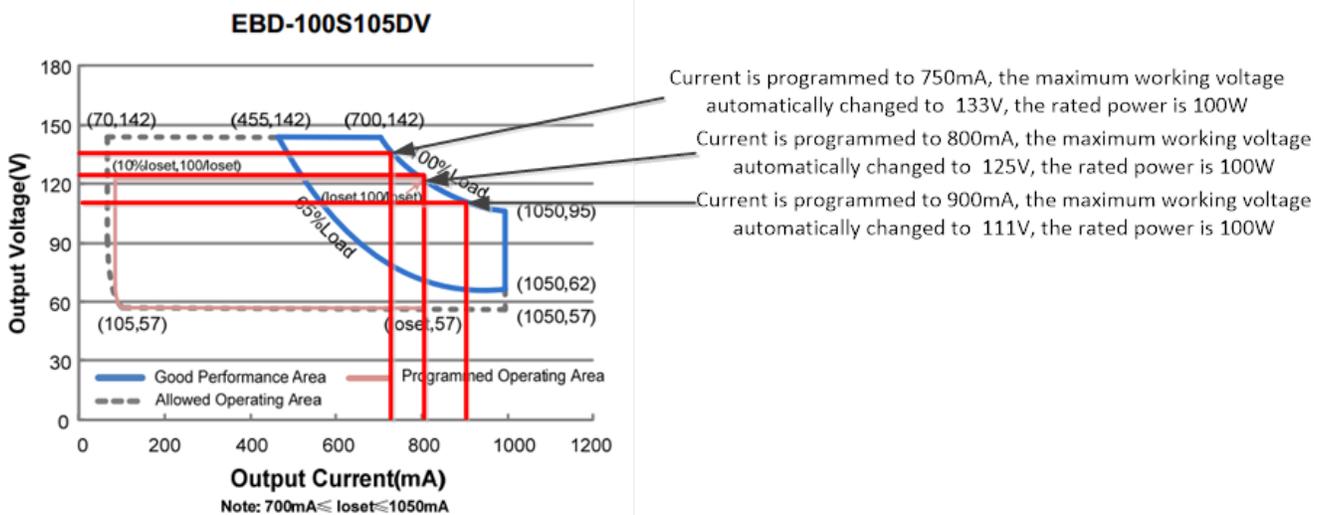
For this CP driver, the current adjustable range for full rated power (100W) is from 700mA to 1050 mA. As remarked in above picture, perhaps you program the driver to 800mA output current, the maximum output voltage of driver will be automatically changed to 125V for constant power (100W), the other adjustable current in this range has same theory.

- The range from 700mA to 1050ma is adjustable range for constant power. But when you program the output current down below 700mA, what happened? The output current also can be adjustable below 700mA, in this case, the maximum output voltage will keep the same, which means that the total rated power is lower than 100W and be in derated area, such as if the current programmed to 600mA, the total rated power will be 85.2W(0.6A X 142V=85.2W).

- Then make below parameters written in our datasheet clearly.

Output Current Range	Full-Power Current Range (1)	Default Output Current	Input Voltage Range (2)	Output Voltage Range	Max. Output Power	Typical Efficiency (3)	Power Factor (3)	Model Number
70-1050mA	700-1050mA	700 mA	176~305 Vac	57~142 Vdc	100 W	90.5%	0.98	EBD-100S105DV

For this driver, the current adjustable range is from 70mA to 1050mA, which include the derated power range and constant (full) power range. The current adjustable range for derated power is from 70mA to 700mA, the current adjustable range for constant (full) power is from 700mA to 1050mA.

2. Requirements of Operating Environment

2.1 Hardware System
Mouse, keyboard, more than 20GB HDD capacities, more than 512 Mb
RAM capacities, more than 1GHz processed frequency.

