inventronics SUM-1K0SxxxMGR 1000W Programmable Driver with INV Digital Dimming Owner's Manual

SUM-1K0SxxxMGR Rev.B
1000W Programmable Driver with INV Digital Dimming

c UL us E326335 FC CE CB
global-mark

Contents

Features

- Panel Mount Connectors Facilitates Installation
- Rotary Switch+RJ12 Connector
- Hot-plugging Protection
- Parallel LED Protection
- Ultra High Efficiency (Up to 96%)
- Full Power at Wide Output Current Range (Constant Power)
- Adjustable Output Current (AOC)with Programmability
- Isolated 0-10V/PWM/Resistor/3-Timer-Modes Dimmable
- Adjustable Dimming Curve
- INV Digital Dimming, UART Based Communication Protocol
- Dim-to-Off with Standby Power ≤ 0.5W
- Minimum Dimming Level with 5% or 10% Selectable
- Hold Time Adjustable
- Fade Time Adjustable
- Low Inrush Current
- Output Lumen Compensation
- End-of-Life Indicator
- Input Surge Protection: DM 6kV, CM 10kV
- All-Around Protection: IOVP, IUVP, OVP, SCP, OTP
- IP66 and UL Dry/Damp/Wet Location
- 5 Years Warranty

Description

The SUM-1K0SxxxMGR series is a 1000W, constant-current, programmable and IP66 rated LED driver that operates from 90-305Vac input with excellent power factor. Created for many lighting applications including high mast, sports, UV-LED, aquaculture and horticulture, etc. It provides rotary switch, RJ12 connector and dim-to-off functionality. The dimming control supports 0-10V dimming as well as two-way communication via Digital Dimming, a UART based communication protocol. The high efficiency of these drivers and compact metal case enables them to run cooler, significantly improving reliability and extending product life. To ensure trouble-free operation, protection is provided against input surge, input under voltage, input over voltage, output over voltage, short circuit, and over temperature.

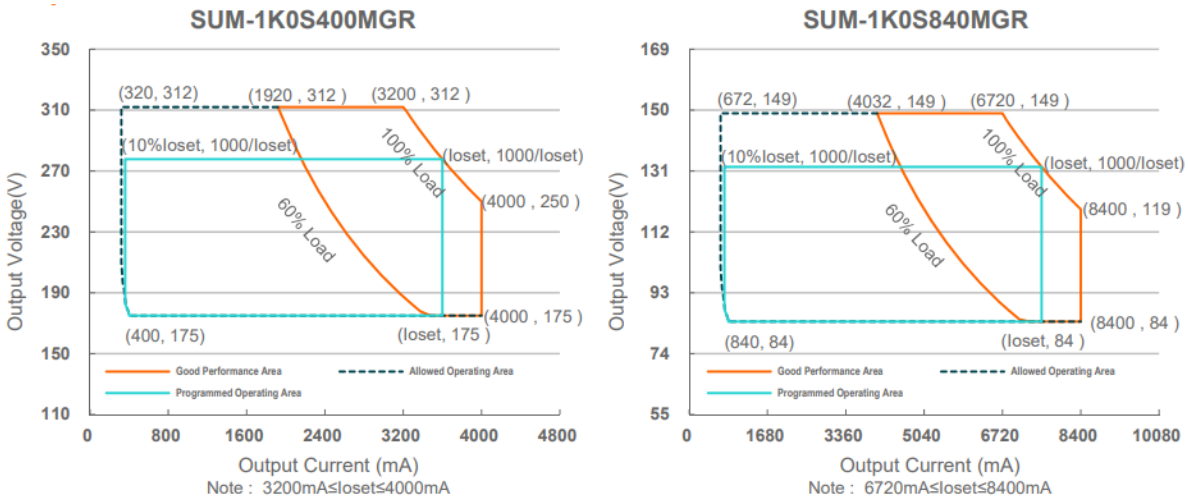
Models

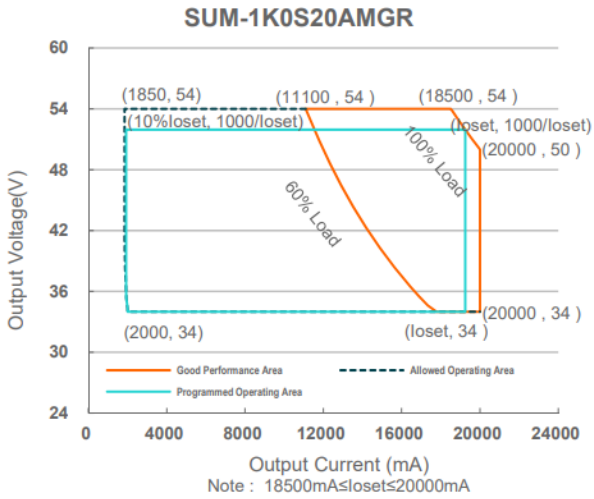
Adjustable Output Current Range (A)	Full-Power Current Range (A)(1)	Default Output Current (A)	Output Voltage Range (Vdc)	Max. Output Power (W)	Typical Efficiency (2)	Typical Power Factor		Model Number (3) (4)
						120Vac	220Vac	
0.32-4	3.2-4	3.3	175~ 312	1000	95.0%	0.99	0.96	SUM-1K0S400MGR
0.672-8.4	6.72-8.4	7.7	84 ~ 149	1000	95.0%	0.99	0.96	SUM-1K0S840MGR
1.85-20	18.5-20	18.5	34 ~ 54	1000	95.5%	0.99	0.96	SUM-1K0S20AMGR (5)

Notes:

1. Output current range with constant power at 1000W.
2. Measured at 100% load and 220Vac input (see below “General Specifications” for details).
3. Certified input voltage range: UL, FCC 100-277Vac; otherwise: 100-240Vac
4. All the models are certificated to global-mark, except SUM-1K0S20AMGR
5. SELV output

I-V Operation Area





Input Specifications

Parameter	Min.	Typ.	Max.	Notes
Input AC Voltage	90 Vac	–	305 Vac	
Input DC Voltage	127 Vdc	–	300 Vdc	
Input Frequency	47 Hz	–	63 Hz	
Leakage Current	–	–	0.75 MIU	UL 8750; 277Vac/ 60Hz
	–	–	0.70 mA	IEC 60598-1; 240Vac/ 60Hz

Parameter	Min.	Typ.	Max.	Notes
Input AC Current	–	–	10.07 A	Measured at 80% load and 120 Vac input.
	–	–	5.39 A	Measured at 100% load and 220 Vac input.
Inrush Current(I2t)	–	–	2.89 A2s	At 220Vac input, 25°C cold start, duration=17.6 ms, 10%Ipk-10%Ipk.
PF	0.90	–	–	At 100-277Vac, 50-60Hz,60%-100%Load (600 – 1000W)
THD	–	–	20%	
THD	–	–	10%	At 220-240Vac, 50-60Hz,75%-100%Load (750 – 1000W)

Output Specifications

Parameter	Min.	Typ.	Max.	Notes
Output Current Tolerance	-5%Ioset	–	5%Ioset	100% load
Output Current Setting(Ioset Range) SUM-1K0S400MGR SUM-1K0S840MGR SUM-1K0S20AMGR	320 mA 672 mA 1850 mA	– – –	4000 mA 8400 mA 20000 mA	
Output Current Setting Range with Constant Power SUM-1K0S400MGR SUM-1K0S840MGR SUM-1K0S20AMGR	3200 mA 6720 mA 18500 mA	– – –	4000 mA 8400 mA 20000 mA	
Total Output Current Ripple (pk-pk)	–	5%Iomax	10%Iomax	100% load, 20 MHz BW
Output Current Ripple at < 200 Hz (pk-pk)	–	–	2%Iomax	70%-100% load
Startup Overshoot Current	–	–	10%Iomax	100% load
No Load Output Voltage SUM-1K0S400MGR SUM-1K0S840MGR SUM-1K0S20AMGR	– – –	– – –	350 V 170 V 60 V	
Line Regulation	–	–	±0.5%	100% load
Load Regulation	–	–	±3.0%	
Turn-on Delay Time	–	–	0.5 s	Measured at 120-277Vac input, 60%-100% Load
Temperature Coefficient of Ioset	–	0.03%/°C	–	Case temperature = 0°C ~Tc max

