INVENTRONICS SSM-1K0SxxxMGR 1000W Programmable Driver with INV Digital Dimming Owner's Manual

Contents

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INVENTRONICS SSM-1K0SxxxMGR 1000W Programmable Driver with INV Digital Dimming

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- IP66 and UL Dry/Damp/Wet Location
- 5 Years Warranty

Description

The SSM-1K0SxxxMGR series is a 1000W, constant-current, programmable and IP66-rated LED driver that operates from 249-528Vac input with excellent power factor. Created for many lighting applications including high mast, sports, UV-LED, aquaculture horticulture, etc. It provides a 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.

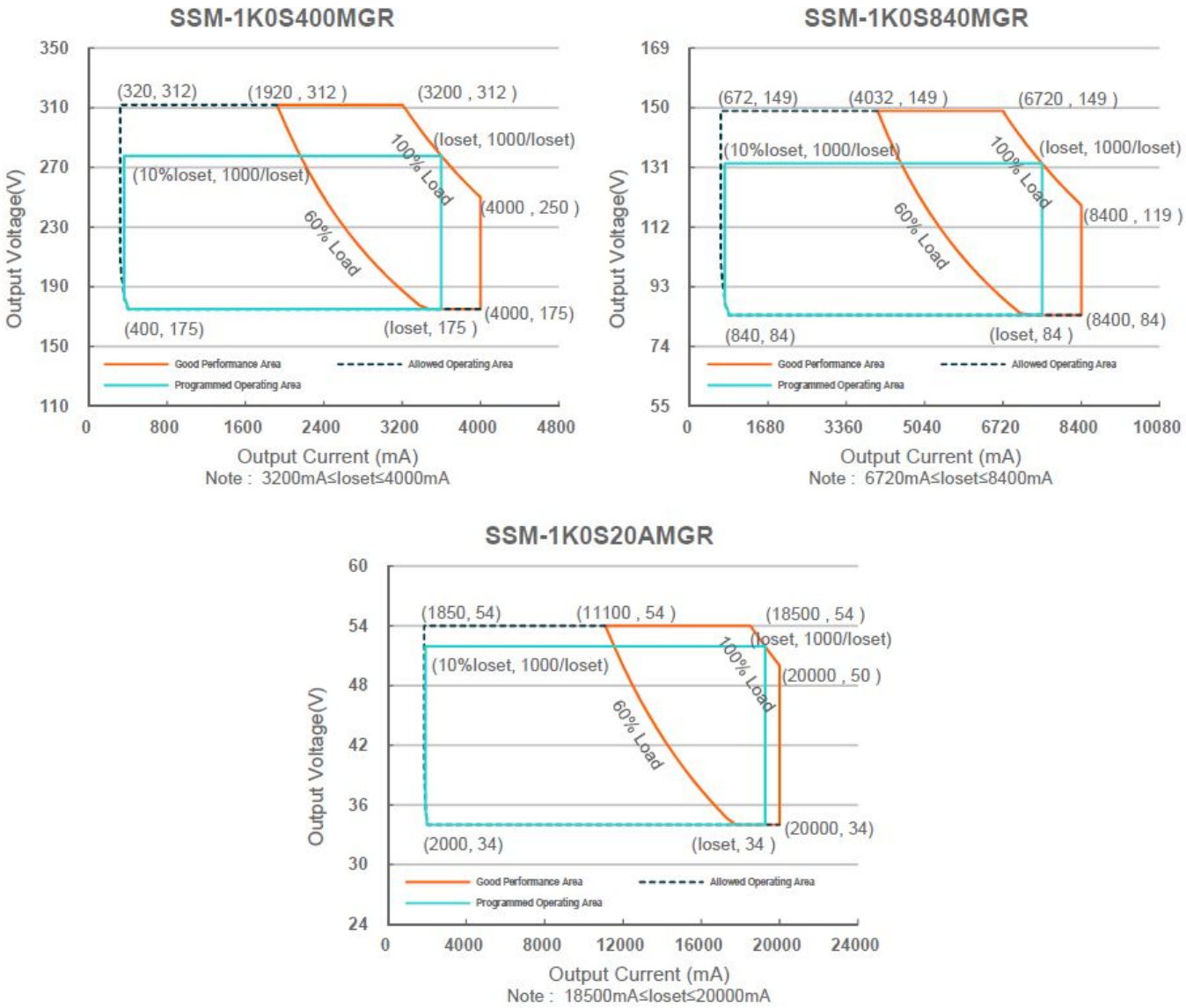
Models

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)
						277Vac	480Vac	
0.32-4	3.2-4	3.3	175-312	1000	96.0%	0.99	0.96	SSM-1K0S400MGR
0.672-8.4	6.72-8.4	7.7	84-149	1000	95.5%	0.99	0.96	SSM-1K0S840MGR
1.85-20	18.5-20	18.5	34-54	1000	96.0%	0.99	0.96	SSM-1K0S20AMGR(4)

Notes

1. Output current range with constant power at 1000W.
2. Measured at 100% load and 480Vac input (see below “General Specifications” for details).
3. Certified voltage range: UL, FCC 277-480Vac; otherwise: 277-400Vac.
4. SELV output

Operating Area



Input Specifications

Parameter	Min.	Typ.	Max.	Notes
Input AC Voltage	249 Vac	–	528 Vac	
Input DC Voltage	352 Vdc	–	500 Vdc	
Input Frequency	47 Hz	–	63 Hz	
Leakage Current	–	–	0.75 MIU	UL 8750; 480Vac/60Hz
			0.70 mA	IEC 60598-1; 480Vac/60Hz
Input AC Current	–	–	4.29 A	Measured at 100% load and 277 Vac input.
	–	–	2.53 A	Measured at 100% load and 480 Vac input.
Inrush Current(I2t)	–	–	1.80 A2s	At 480Vac input, 25°C cold start, duration=11.9ms, 10%Ipk-10%Ipk.