2.2 Software System
Windows XP, Windows 7, Microsoft.NET Framework 4.0 or above.

3. Installation Instruction of Programming Interface

3.1 Installation of Programming Interface
The installation of programming interface is divided into two steps. The first step is to install the USB series driver app, and the second step is to install programming interface app. These two apps, detailed installation instruction document and video can be downloaded from below link.
Datasheet of **PRG-MUL2** programmer:
http://www.inventronics-co.com/searchCp.aspx?key=PRG
Installation apps and instruction document:
http://www.inventronics-co.com/download.aspx?c_kind=3&c_kind2=202
Installation Video and basic issues troubleshooting:
There are 4 videos that walk through the entire programming process found at the link below. (The quality may be adjusted under settings.)
https://drive.google.com/folderview?id=0BwAvtydf35rOX3hjWTVFYl9Nc00&usp=sharing
Video 1: walks through downloading the programming software from our website
Video 2: walks through connecting the driver to the programmer, what the software looks like, and how to program the output
Video 3: walks through our available programming accessories and how to program "offline" or on an assembly line where the file cannot be accidentally modified
Video 4: walks through common error messages
Note: the 0~10V programmable driver and DALI programmable driver have same programming procedures.
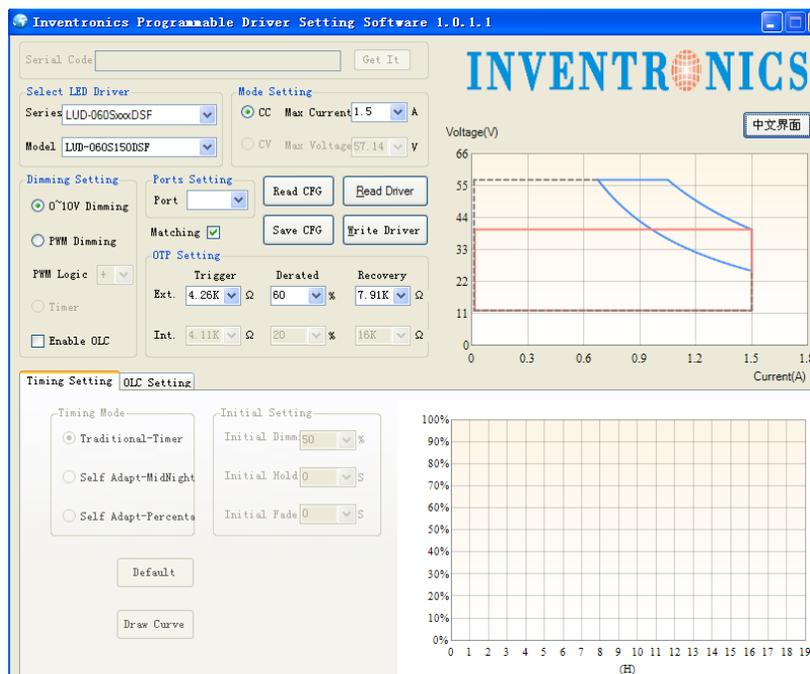
3.2 Start Programming Interface

The programming interface of PRG-MUL2 programmer can be started by below two methods.

a. Desktop icon

b. Open paths: Start icon ➡ All Procedures ➡ Inventronics ➡ Product Information ➡ Product.exe ➡ Choose '0~10V dimming driver' for 0~10V programmable driver or 'DALI' driver for DALI programmable driver

The programming interface of PRG-MUL2 programmer is displayed as follows.
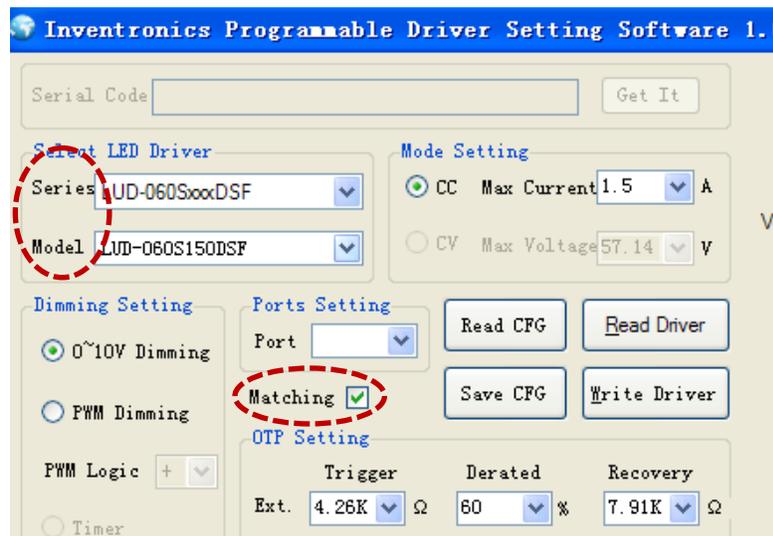

0~10V programming interface

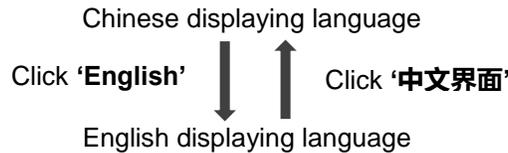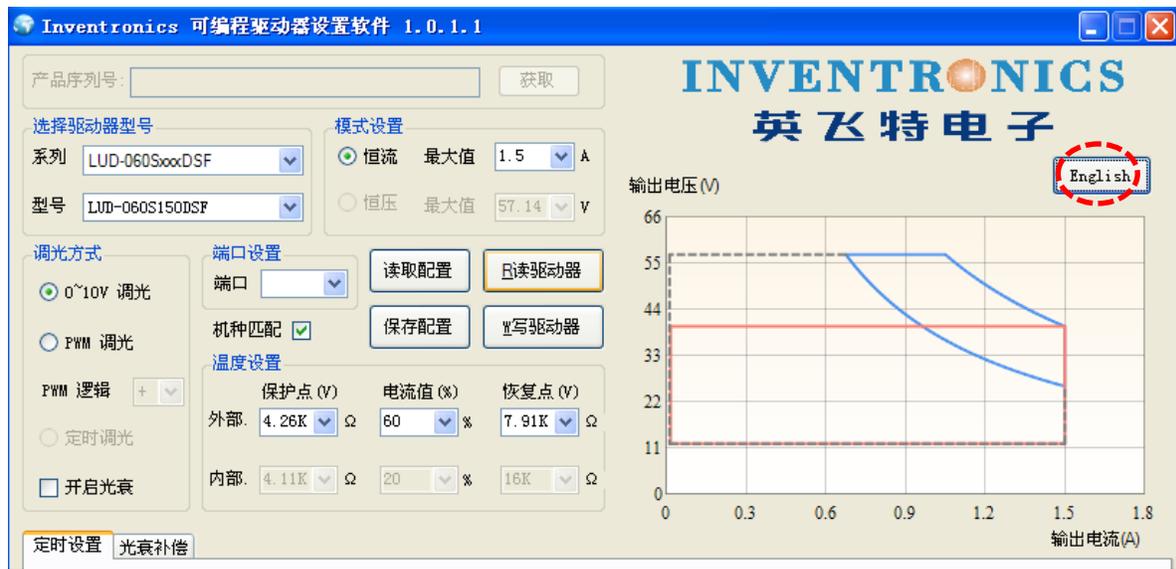**DALI programming interface**