General Specifications

Parameter	Min.	Typ.	Max.	Notes
Efficiency at 120 Vac input:				
SUM-1K0S400MGR				
Io= 3200 mA Io= 4000 mA SUM-1K0S840 MGR	90.0% 89.0%	92.0% 91.0%	– –	Measured at 80% load and steady-state temperature in 25°C ambient;
Io= 6720 mA	91.0%	93.0%	–	(Efficiency will be about 2.0% lower if
Io= 8400 mA SUM-1K0S20A MGR	90.0%	92.0%	–	measured immediately after startup.)
Io= 18500 mA	91.0%	93.0%	–	
Io= 20000 mA	91.0%	93.0%	–	
Efficiency at 220 Vac input:				
SUM-1K0S400MGR				
Io= 3200 mA Io= 4000 mA SUM-1K0S840 MGR	93.0% 93.0%	95.0% 95.0%	– –	Measured at 100% load and steady-stat e temperature in 25°C ambient;
Io= 6720 mA	93.0%	95.0%	–	(Efficiency will be about 2.0% lower if
Io= 8400 mA SUM-1K0S20AMGR	93.0%	95.0%	–	measured immediately after startup.)
Io= 18500 mA	93.5%	95.5%	–	
Io= 20000 mA	93.5%	95.5%	–	
Efficiency at 277 Vac input:				
SUM-1K0S400MGR				
Io= 3200 mA Io= 4000 mA SUM-1K0S840 MGR	93.5% 93.5%	95.5% 95.5%	– –	Measured at 100% load and steady-stat e temperature in 25°C ambient;
Io= 6720 mA	93.0%	95.0%	–	(Efficiency will be about 2.0% lower if
Io= 8400 mA SUM-1K0S20AMGR	93.0%	95.0%	–	measured immediately after startup.)
Io= 18500 mA	94.0%	96.0%	–	
Io= 20000 mA	94.0%	96.0%	–	
Standby Power	–	–	0.5 W	Measured at 230Vac/50Hz; Dimming off
MTBF	–	206,000 Hours	–	Measured at 220Vac input, 80%Load an d 25°C ambient temperature (MIL-HDBK - 217F)
Lifetime	–	110,000 H ours	–	Measured at 220Vac input, 80%Load an d 70°C case temperature; See lifetime v s. Tc curve for the details

	–	50,000Hours	–	Measured at 220Vac input, 100%Load and 40°C ambient temperature
Operating Case Temperature for Safety Tc_s	-40°C	–	+90°C	
Operating Case Temperature for Warranty Tc_w	-40°C	–	+80°C	Case temperature for 5 years warranty Humidity: 10%RH to 95%RH
Storage Temperature	-40°C	–	+85°C	Humidity: 5%RH to 95%RH
Dimensions Inches (L × W × H) Millimeters (L × W × H)				With mounting ear
	16.73 × 4.25 × 1.91			17.72 × 4.25 × 1.91
	425 × 108 × 48.5			450 × 108 × 48.5
Net Weight	–	3710 g	–	

Dimming Specifications

Parameter		Min.	Typ.	Max.	Notes
Absolute Maximum Voltage o n the Vdim (+) Pin		-20 V	–	20 V	
Source Current on Vdim (+) Pin		90 uA	100 uA	110 uA	Vdim(+) = 0 V
Dimming Output Ra nge with 1 0%-100% (Default)	SUM-1K0S400M GR SUM-1K0S8 40MGR SUM-1K 0S20AMGR	10%Ioset	–	Ioset	3200 mA ≤ Ioset ≤ 4000 mA 6720 mA ≤ Ioset ≤ 8400 mA 18500 mA ≤ Ioset ≤ 20 000 mA
	SUM-1K0S400M GR SUM-1K0S840M GR SUM-1K0S2 0AMGR	320 mA 672 mA 1850 mA	–	Ioset	320 mA ≤ Ioset ≤ 3200 mA 672 mA ≤ Io set ≤ 6720 mA 1850 mA ≤ Ioset 18500 mA
Dimming Output Ra nge with 5 %-100% (Settable)	SUM-1K0S400M GR SUM-1K0S8 40MGR SUM- 1K0S20AMGR	5%Ioset	–	Ioset	3200 mA ≤ Ioset ≤ 4000 mA 6720 mA ≤ Ioset ≤ 8400 mA 18500 mA ≤ Ioset ≤ 20 000 mA
	SUM-1K0S400M GR SUM-1K0S8 40MGR SUM-1K 0S20AMGR	160 mA 336 mA 925 mA	–	Ioset	320 mA ≤ Ioset ≤ 3200 mA 672 mA ≤ Io set ≤ 6720 mA 1850 mA ≤ Ioset 18500 mA
Recommended Dimming Inp ut Range		0 V	–	10 V	Default 0-10V dimming mode.
Dim off Voltage		0.35 V	0.5 V	0.65 V	
Dim on Voltage		0.55 V	0.7 V	0.85 V	
Hysteresis		–	0.2 V	–	
PWM_in High Level		3 V	–	10 V	Dimming mode set to PWM in Inventron ics Programing Software.
PWM_in Low Level		-0.3 V	–	0.6 V	
PWM_in Frequency Range		200 Hz	–	3 KHz	
PWM_in Duty Cycle		1%	–	99%	
PWM Dimming off (Positive L ogic)		3%	5%	8%	
PWM Dimming on (Positive L ogic)		5%	7%	10%	
PWM Dimming off (Negative Logic)		92%	95%	97%	
PWM Dimming on (Negative Logic)		90%	93%	95%	
Hysteresis		–	2%	–	

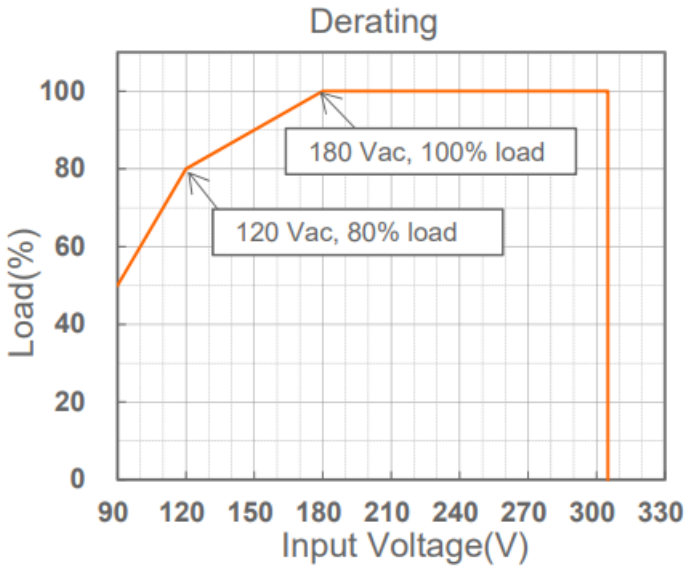
Safety & EMC Compliance

Safety Category	Standard
UL/CUL	UL 8750, CAN/CSA-C22.2 No. 250.13
CE	EN 61347-1, EN 61347-2-13
CB	IEC 61347-1, IEC 61347-2-13
global-mark	AS/NZS 61347.1, AS/NZS 61347.2.13

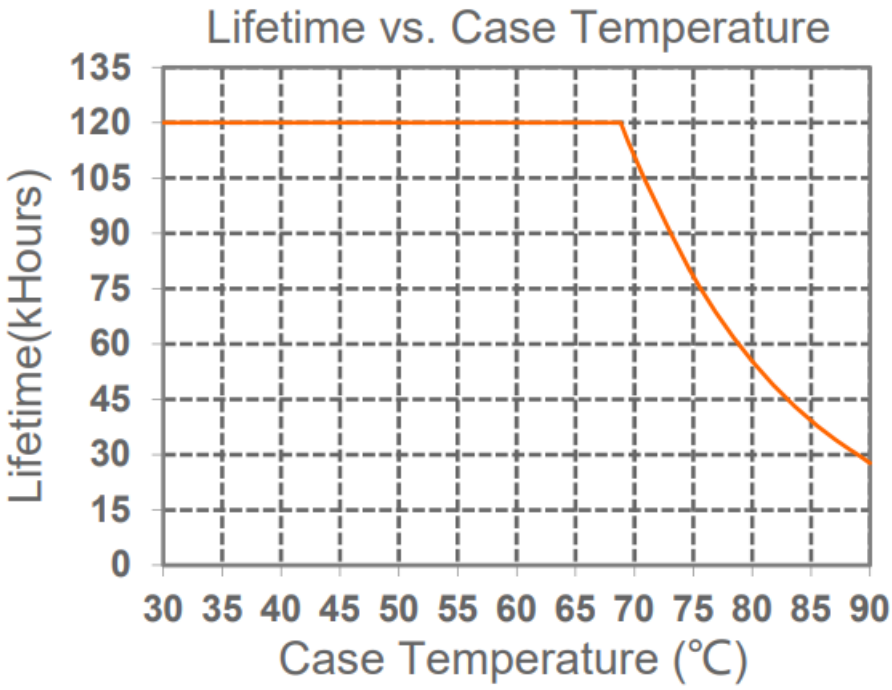
EMI Standards	Notes
EN IEC 55015 (1)	Conducted emission Test &Radiated emission Test
EN IEC 61000-3-2	Harmonic current emissions
EN 61000-3-3	Voltage fluctuations & flicker
FCC Part 15(1)	ANSI C63.4 Class B
	This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: [1] this device may not cause harmful interference, an d [2] this device must accept any interference received, including interference th at may cause undesired Operation.
EMS Standards	**Notes**
EN 61000-4-2	Electrostatic Discharge (ESD): 8 kV air discharge, 4 kV contact discharge
EN 61000-4-3	Radio-Frequency Electromagnetic Field Susceptibility Test-RS
EN 61000-4-4	Electrical Fast Transient / Burst-EFT
EN 61000-4-5	Surge Immunity Test: AC Power Line: Differential Mode 6 kV, Common Mode 1 0 kV
EN 61000-4-6	Conducted Radio Frequency Disturbances Test-CS
EN 61000-4-8	Power Frequency Magnetic Field Test
EN 61000-4-11	Voltage Dips
EN 61547	Electromagnetic Immunity Requirements Applies To Lighting Equipment

Note: (1) This LED driver meets the EMI specifications above, but EMI performance of a luminaire that contains it depends also on the other devices connected to the driver and on the fixture itself.