Parameter	Min.	Typ.	Max.	Notes
PF	0.90	–	–	At 277-480Vac, 50-60Hz,60%-100%Load (600 – 1000W)
THD	–	–	20%	

Output Specifications

Parameter	Min.	Typ.	Max.	Notes
Output Current Tolerance	-5%Ioset	–	5%Ioset	100% load
Output Current Setting(Ioset Range) SSM-1K0S400MGR SSM-1K0S840MGR SSM-1K0S20AMGR	 320 mA 672 mA 1850 mA	 – – –	 4000 mA 8400 mA 20000 mA	
Output Current Setting Range with Constant Power SSM-1K0S400MGR SSM-1K0S840MGR SSM-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 SSM-1K0S400MGR SSM-1K0S840MGR SSM-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 277-480Vac input, 60%-100% Load
Temperature Coefficient of Iset	–	0.03%/°C	–	Case temperature = 0°C ~Tc max

General Specifications

Parameter	Min.	Typ.	Max.	Notes
Efficiency at 277 Vac input:				
SSM-1K0S400MGR				
Io= 3200 mA Io= 4000 mA	93.0% 93.0%	95.0% 95.0%	– –	Measured at 100% load and steady-st ate
SSM-1K0S840MGR				temperature in 25°C ambient;
Io= 6720 mA	92.5%	94.5%	–	(Efficiency will be about 2.0% lower if
Io= 8400 mA SSM-1K0S20AMGR	92.5%	94.5%	–	measured immediately after startup.)
Io= 18500 mA	92.5%	94.5%	–	
Io= 20000 mA	93.0%	95.0%	–	

Parameter	Min.	Typ.	Max.	Notes
Efficiency at 400 Vac input:				
SSM-1K0S400MGR				
Io= 3200 mA Io= 4000 mA	93.5% 93.5%	95.5% 95.5%	– –	Measured at 100% load and steady-st ate
SSM-1K0S840MGR				temperature in 25°C ambient;
Io= 6720 mA	93.5%	95.5%	–	(Efficiency will be about 2.0% lower if
Io= 8400 mA SSM-1K0S20AMGR	93.0%	95.0%	–	measured immediately after startup.)
Io= 18500 mA	94.0%	96.0%	–	
Io= 20000 mA	93.5%	95.5%	–	
Efficiency at 480 Vac input:				
SSM-1K0S400MGR				

Io= 3200 mA Io= 4000 mA	94.0% 94.0%	96.0% 96.0%	– –	Measured at 100% load and steady-state
SSM-1K0S840MGR				temperature in 25°C ambient;
Io= 6720 mA	93.5%	95.5%	–	(Efficiency will be about 2.0% lower if
Io= 8400 mA SSM-1K0S20AMGR	93.0%	95.0%	–	measured immediately after startup.)
Io= 18500 mA	94.0%	96.0%	–	
Io= 20000 mA	93.5%	95.5%	–	
Standby Power	–	1.5 W	–	Measured at 480Vac/50Hz; Dimming off
MTBF	–	200,000 Hours	–	Measured at 480Vac input, 80%Load and 25°C ambient temperature (MIL-HDBK - 217F)
Lifetime	–	100,000 Hours	–	Measured at 480Vac input, 80%Load and 70°C case temperature; See lifetime vs. Tc curve for the details
	–	50,000 Hours	–	Measured at 277Vac 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	–	3700 g	–	

Dimming Specifications

Parameter		**Min.**	**Typ.**	**Max.**	**Notes**
Absolute Maximum Voltage on the Vdim (+) Pin		-20 V	–	20 V	
Source Current on Vdim (+)Pin		90 uA	100 uA	110 uA	Vdim(+) = 0 V
Dimming Output Range with 10%-100% (Default)	SSM-1K0S400MGR SSM-1K0S840MGR SSM-1K0S20AMGR	10%Ioset	–	Ioset	3200 mA ≤ Ioset ≤ 4000 mA 6720 mA ≤ Ioset ≤ 8400 mA 18500 mA ≤ Ioset ≤ 20000 mA
	SSM-1K0S400MGR SSM-1K0S840MGR SSM-1K0S20AMGR	320 mA 672 mA 1850 mA	–	Ioset	320 mA ≤ Ioset ≤ 3200 mA 672 mA ≤ Ioset ≤ 6720 mA 1850 mA ≤ Ioset 18500 mA

Parameter		Min.	Typ.	Max.	Notes
Dimming Output Range with 5%-100% (Settable)	SSM-1K0S400MGR SSM-1K0S840MGR SSM-1K0S20AMGR	5%Ioset	–	Ioset	3200 mA ≤ Ioset ≤ 4000 mA 6720 mA ≤ Ioset ≤ 8400 mA 18500 mA ≤ Ioset ≤ 20000 mA
	SSM-1K0S400MGR SSM-1K0S840MGR SSM-1K0S20AMGR	160 mA 336 mA 925 mA	–	Ioset	320 mA ≤ Ioset ≤ 3200 mA 672 mA ≤ Ioset ≤ 6720 mA 1850 mA ≤ Ioset 18500 mA
Recommended Dimming Input 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 Inventronics Programming 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 Logic)		3%	5%	8%	
PWM Dimming on (Positive Logic)		5%	7%	10%	
PWM Dimming off (Negative Logic)		92%	95%	97%	
PWM Dimming on (Negative Logic)		90%	93%	95%	
Hysteresis		–	2%	–	

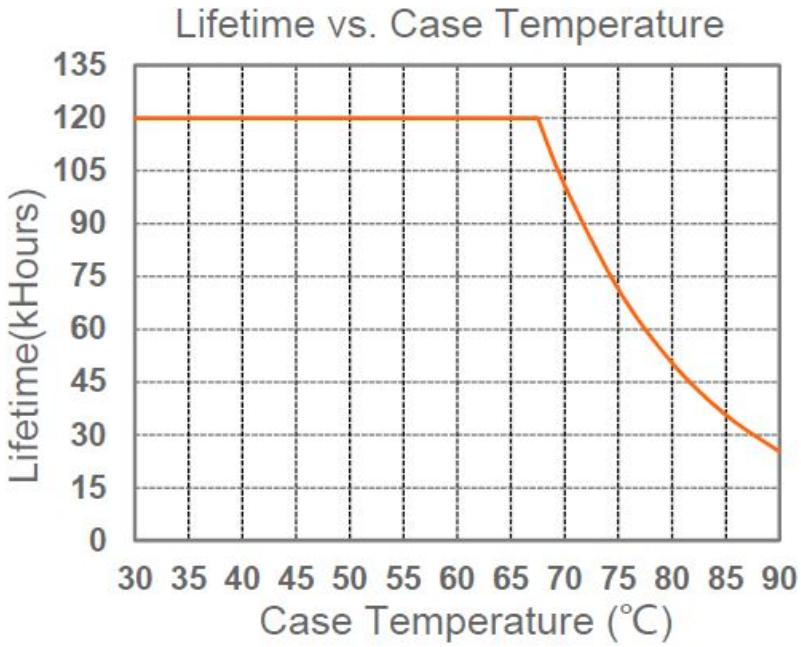
Safety &EMC Compliance

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
EMI Standards	**Notes**
EN IEC 55015(1)	Conducted emission Test and 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 th e following two conditions: [1] this device may not cause harmful interference, and [2] this device must accept any interference received, including interferenc e that may cause undesired Operation.