4. Function introduction

4.1 Using notes
- The right configuration information should be downloaded into the programmable drivers as programming the driver at the first time (Default current driver).
- Keep the same series and model in continuous downloading when the 'Matching' item is selected as below. The 'Matching' item should be unchecked as programming different series driver or fail to program.


4.2 English and Chinese displaying language switching
The default displaying language of programming interface is same as the language of operating system, the proper operating language is chosen by clicking language switched button as below.

Chinese displaying language

Click **'English'**   Click **'中文界面'**

English displaying language

4.3 Port Setting

The programming interface will read out the port number of connecting driver if connecting well between LED driver, programmer and PC. The right port should be chosen when many different electronic devices are connected with PC.
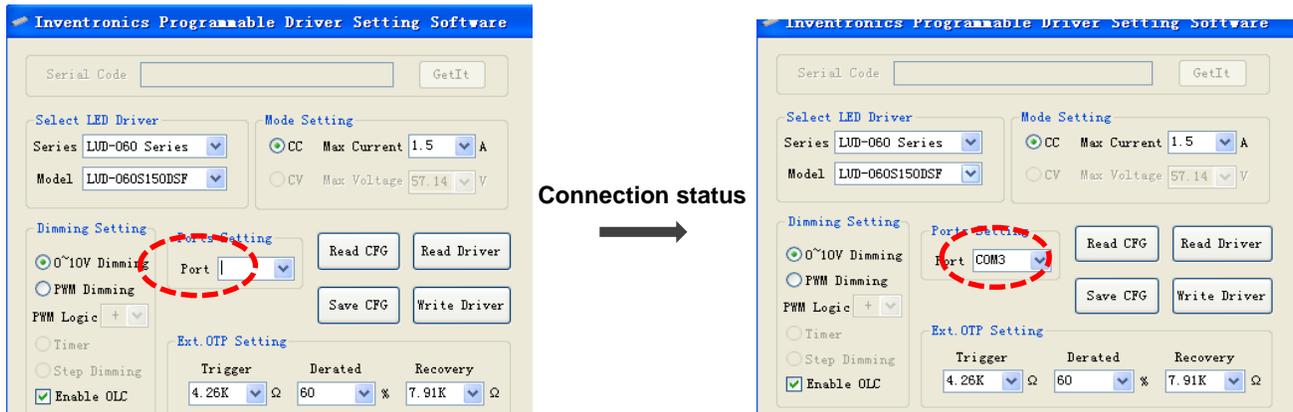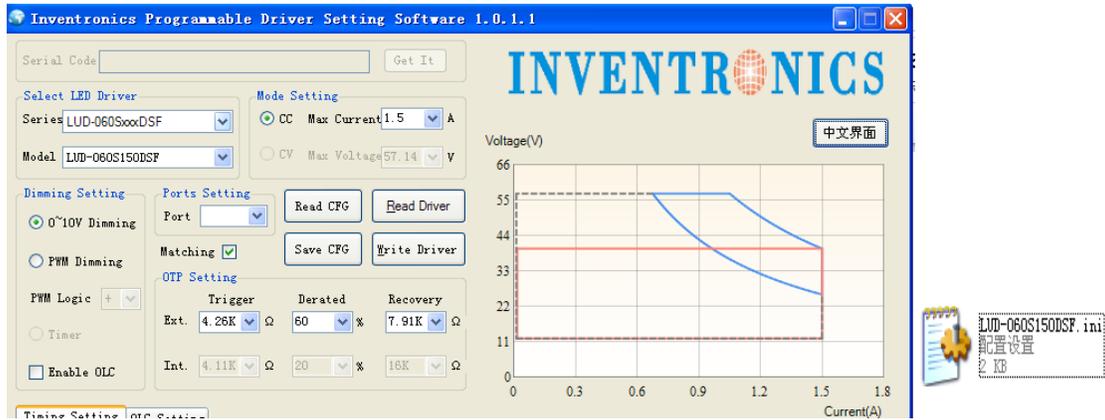

Connection status

Note: please check wiring connection or re-install the USD driving app when the port cannot be recognized by programming interface.

## 4.4 Read and Save functional configuration file

Save configuration: The functional parameters shown on programming interface can be revised/changed, and those functions can be saved as a functional configuation file with .int suffix, which can facilitate to program bacth products and remind customer what configuration information had been set to programmable driver.

Read configuration: The functional configuration file with .int suffix can be read by programmer and shown on programming interface.