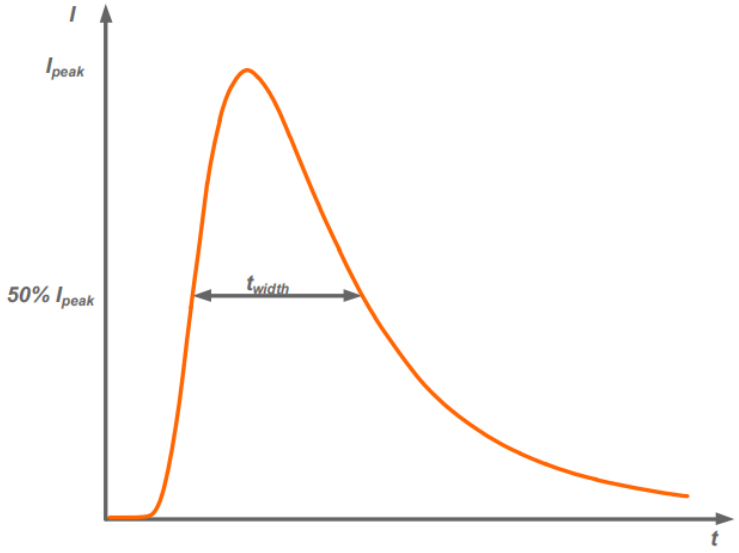
Derating



Lifetime vs. Case Temperature

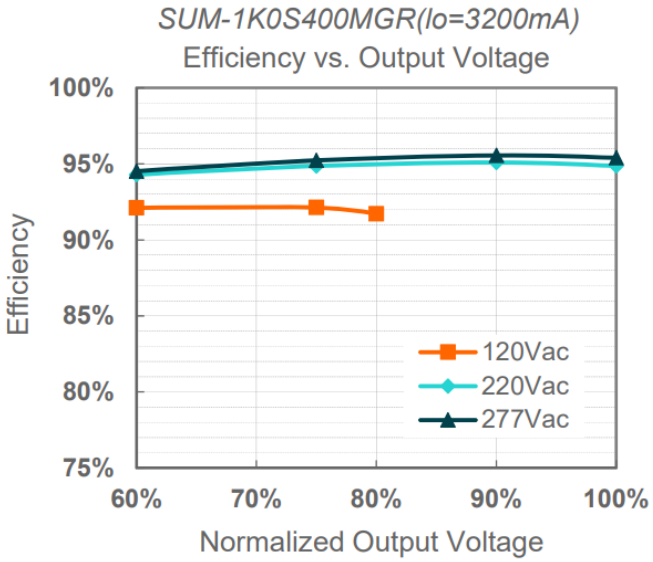


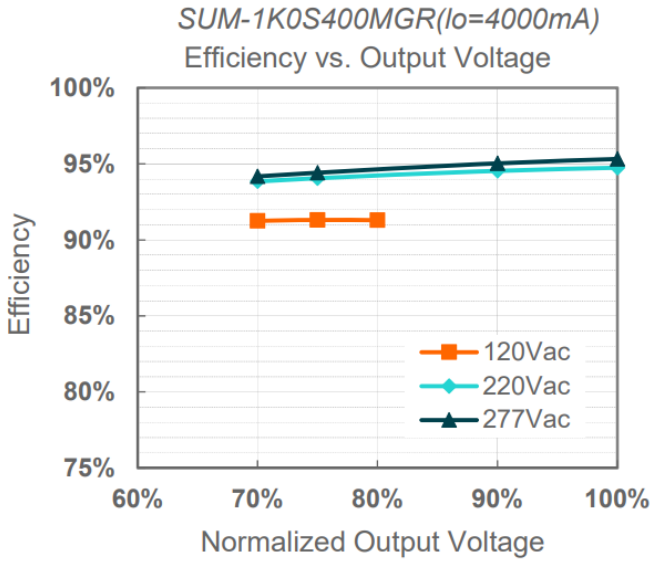
Inrush Current Waveform

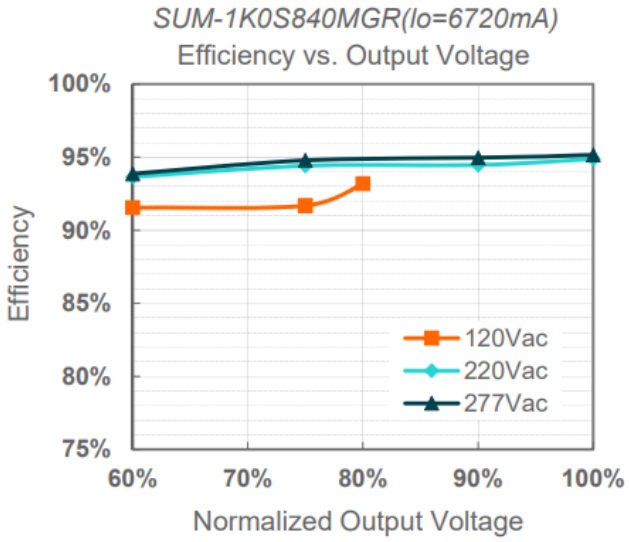


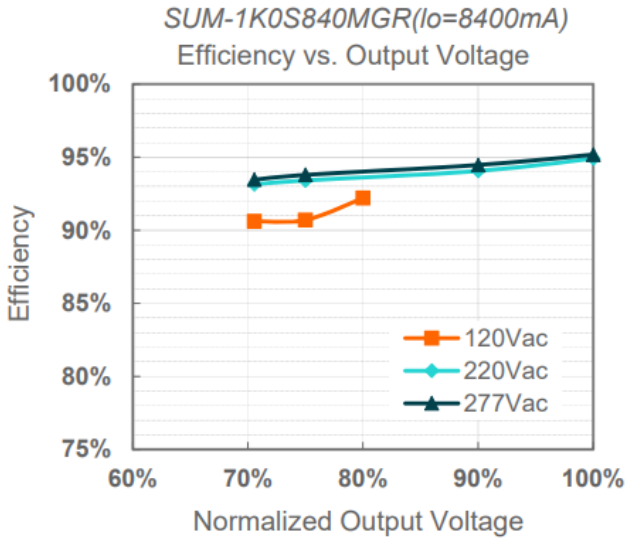
Input AC Voltage	I_{peak}	t_{width} (@ 50% Ipeak)
220Vac	14.8A	4.12ms