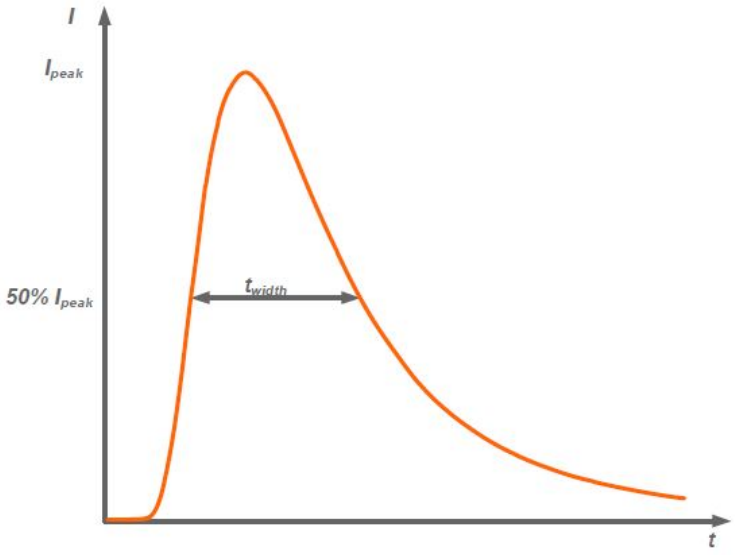
EMS Standards	Notes
EN 61000-4-2	Electrostatic Discharge (ESD): 8 kV air discharge, 4 kV contact discharge
EN 61000-4-3	Radio-Frequency Electromagnetic Field Susceptibility Test-RS
EN 61000-4-4	Electrical Fast Transient / Burst-EFT
EN 61000-4-5	Surge Immunity Test: AC Power Line: Differential Mode 6 kV, Common Mode 10 kV
EN 61000-4-6	Conducted Radio Frequency Disturbances Test
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 the EMI performance of a luminaire that contains it depends also on the other devices connected to the driver and on the fixture itself.

Lifetime vs. Case Temperature

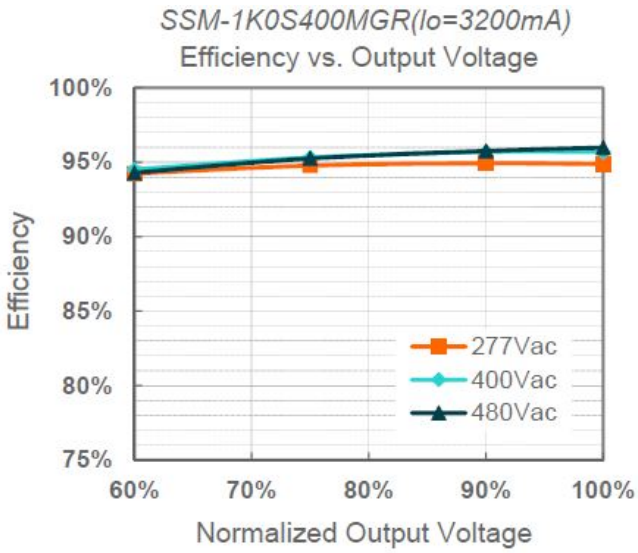


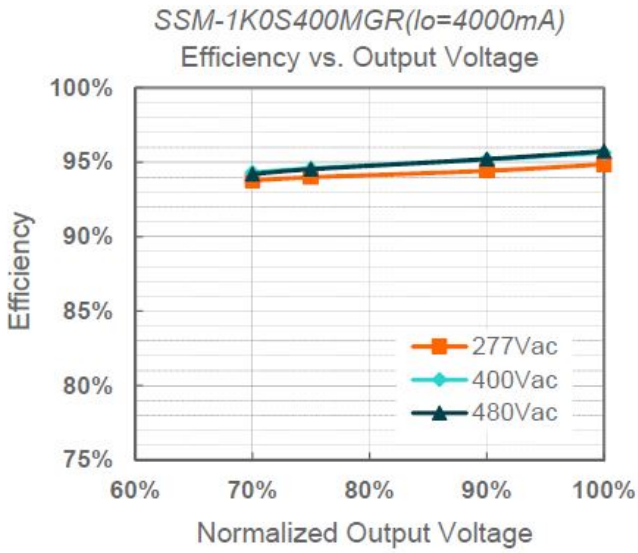
Inrush Current Waveform

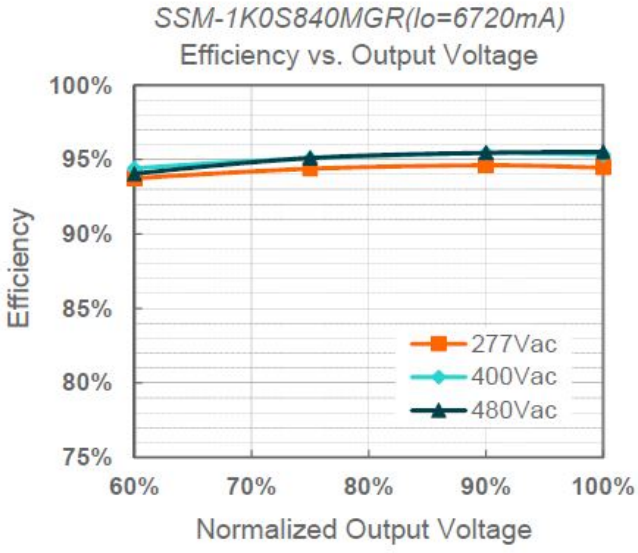


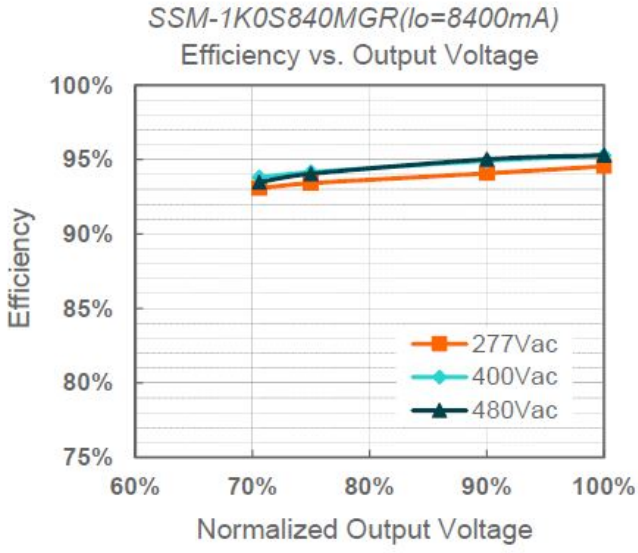
Input AC Voltage	I_{peak}	t_{width} (@ 50% Ipeak)
480V	14.2A	3.72ms