4.5 Driver Series and Models Choice

The right series and models of connecting driver are chosen on the programming interface.
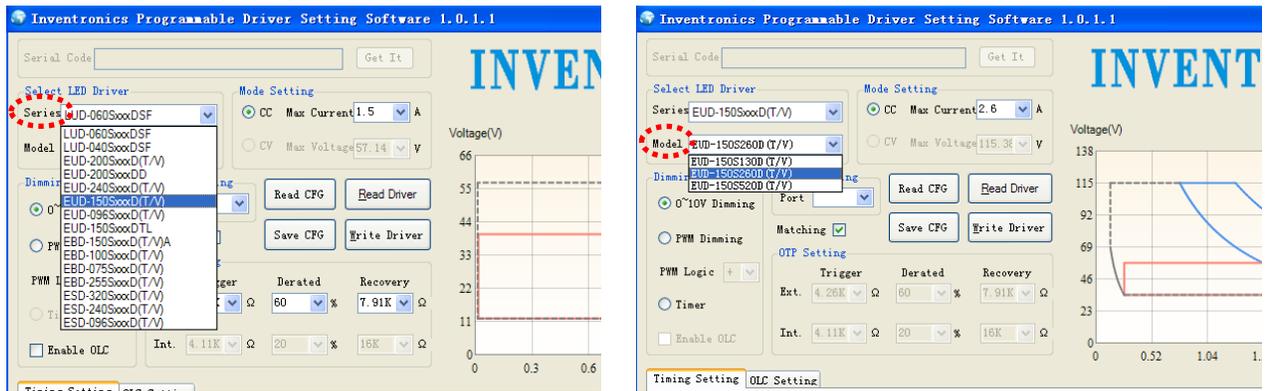
4.6 Dimming Functions

Three dimming functions are integrated in the 0~10V programmable drivers, which include 0~10V, PWM and Timing dimming functions. DALI dimming function is integrated in DALI driver. The detailed dimming function is selected according to the actual application.
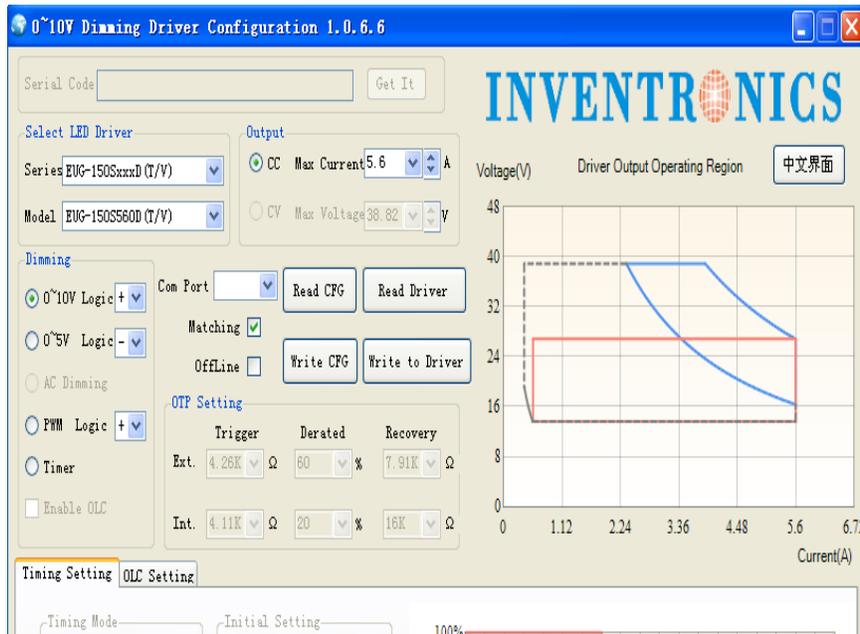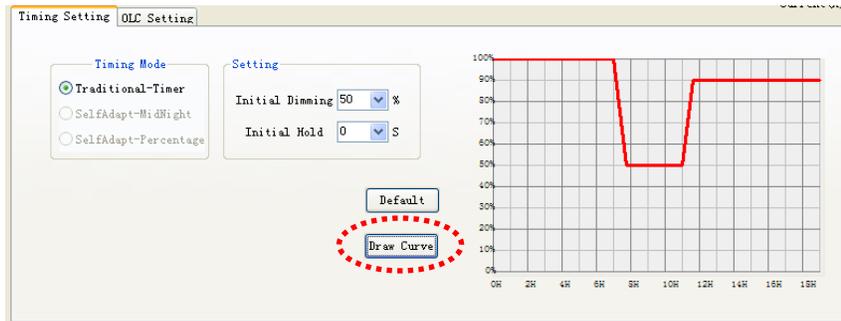
4.7 Timing Dimming Function