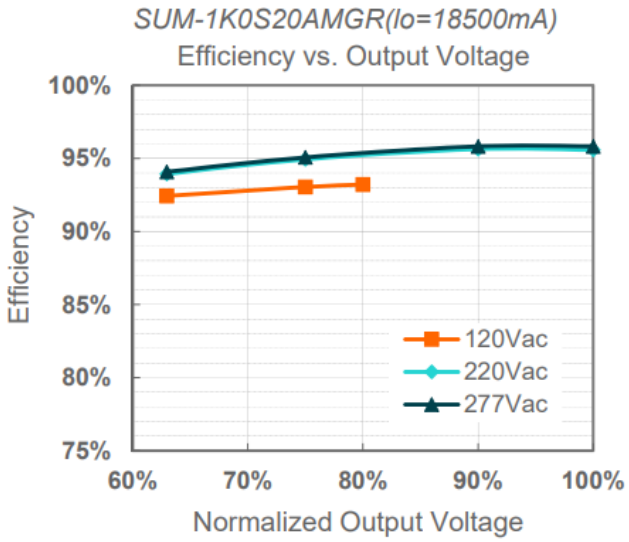
Efficiency vs. Load

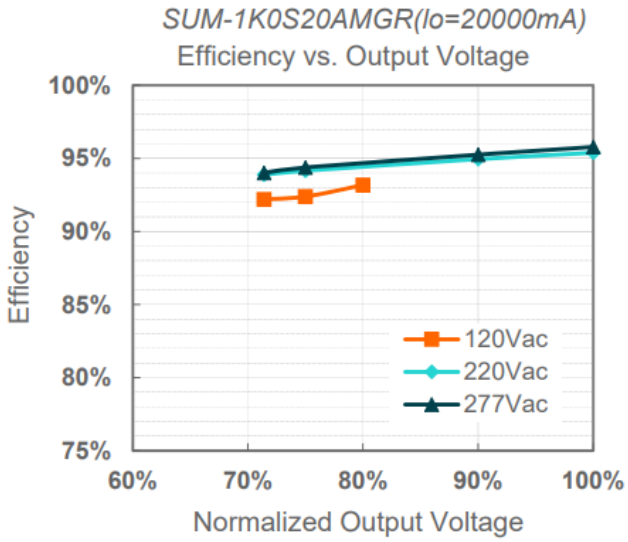




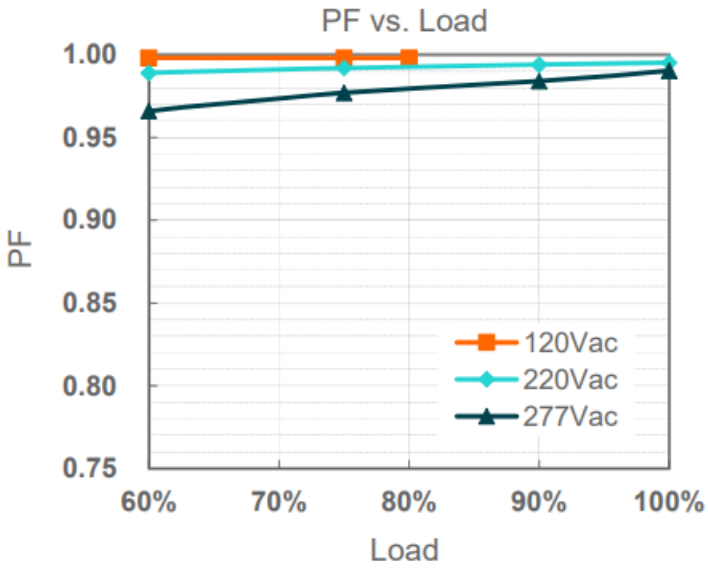




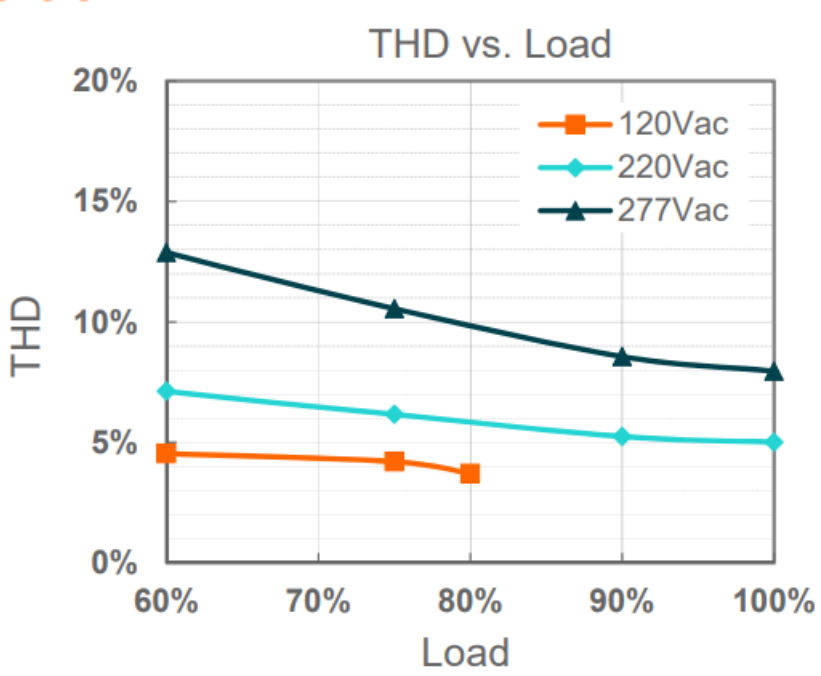




Power Factor

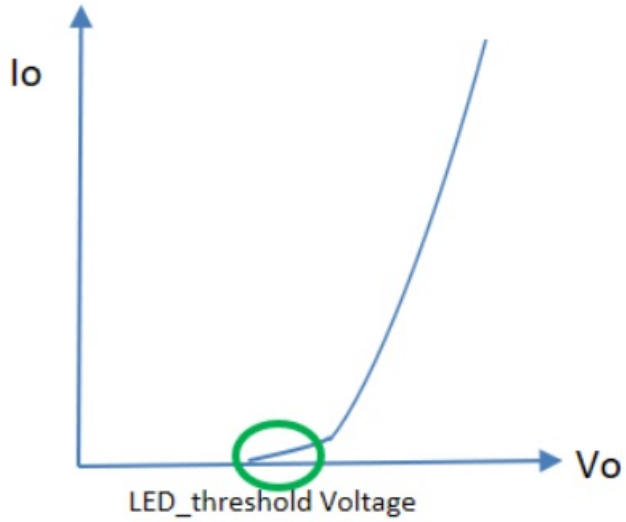


Total Harmonic Distortion



Hot-plugging Protection

This feature protects LEDs when connecting to a driver that is already powered on. This is disabled by default and can be enabled through the Inventronics Programing Software.



LED threshold voltage (Vth) is the minimum voltage required for current to flow through the LED load. After this threshold is met, the LED forward voltage (Vf) increases as the current increases.

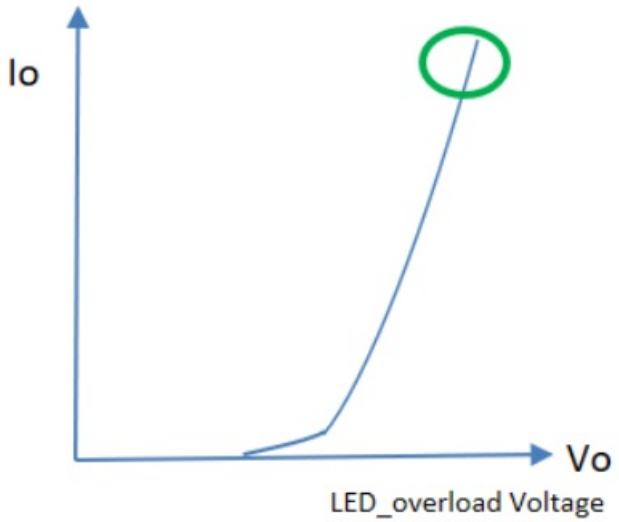
Set Vth close to, but higher than the actual LED threshold voltage for optimized performance. The greater the difference between the Vth setting and the actual LED threshold voltage, the higher the overshoot current will be. The Vth setting must be lower than Vf.

Please test, program, and tune this feature for each LED load design.

Parameter			Min.	Typ.	Max.	Notes
Hot- plugging Protection	LED Threshold Voltage Setting Range	SUM-1K0S400MGR	175 V	–	312 V	Set Vth close to, but higher than the actual LED threshold voltage
		SUM-1K0S840MGR	84 V	–	149 V	
		SUM-1K0S20AMGR	44 V	–	54 V	
	Setting Tolerance		-2%	–	2%	

Parallel LED Protection

This feature helps protect parallel LEDs from a high, overcurrent condition by limiting the voltage. This is disabled by default and can be enabled through the Inventronics Programing Software.



Set V_overload close to, but higher than the maximum forward voltage for optimized performance. The greater the difference between the V_overload setting and the maximum forward voltage, the higher the overload stress will be. The V_overload setting must be higher than Vf.
Please test, program, and tune this feature for each LED load design.