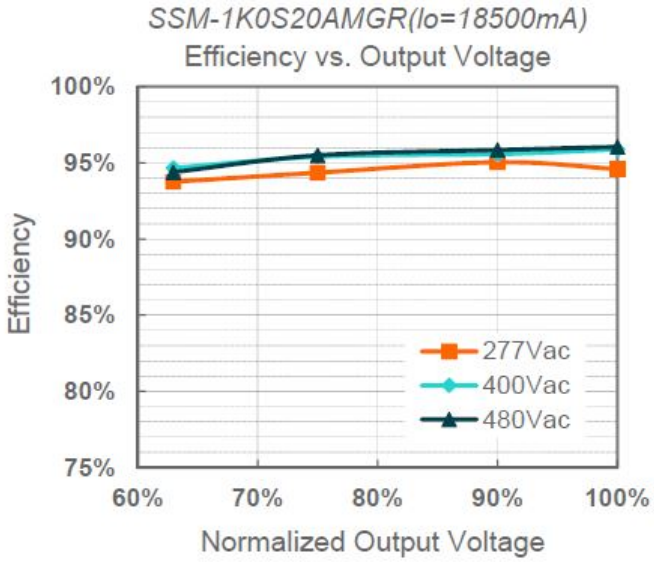
Efficiency vs. Load

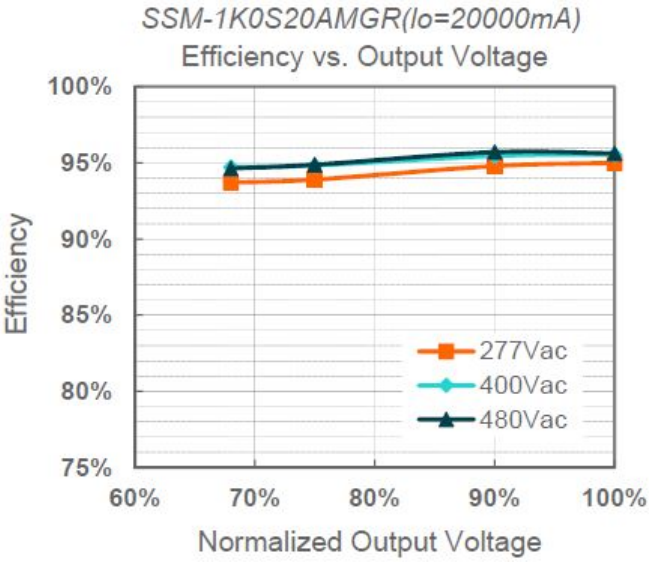




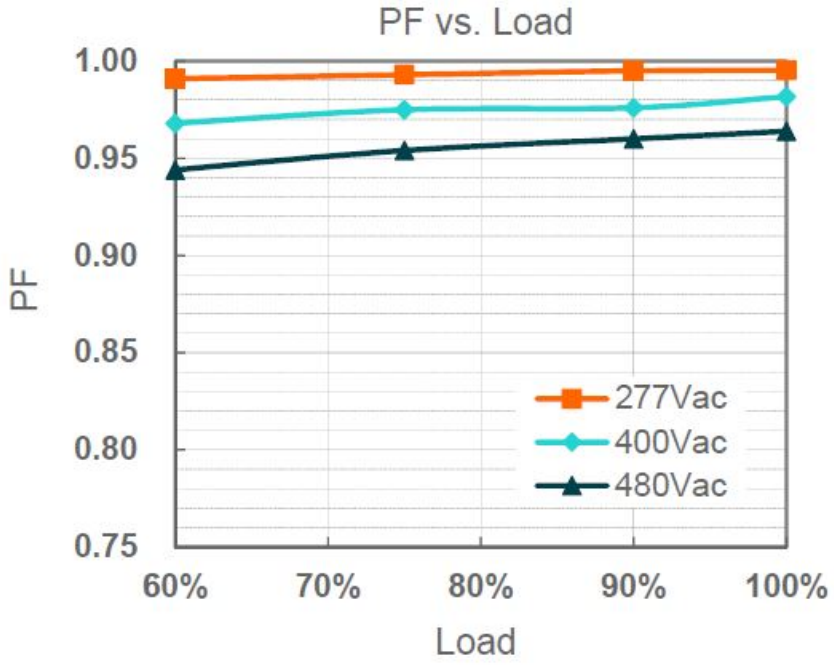




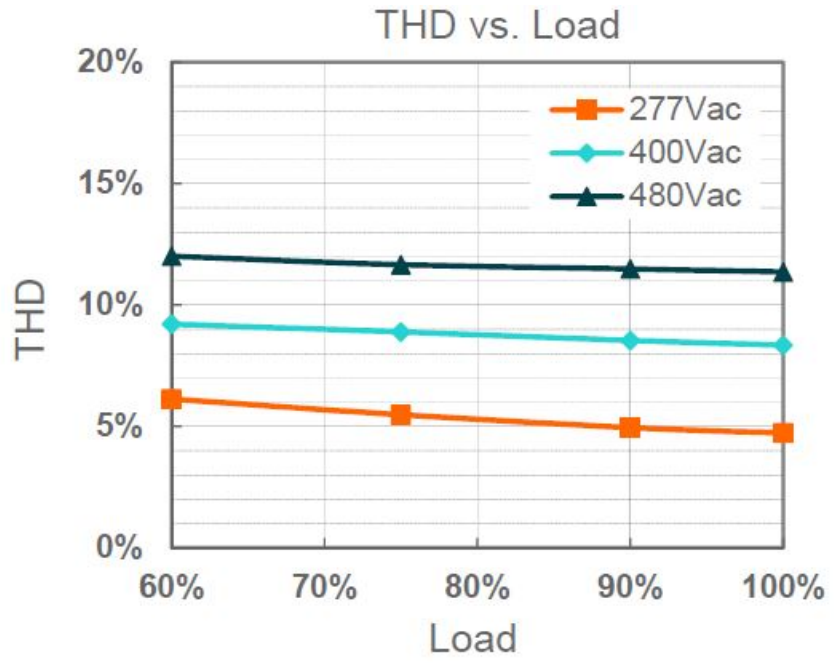




Power Factor

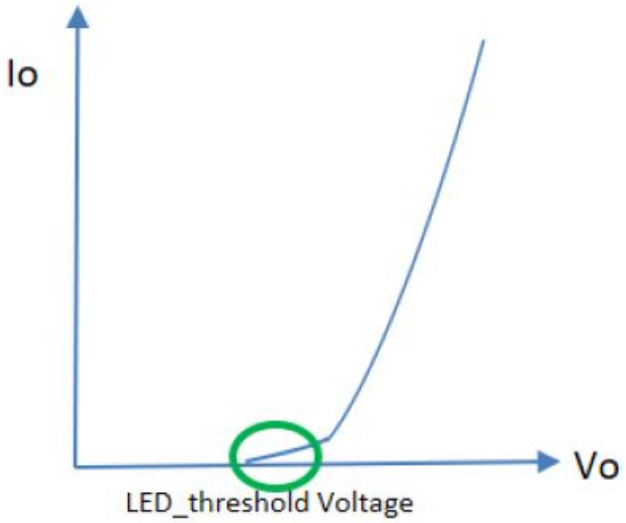


Total Harmonic Distortion



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 Programming Software.