Set different output current level of driver in different dimming stage to change luminous flux of luminaires according to the actual application. The timing dimming function can be realized in up to six stages. The driver will be operated from beginning when powering on driver.
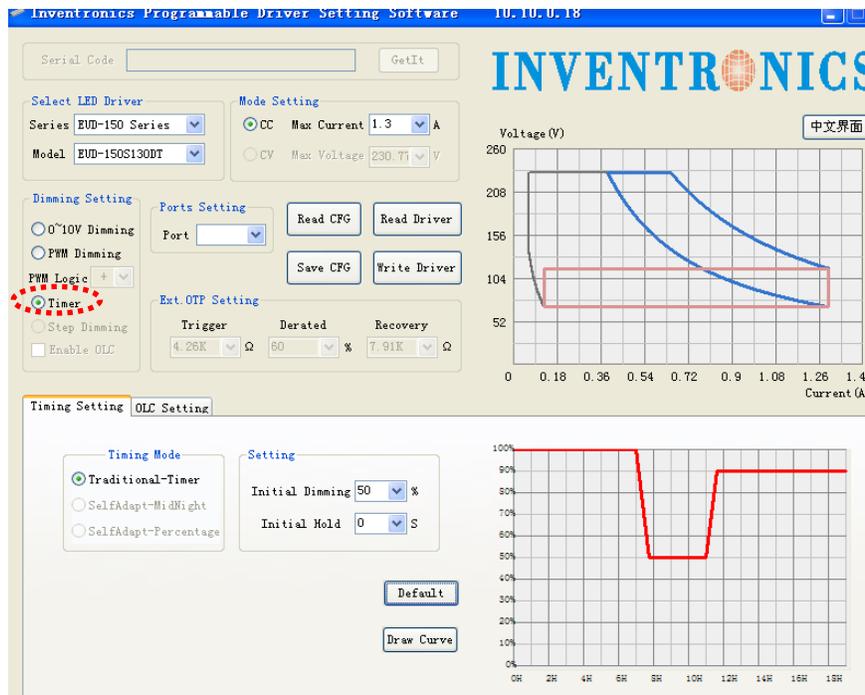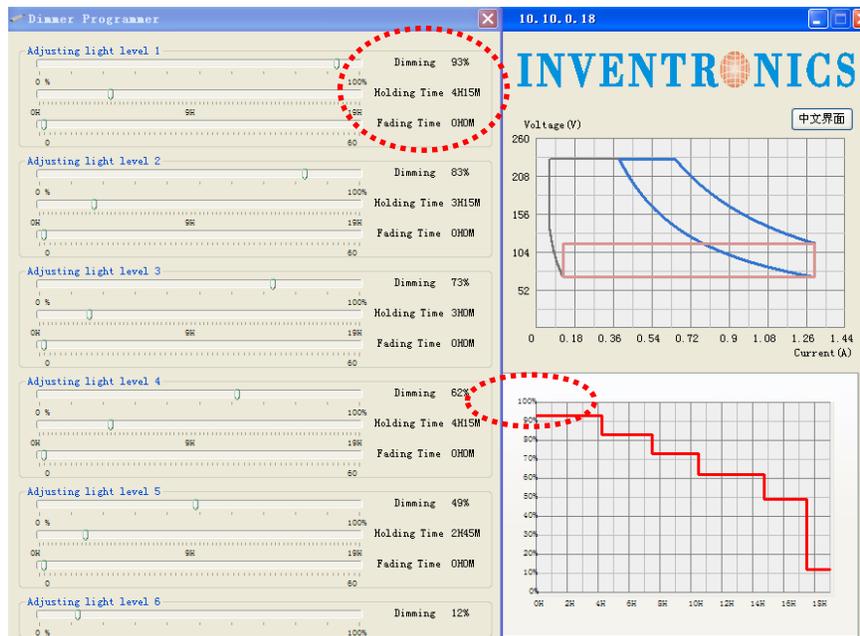

Selected traditional-timer function as the following picture shown:
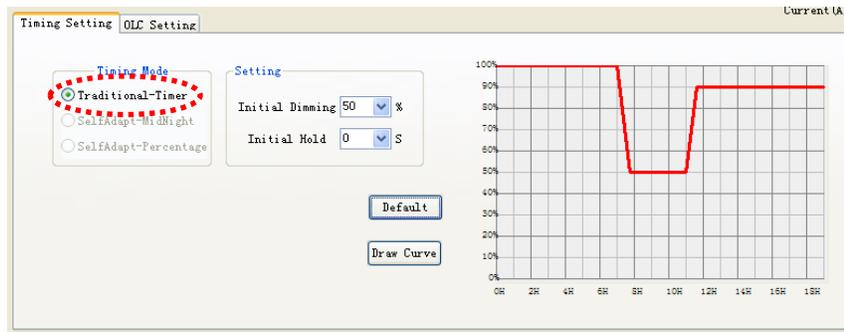
Set different output current level of drivers in different stages by clicking 'Draw Curve' button as the following picture shows:

Click '**Draw curve**' Button

In every timing stage, three parameters can be adjustable, which include adjustable output current (Dimming), holding time and Fading time. The right half part of interface is the function curve can be drawn based on setting in the left part.

Note: the driver will keep the same operation curve as setting in six stage after 19Hrs working.