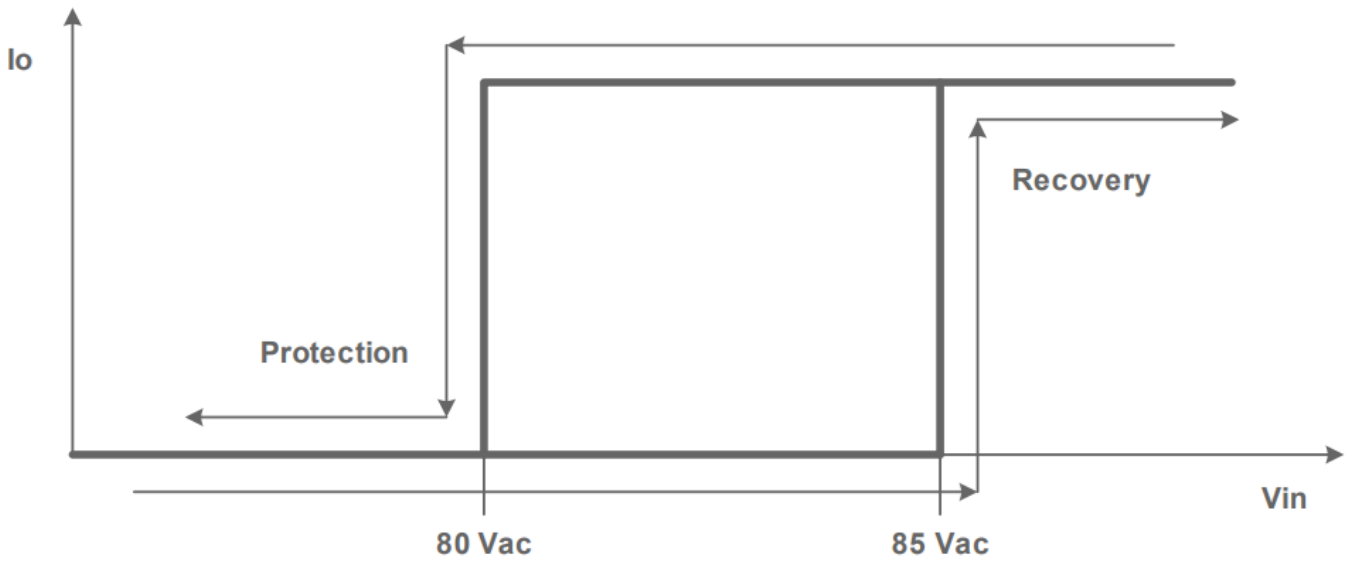
Parameter			Min.	Typ.	Max.	Notes
Parallel LED Protection	Overload Voltage Setting Range	SUM-1K0S400MGR	175 V	–	325 V	Set V_overload close to, but higher than the maximum LED forward voltage
		SUM-1K0S840MGR	90 V	–	155 V	
		SUM-1K0S20AMGR	47 V	–	56 V	
	Setting Tolerance		-2%	–	2%	

Protection Functions

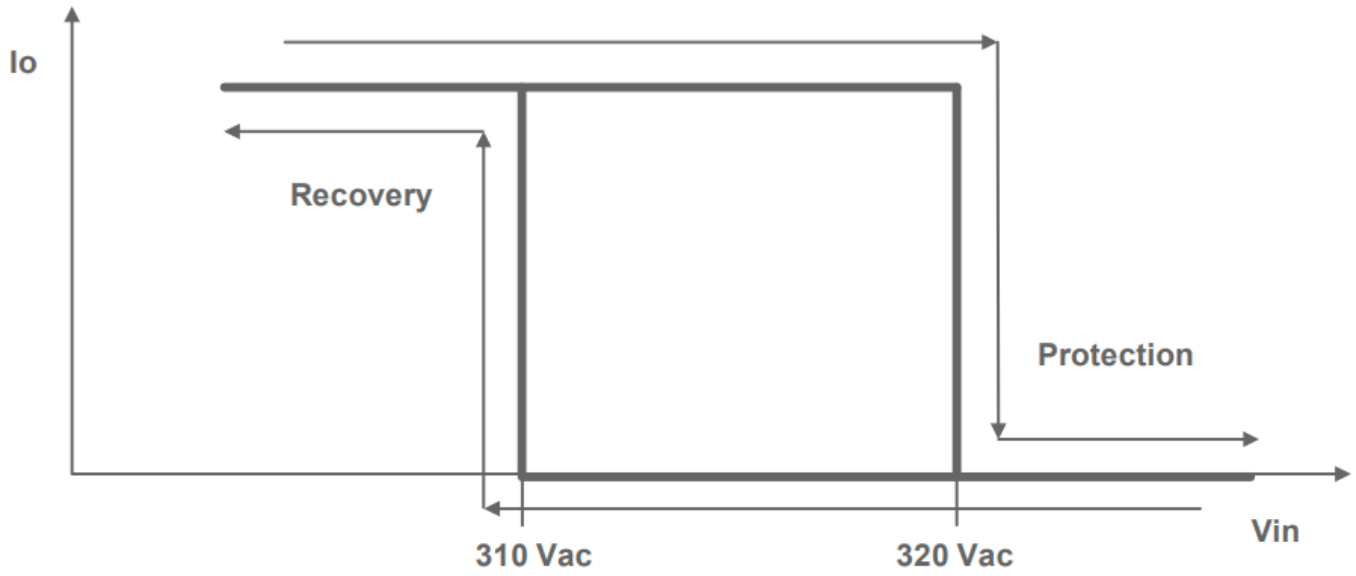
Parameter		Min.	Typ.	Max.	Notes
Over Voltage Protection		Limits output voltage at no load and in case the normal voltage limit fails.			
Short Circuit Protection		Auto Recovery. No damage will occur when any output is short circuited. The output shall return to normal when the fault condition is removed.			
Over Temperature Protection		Decreases output current, returning to normal after over temperature is removed.			
Input Under Voltage Protection (IUVP)	Input Under Voltage Protection	70 Vac	80 Vac	90 Vac	Turn off the output when the input voltage falls below protection voltage.
	Input Under Voltage Recovery	75 Vac	85 Vac	95 Vac	Auto Recovery. The driver will restart when the input voltage exceeds recovery voltage.
Input Over Voltage Protection (IOVP)	Input Over Voltage Protection	310 Vac	320 Vac	330 Vac	Turn off the output when the input voltage exceeds protection voltage.
	Input Over Voltage Recovery	300 Vac	310 Vac	320 Vac	Auto Recovery. The driver will restart when the input voltage falls below recovery voltage.
	Max. of Input Over Voltage	–	–	350 Vac	The driver can survive for 8 hours with a stable input voltage stress of 350Vac.

Note: When removing the protective cap of RJ12, the waterproof protection performance should be evaluated together with external connected system by users.

Input Under Voltage Protection Diagram

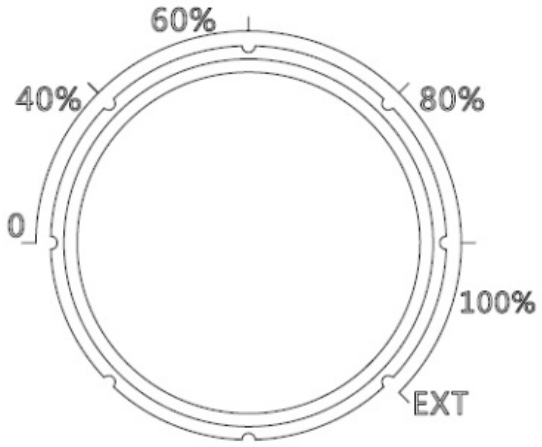


Input Over Voltage Protection Diagram

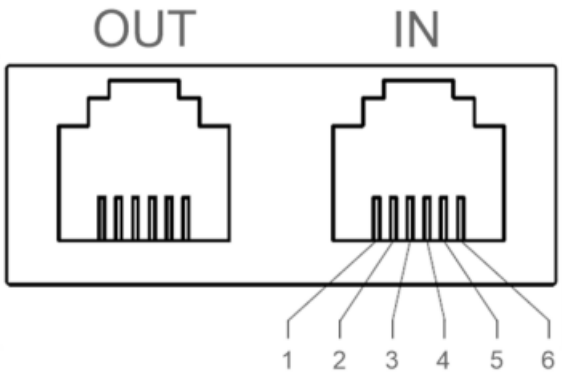


Rotary Switch and RJ12 interface

Output current can be set as 0, 40%, 60%, 80%, 100% level by rotary switch and the output current can be dimmed by dimming wire in RJ12 connector when rotary switch is at ‘EXT’ position. The default mode is in ‘EXT’.