- The 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.



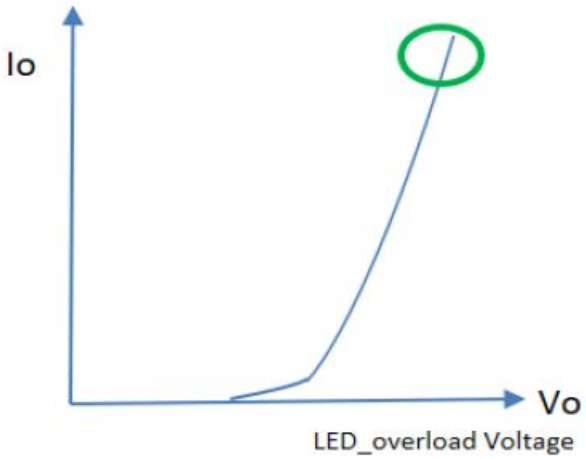
Hot-plugging Protection (Continued)

Parameter			Min.	Typ.	Max.	Notes
Hot-plugging Protection	LED Threshold Voltage Setting Range	SSM-1K0S400MGR	175 V	-	312 V	Set Vth close to, but higher than the actual LED threshold voltage
		SSM-1K0S840MGR	84 V	-	149 V	
		SSM-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 Programming 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	SSM-1K0S400MGR	175 V	–	325 V	Set V_overload close to, but higher than the maximum LED forward voltage
		SSM-1K0S840MGR	90 V	–	155 V	
		SSM-1K0S20AMGR	47 V	–	56 V	
	Setting Tolerance		-2%	–	2%	

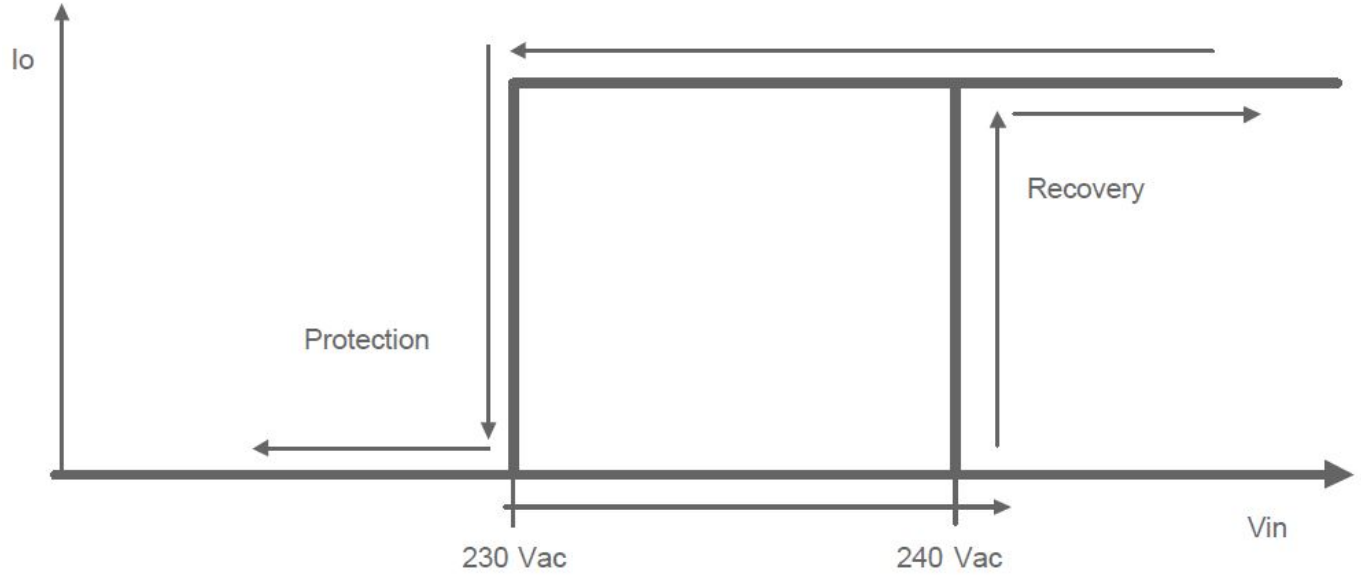
Protection Functions

Parameter		Min.	Typ.	Max.	Notes
Over Temperature Protection		Decreases output current, returning to normal after over temperature is removed.			
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 Voltage Protection		Limits output voltage at no load and in case the normal voltage limit fails.			
Input Under Voltage Protection (IUVP)	Input Protection Voltage	220 Vac	230 Vac	240 Vac	Turn off the output when the input voltage falls below the protection voltage.
	Input Recovery Voltage	230 Vac	240 Vac	250 Vac	Auto Recovery. The driver will restart when the input voltage exceeds the recovery voltage.