4.7.2 Self-Adapt Mid-Night Timing Function

● **Working Principle**

Firstly, set up a timing curve preliminarily for the first day, If the difference of working time of following continuous two day is less than 15Mins, then for the fourth day, the total operating time of timing curve will the same as second and third day, and the total time will be equally distributed by Mid-night line. (If this time difference of continuous two days is more than 15 Mins, the timing curve of fourth day will be kept same as curve set up in first day)

● **Operating Instruction**

Self-adapt Midnight:

First day: (total working time is 14 Hrs., purple curve is the available working curve)
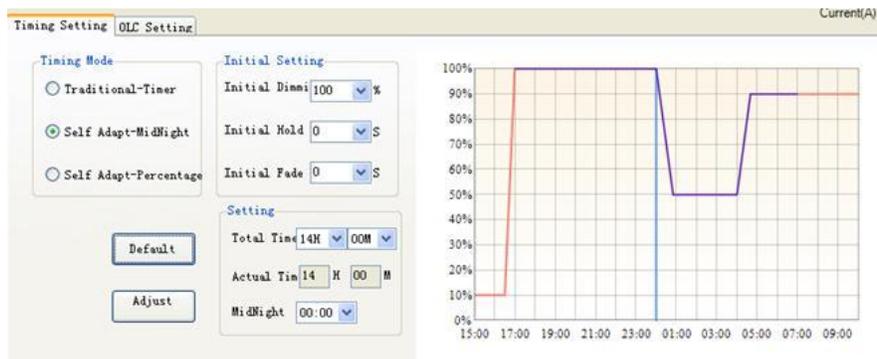
Second day and third day (total time is 10H per one day, and the working time difference is less than 15Mins. Fourth day(total working time is 10H ,and timing curve as following shown)
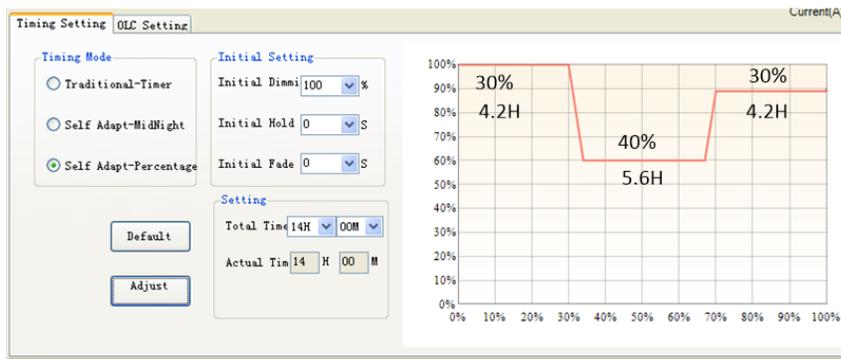

4.7.3 Self-Adapt Percentage Timing Function

Self-Adapt Percentage:

● **Working principle**

The basic working principle is same as Self-adapt Midnight timing function, every stage of this timing mode describe as percentage, not time. Therefore, for the fourth day, the total time will be distributed to every stage by percentage based on you set up in first day.

First day: (total working time is 14 H)

Second day and third day (Total time is 10H per one day, and the working time difference is less than 15Mins.
Fourth day (Total working time is 10Hrs, and timing curve as following shown)

Notes: Self-adapt Midnight and percentage timing function only be existed in our LUD, EUD, ESD series drivers.

4.8 Output lumens compensation (OLC)

The luminous efficiency will be decreased when the LED is used for certain time, which can reduce the luminous flux to lower the brightness of LED. This function of lumens attenuation compensation in our driver will increase output current to compensate reduced luminous flux of LED, which can keep the same output lumen and sustain the brightness of LED.
Select 'Enable OLC' and 'OLC Setting' items.
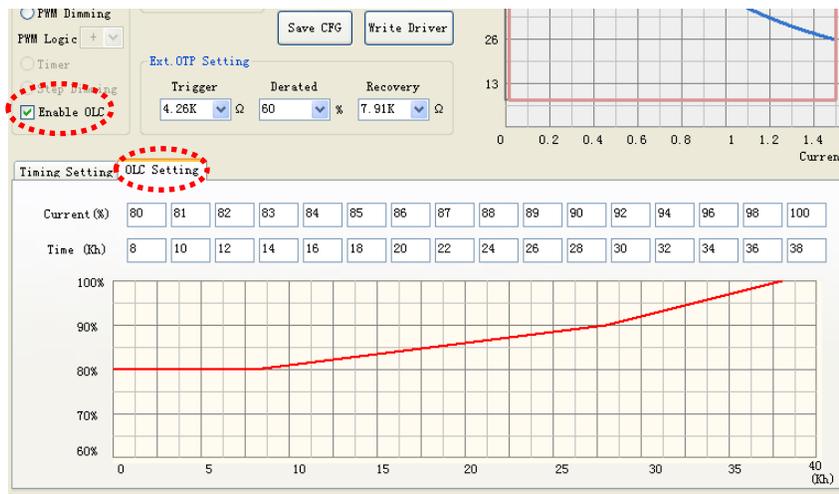
Change the parameters:
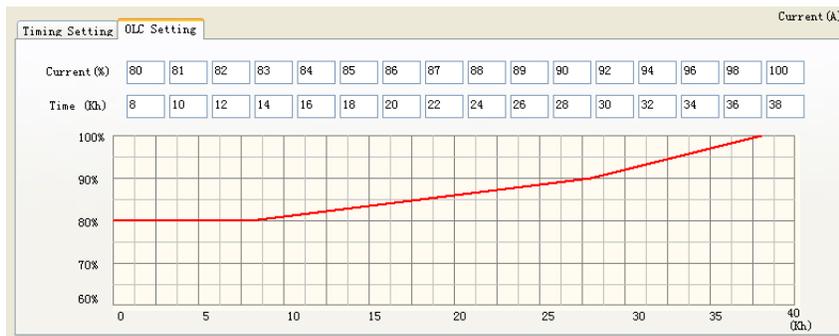
The red curve is drawn based on data are set in the blank of 'Current (%)' and 'Time (Kh)', which can be set based on the luminous depreciation curve of LED chips/COB .