Rotary Switch



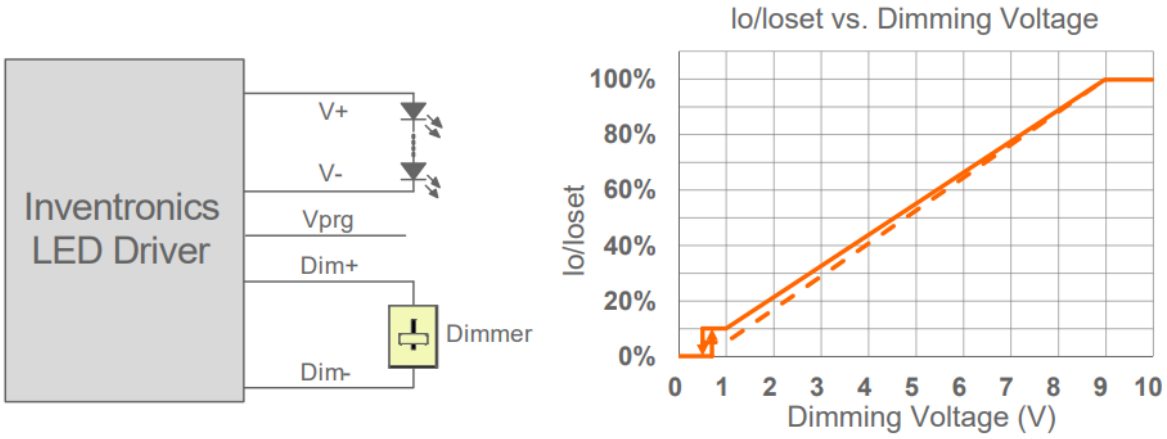
RJ12 Connector

Pin	Function
1,6	Vprg
2,5	Dim+
3,4	Dim-

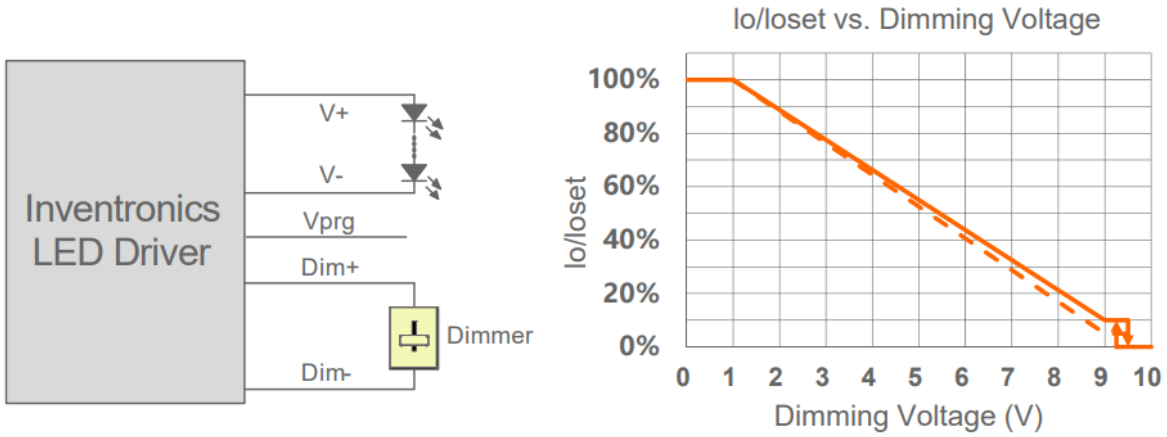
Dimming

0-10V Dimming

The recommended implementation of the dimming control is provided below.



Implementation 1: Positive logic



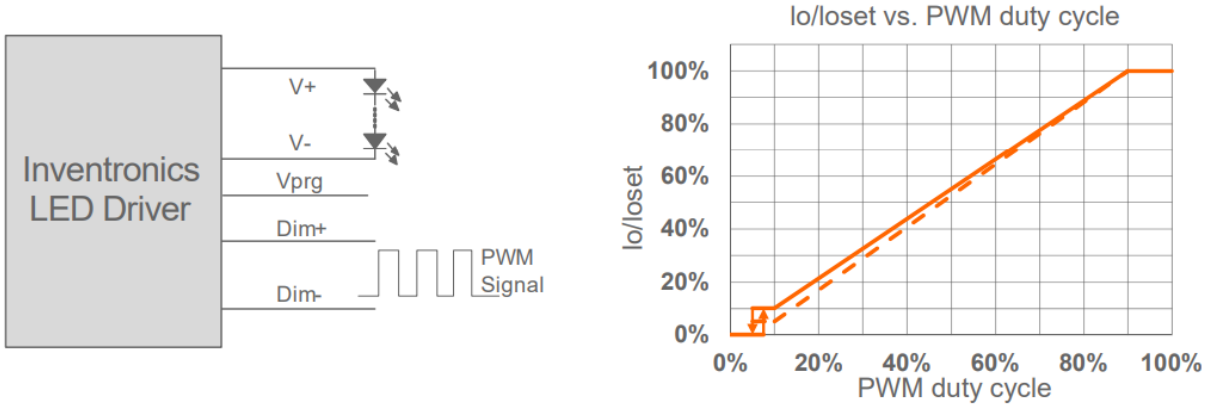
Implementation 2: Negative logic

Notes:

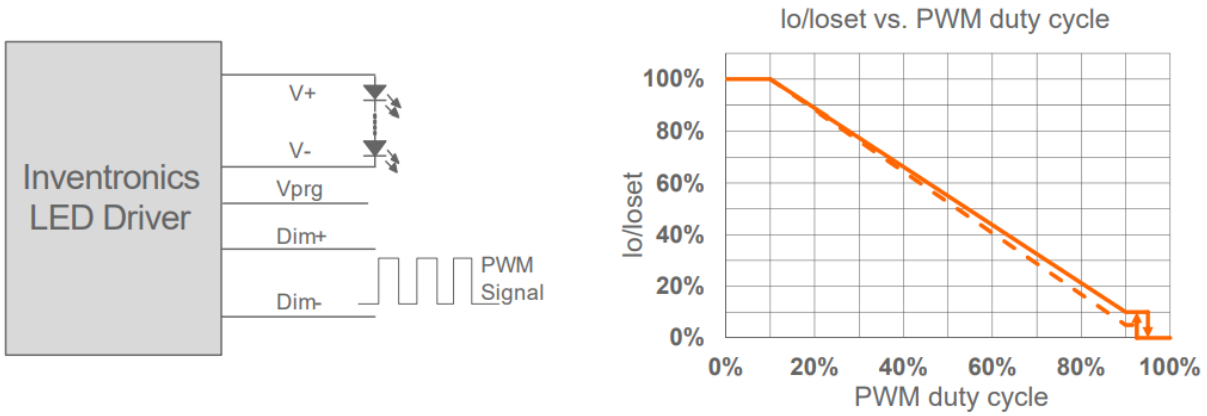
1. Do NOT connect Dim– to the output V– or V+, otherwise the driver will not work properly.
2. The dimmer can also be replaced by an active 0-10V voltage source signal or passive components like zener.
3. When 0-10V negative logic dimming mode and Dim+ is open, the driver will dim to off and be standby.

PWM Dimming

The recommended implementation of the dimming control is provided below.



Implementation 3: Positive logic



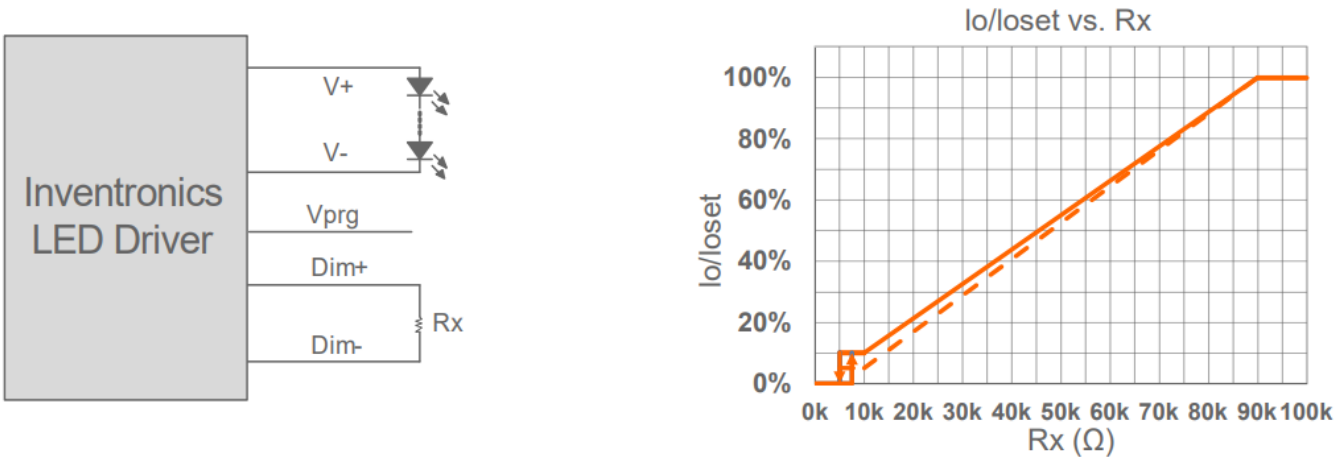
Implementation 4: Negative logic

Note:

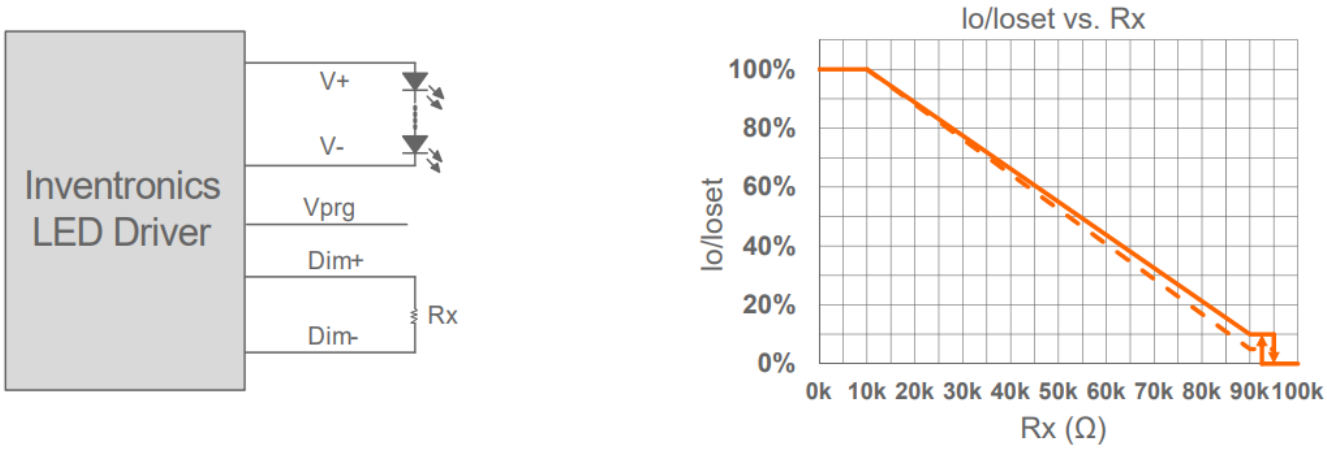
1. Do NOT connect Dim– to the output V– or V+, otherwise the driver will not work properly.
2. When PWM negative logic dimming mode and Dim+ is open, the driver will dim to off and be standby.

Resistor Dimming

The recommended implementation of the dimming control is provided below.



Implementation 5: Positive logic



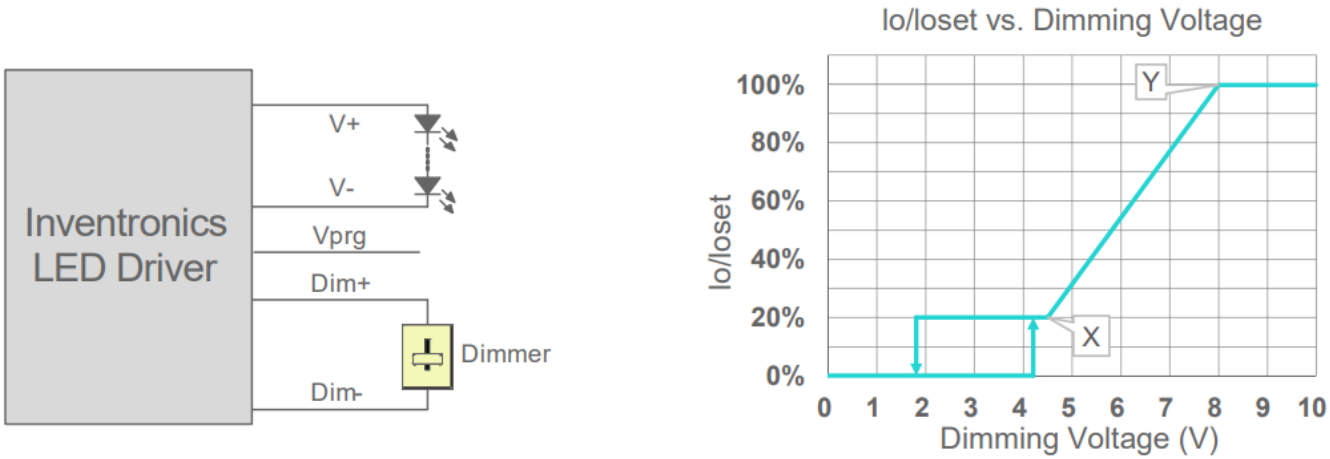
Implementation 6: Negative logic

Notes:

1. Do NOT connect Dim– to the output V– or V+, otherwise the driver will not work properly.
2. When resistor negative logic dimming mode and Dim+ is open, the driver will dim to off and be standby.

Adjustable Dimming Curve

0-10V dimming curve can be set as corresponding dimming voltage by Inventronics Multi Programmer. Take the positive logic dimming as an example, the recommended implementation of the dimming control is provided below.



Implementation 7: Positive logic

Notes:

1. Do NOT connect Dim– to the output V– or V+, otherwise the driver will not work properly.
2. The dimmer can also be replaced by an active 0-10V voltage source signal or passive components like zener.
3. When dimming voltage X point is set to be smaller than Y point, the dimming curve is positive logic, conversely, when X point is set to be bigger than Y point, the dimming curve is negative logic.
4. For best dimming accuracy, the difference between X point and Y point is advised more than 4V.
5. Dimming off voltage adjustable.

Time Dimming

Time dimming control includes 3 kinds of modes, they are Self Adapting-Midnight, Self AdaptingPercentage and Traditional Timer.

- Self Adapting-Midnight: Automatically adjusts the dimming curve based on the on-time of past two days (if difference <15 minutes), assuming that the center point of the dimming curve is midnight local time.
- Self Adapting-Percentage: Automatically adjusts the on-time of each step by a constant percentage = (actual on-time for the past 2 days if difference <15 min) / (programmed on-time from the dimming curve).
- Traditional Timer: Follows the programmed timing curve after power on with no changes.

- **Output Lumen Compensation**

  Output Lumen Compensation (OLC) may be used to maintain constant light output over the life of the LEDs by driving them at a reduced current when new, then gradually increasing the drive current over time to counteract LED lumen degradation.
- **Minimum Dimming Level with 5% or 10% Selectable**

  The minimum dimming level can be set as 5% or 10% by Inventronics Multi Programmer,10% is default.
- **Hold Time Adjustable**

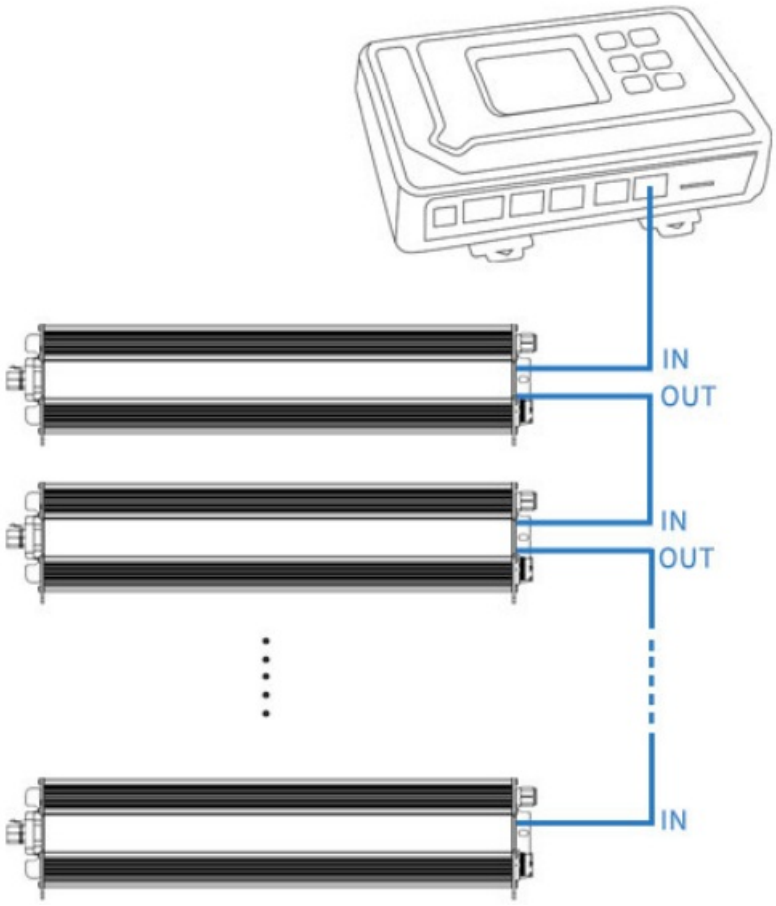
  When AC power is first applied to the LED driver, enabling a “Hold” period can allow devices powered by the Auxiliary voltage to stabilize before the driver fades up to the maximum dimming level. During this period, the driver will not respond to external dimming commands but will respond again after the hold time ends. Both the initial dimming percentage and the duration of this hold period can be adjusted by the Inventronics Multi Programmer. This function is disabled by default
- **Fade Time Adjustable**

  There is a “Fade” period after the “Hold” period. The soft-start time and dimming slope applied to all dimming transitions can be adjusted individually. It is adjusted by the Inventronics Multi Programmer. This function is disabled by default.
- **End Of Life**