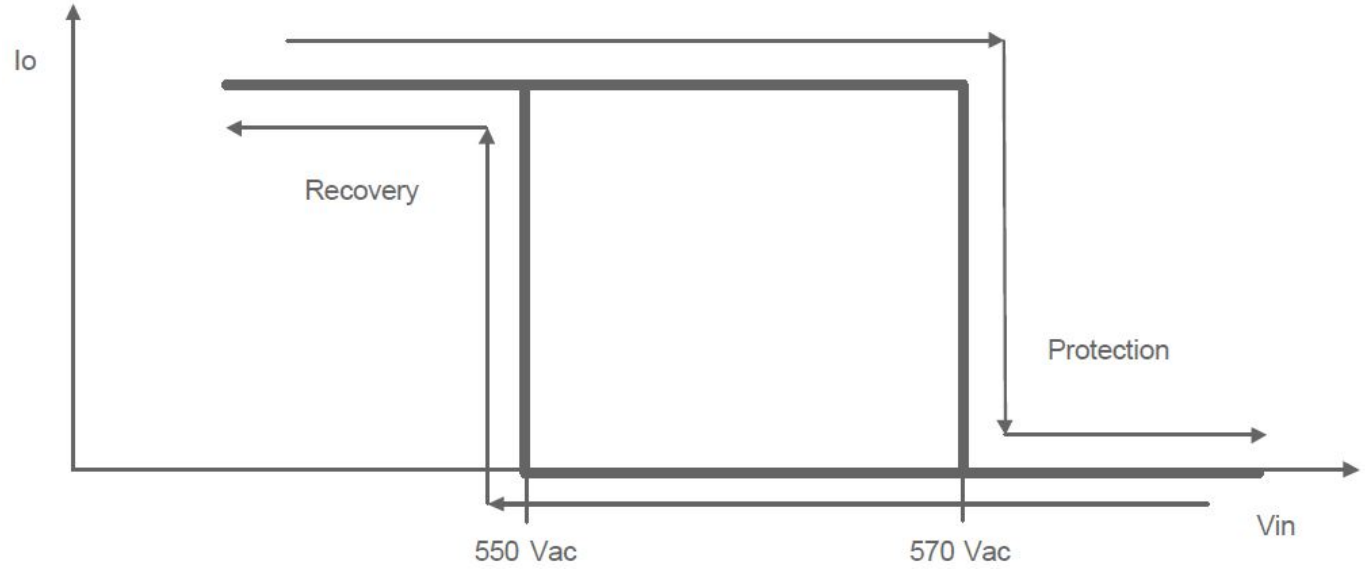
Parameter		Min.	Typ.	Max.	Notes
Input Over Voltage Protection (IOVP)	Input Over Voltage Protection	550 Vac	570 Vac	590 Vac	Turn off the output when the input voltage exceeds the protection voltage.
	Input Over Voltage Recovery	530 Vac	550 Vac	570 Vac	Auto Recovery. The driver will restart when the input voltage falls below recovery voltage.
	Max. of Input Over Voltage			590 Vac	The driver can survive for 8 hours with a stable input voltage stress of 590Vac.