Notes: the OLC function only is existed in LUD, EUD, ESD series drivers.

## 4.9 External over Temperature Protection (OTP)

The external OTP is applied in EUD second generation and LUD series drivers, which is realized by connecting with an external negative temperature coefficient (NTC) thermistor. The characteristic of NTC thermistor is that the resistance goes lower as the ambient temperature goes higher, so the resistance is equivalent to the ambient temperature through getting from relationship curve between temperature and resistance, which can be set on the programing interface. The driver realizes OTP function by detecting the resistance of NTC thermistor.

● **Wiring connection**

The external connection NTC resistor can be put where the temperature wants to be detected.
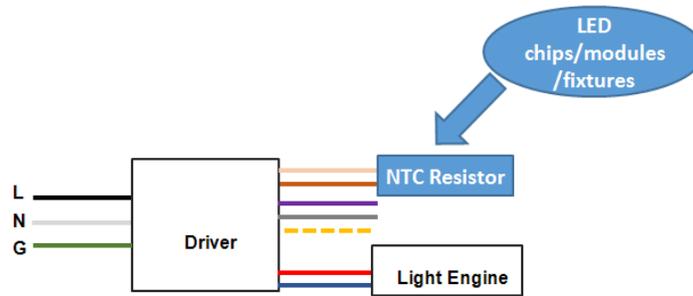
● **Configuration setting**
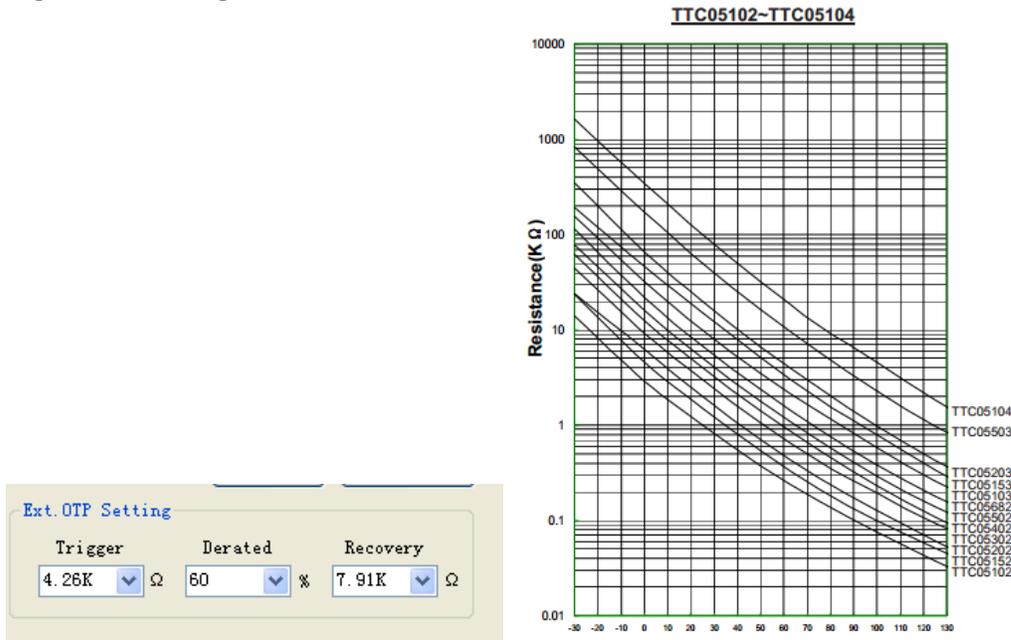
There are three adjustable parameters in external OTP function，which include trigger point, derated output current point and recovery point. The OTP function is triggered when the resistance of NTC thermistor is lower than the trigger point, which keeps the output current of driver at derated current point. Meanwhile, the output current will be recovered to former value before this change when the resistance of NTC thermistor is higher than recovery point.

   Note: the relationship curve between resistance and ambient temperature can be found in datasheet of connection NTC resistor.