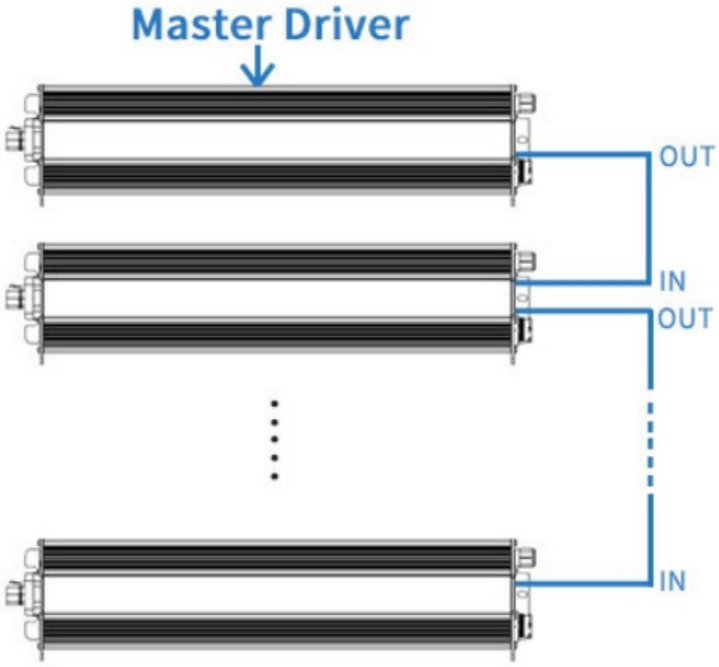
  End-of-Life (EOL) is providing a visual notification to a user that the LED module has reached the end of manufacturer-specified life and that the replacement is recommended. Once active, an indication is given at each power-up of the driver, which the driver indicates this through a lower light output during the first 1 minute before normal operation is continued.
- **Digital Dimming**

  Inventronics Digital Dimming is a UART (Universal Asynchronous Receive Transmitter) based communication protocol. Please refer to **Inventronics Digital Dimming** file for details.
- **Daisy Chain Application**

  Daisy chain system can support synchronous dimming of up to 100 drivers due to unique dimming interface design, please pay attention to right sequence of ‘IN’ and ‘OUT’ port for RJ12 connection

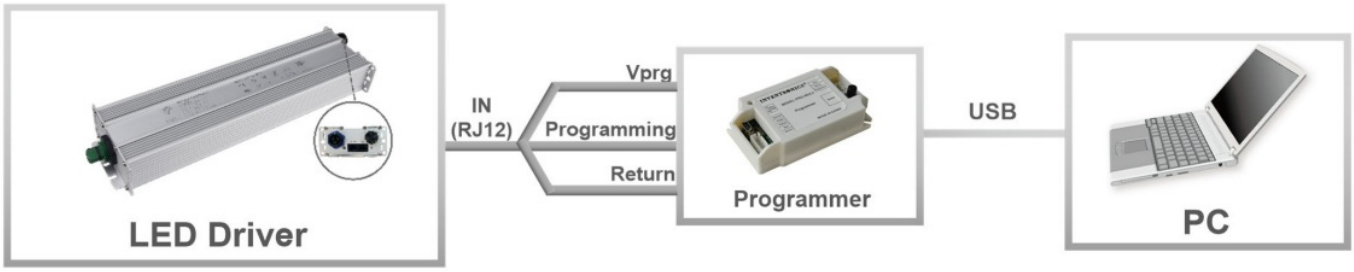


Daisy chain controlled by External Controller
Inventronics supports daisy chain connection for drivers that is dimmed by external controller. All drivers' rotary switch need to be tuned to 'EXT'.



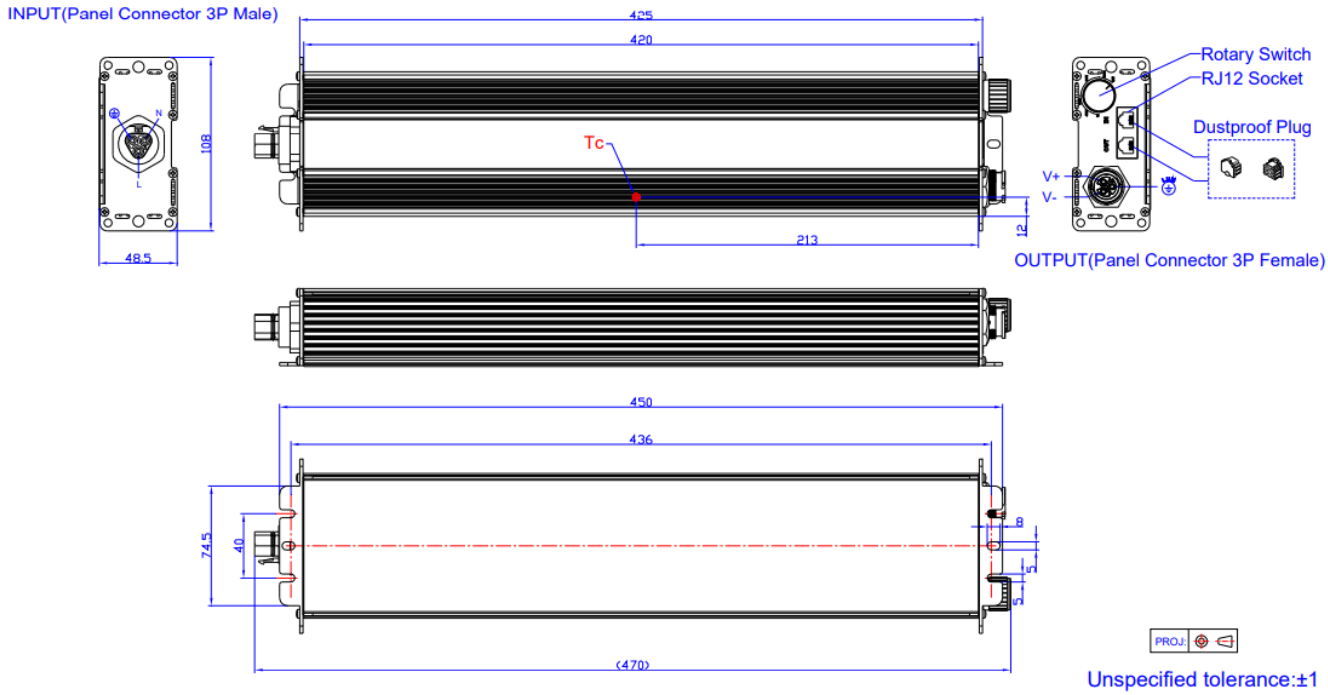
Daisy chain controlled by Driver-self
Inventronics offers the solution to use driver itself to control daisy chain dimming without the controller.
The rotary switch of the master driver is tuned to required dimming level when the rest of drivers are tuned to 'EXT'.

Programming Connection Diagram



Note: The driver does not need to be powered on during the programming process.
Please refer to **PRG-MUL2** (Programmer) datasheet for details.

Mechanical Outline



Note: This driver features UL Wet Location, IP66 panel mount connectors to streamline wiring in the field while still supporting stringent environmental conditions. The mating push-lock are not supplied by Inventronics. Please contact Wieland and Amphenol LTW or one of their suppliers for assistance sourcing the mating push-lock

Location	Series	Rating voltage/current	PN of connector on driver	PN of mating push-lock
Vin	Wieland RST20i3	600V/10A	96.032.1055.7	96.031.0055.7 (Spring) or 96.031.4055.7 (Screw)
Vo	ALTW X-Lok,C-Size	600V/10A	CC-03PMFS-QC801P	CC-03BFMB-QL8APA
		300V/20A	CC-03PMFS-QC800P	CC-03BFMB-QL8APP

RoHS Compliance
Our products comply with reference to RoHS Directive (EU) 2015/863 amending 2011/65/EU, calling for the elimination of lead and other hazardous substances from electronic products.

Revision History

Change Date	Rev.	Description of Change		
		Item	From	To
2023-05-25	A	Datasheet Release	/	/
2024-01-02	B	Format	/	Updated
		Features	/	Updated
		Inrush Current Waveform	/	Updated
		Dimming	/	Updated

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Documents / Resources

	inventronics SUM-1K0SxxxMGR 1000W Programmable Driver with INV Digital Dimming [pdf] Owner's Manual SUM-1K0S400MGR, SUM-1K0S840MGR, SUM-1K0S20AMGR, SUM-1K0SxxxMGR 1000W Programmable Driver with INV Digital Dimming, 1000W Programmable Driver with INV Digital Dimming, Programmable Driver with INV Digital Dimming, Driver with INV Digital Dimming, INV Digital Dimming, Digital Dimming, Dimming

References

- .co.com Domain Name Registry
- Inventronics
- User Manual