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

Input Under Voltage Protection Diagram

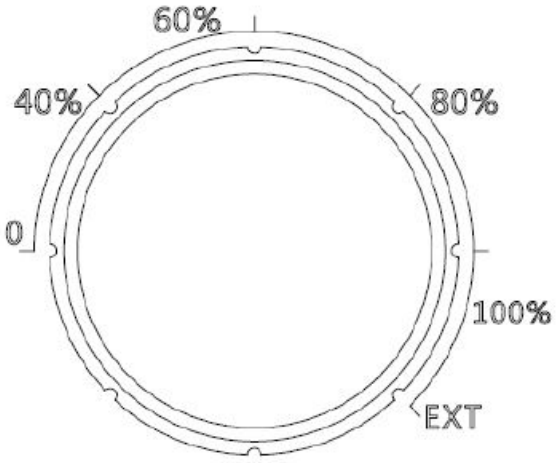


Input Over Voltage Protection Diagram

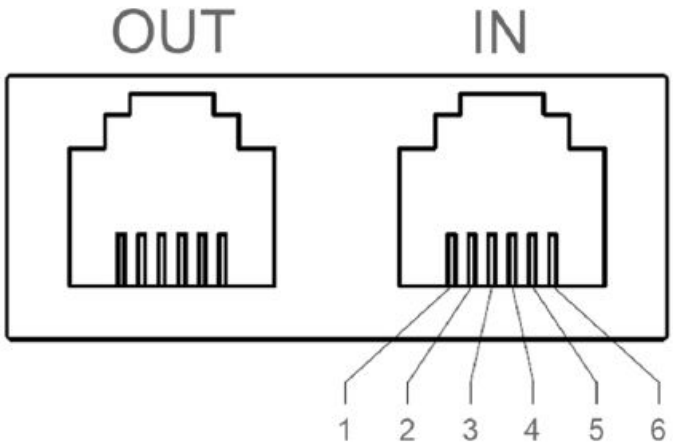


Rotary Switch and RJ12 Connector

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



Rotary Switch



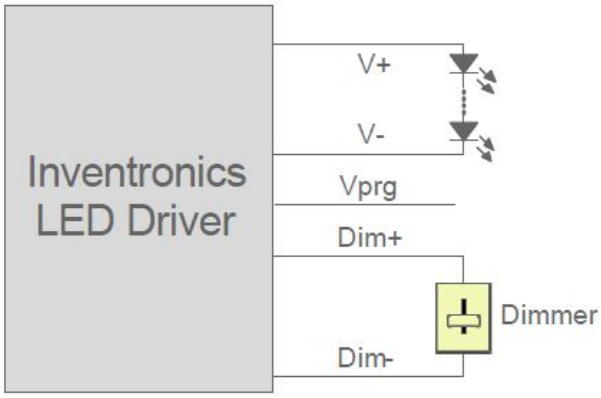
Pin
1,6
2,5
3,4

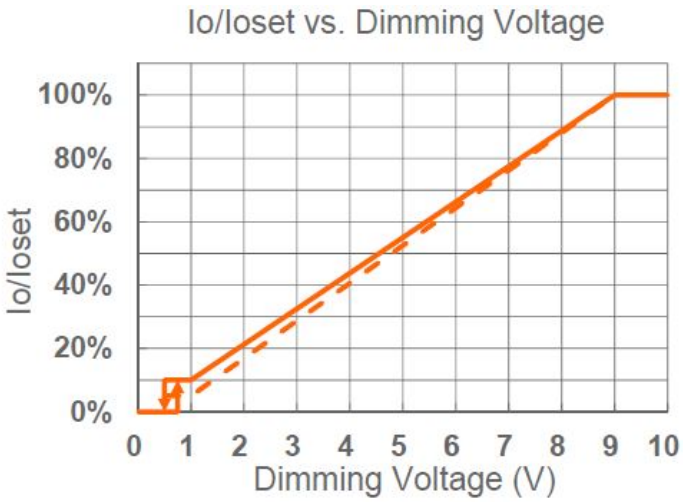
RJ12 Connector

Dimming

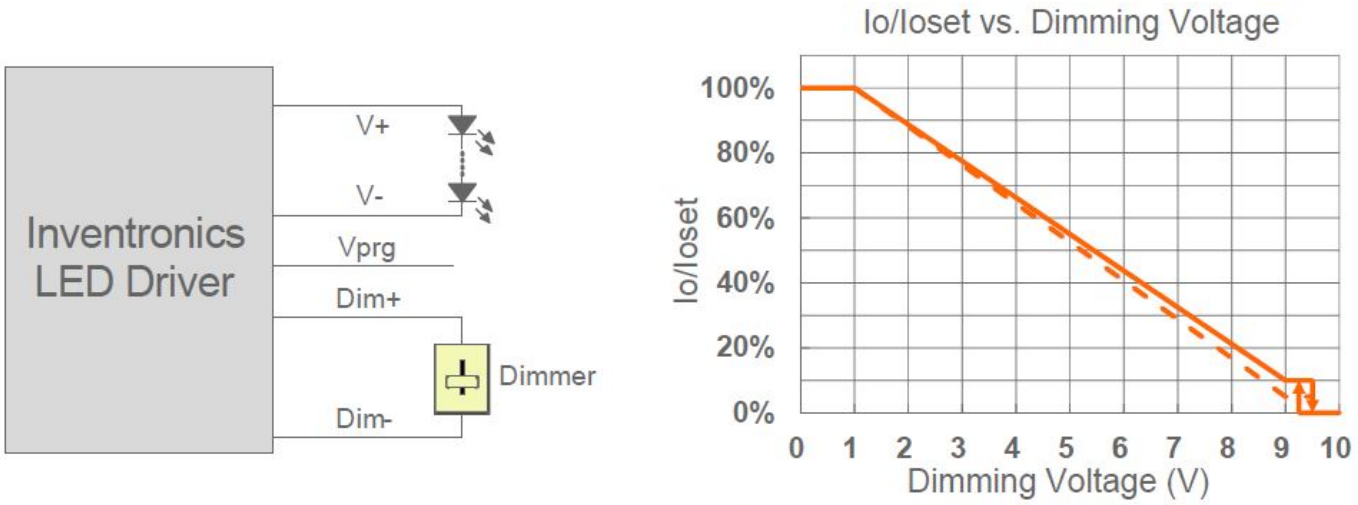
0-10V Dimming

The recommended implementation of the dimming control is provided below.





Implementation 1: Positive logic



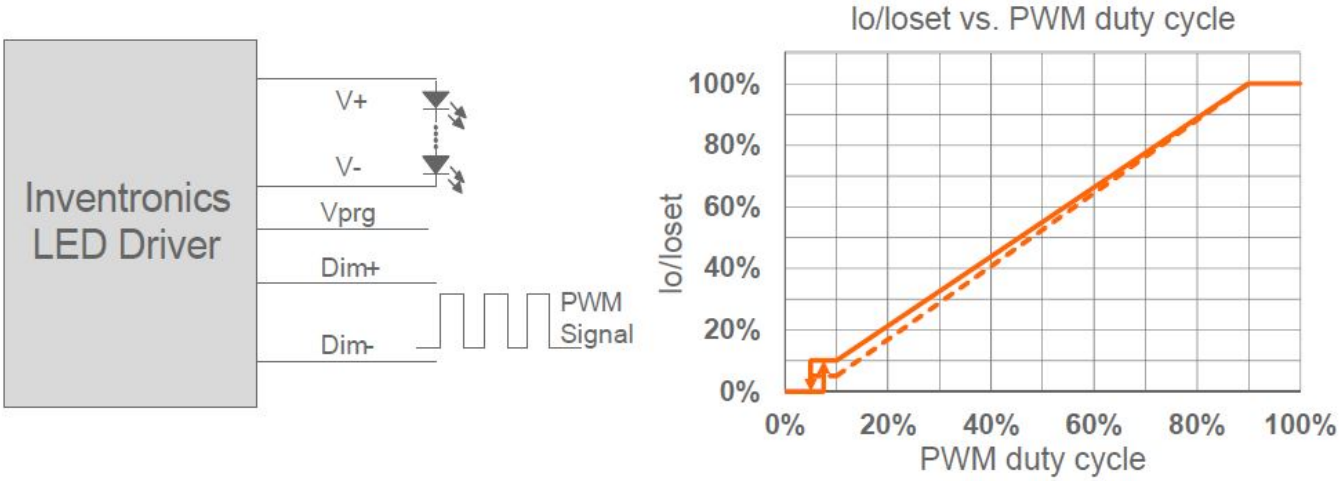
Implementation 2: Negative logic

Notes

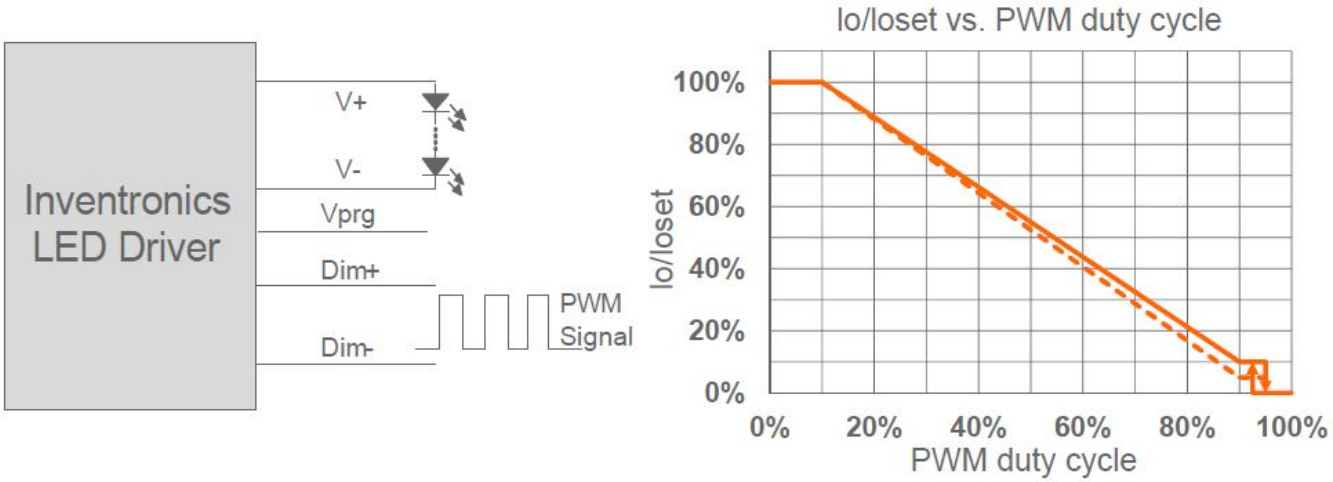
1. Do NOT connect Dim– to the output V– or V+, otherwise the driver will not work properly.
2. The dimmer can also be replaced by an active 0-10V voltage source signal or passive components like a zener.
3. When 0-10V negative logic dimming mode and Dim+ is open, the driver will dim to off and be on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

PWM Dimming

The recommended implementation of the dimming control is provided below.