5. Programming instruction

After knowing the basic function of programmable driver, the configuration information on the programming interface can be downloaded to programmable driver through pressing ' write driver' button, then can press the 'Read driver' button for reading out existing configuration in programmable drivers. There are two types of programming methods can be available for programming: online and offline programming methods.
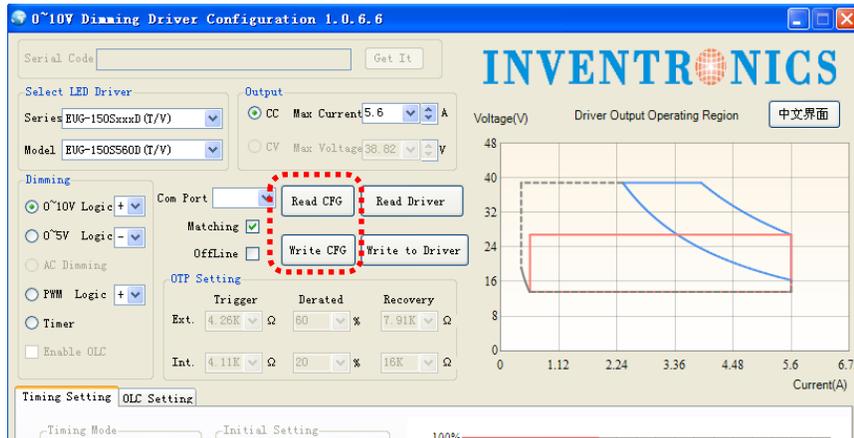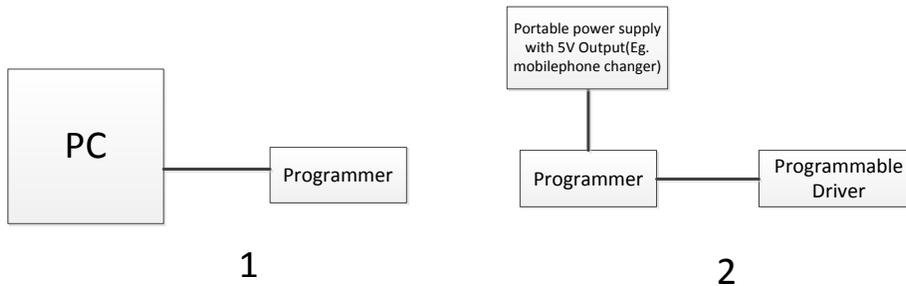
- **Online programming**

Online programming means doing the direct programming as connect the PC, programmer and programmable driver.
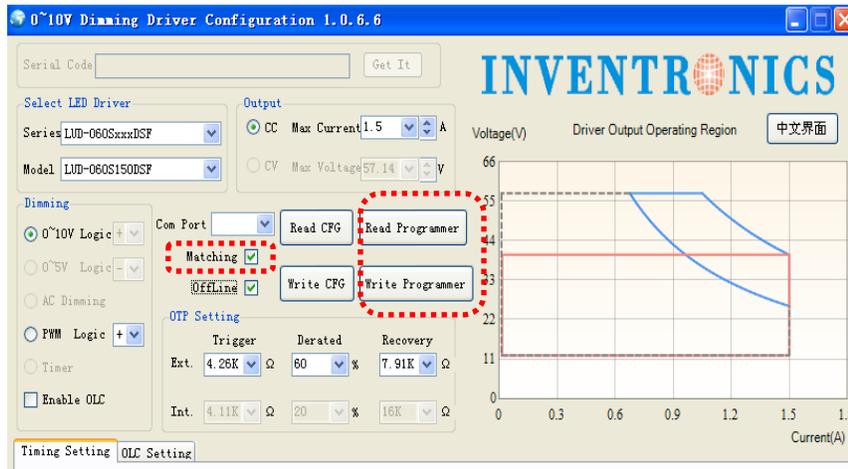

- **Offline programming**

Offline programming means firstly downloading the configuration information to programmer, then downloading to driver with connecting 5V output portable power supply.
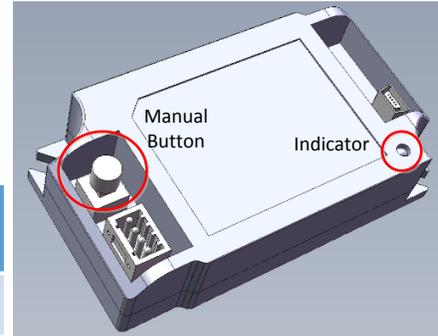

Note: For the offline programming function, the 'offline' item should be checked. Please noting the configuration can only be downloaded to programmer as checking 'offline' item.

In offline programming function, which include two programming methods: manual programming and automatic programming.

● **The function of programming indicator**

Function	Anti-shaking	Manual Programing Mode	Automatic Programming Mode	Buzzer
Press Button	0~0.5s	0.5s-5s	5s-10s	>10s

	Manual Mode		Automatic Mode	
	Red LED	Green LED	Red LED	Green LED
Status				
Start up	flicker N times in 0.5s	flicker N times in 0.5s	flicker N times in 0.5s	flicker N times in 0.5s
Standby	off	on	off	Flicker continuously (per 0.5s)
Programming	off	Flicker continuously	off	Flicker continuously (per 0.5s)
Succeed	off	on	off	on
Failed	on	off	on	off

Note: the "N" in the table indicate the programming mode, refer to the below.
  N=1 Off-line programming mode for 0~xV controller.
  N=2 Off-line programming mode for Timer controller.
  N=3 Off-line programming mode for constant power driver.
  N=4 Off-line programming mode for DALI supported driver.

● **Manual programming**

The default programming mode of 'Offline' function is manual programming. The manual button should be pressing for programming when connecting well programmer, portable power supply and programmable driver.

● **Automatic programming**

Automatic programming means the driver will be automatically programmed once connect well programmer, portable power supply and programmable driver(not need to press manual button for programming)

Press the manual button for more than 5 seconds to make indicator continuously flicker between red and green color, which means the offline programming changed from manual programming to automatic programming.

- **Programming diagnostics**
a. Connect the programmer with a buzzer, the buzzer will make a noisy when programming successfully.
b. Press the 'read driver' button for reading out existing configuration in programmable driver
c. Use multimeter to check when powering on driver with LED load.

Any questions, please feel free to contact with Inventronics' FAE team
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