Implementation 3: Positive logic



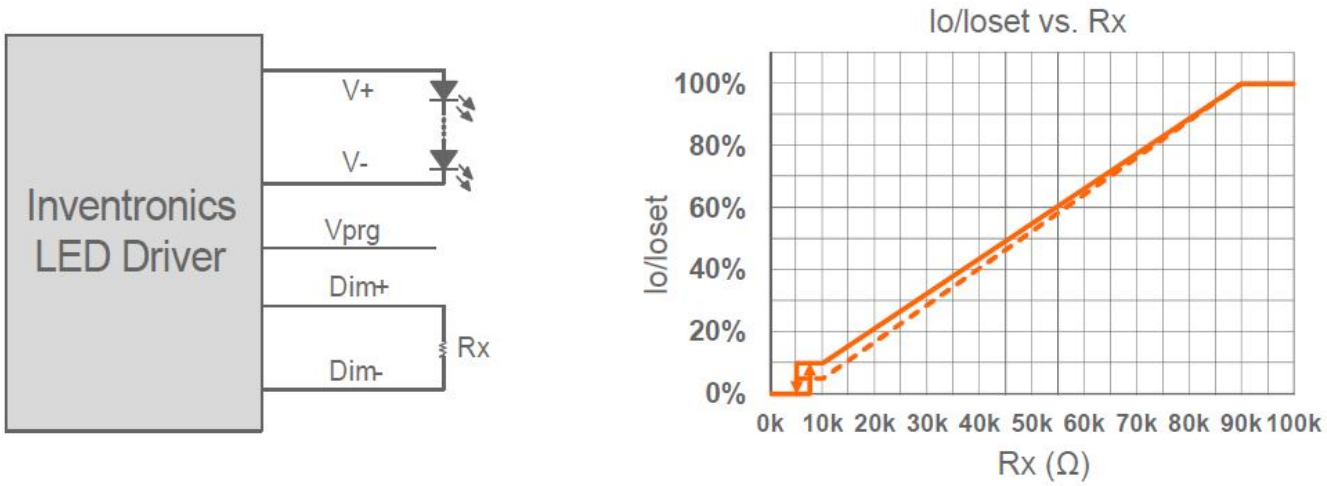
Implementation 4: Negative logic

Notes

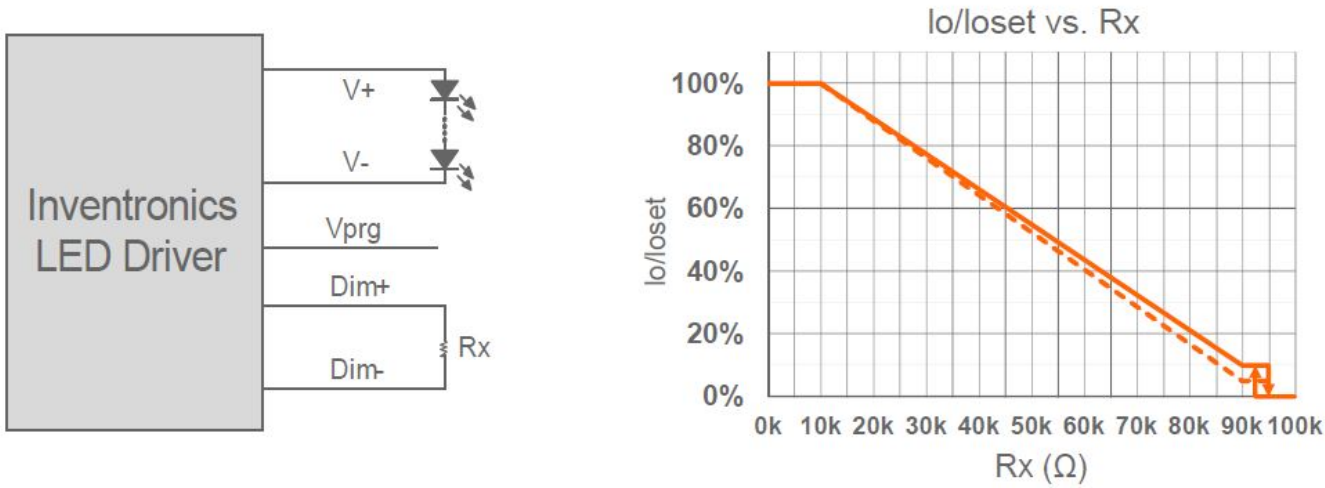
1. Do NOT connect Dim– to the output V– or V+, otherwise the driver will not work properly.
2. When PWM negative logic dimming mode and Dim+ is open, the driver will dim to off and be on standby.

Resistor Dimming

The recommended implementation of the dimming control is provided below.



Implementation 5: Positive logic



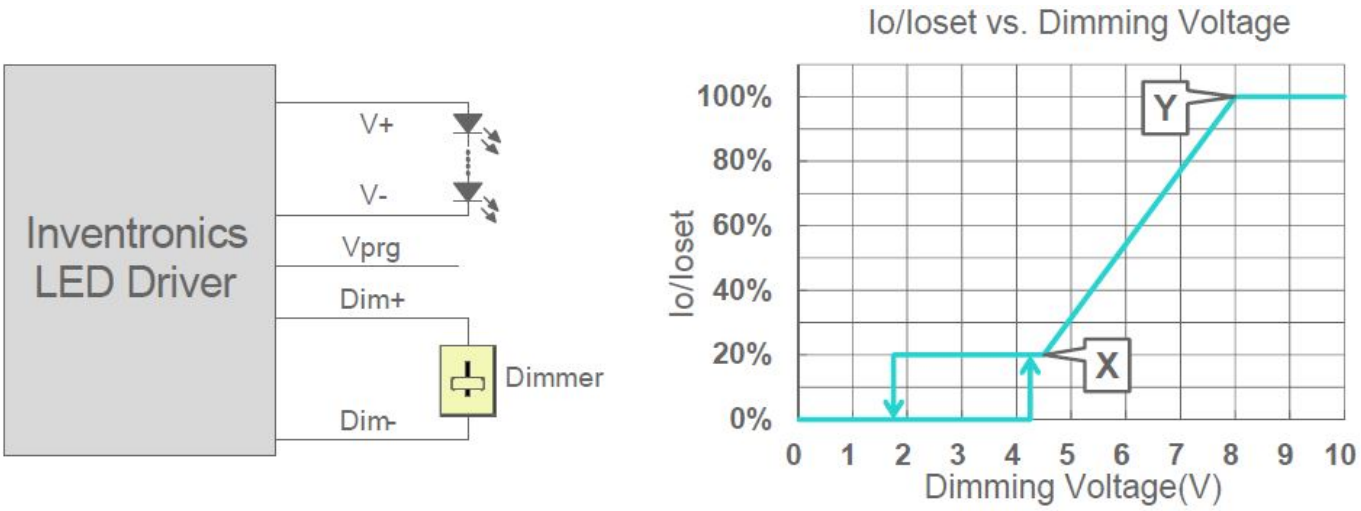
Implementation 6: Negative logic

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 on standby.

Adjustable Dimming Curve

The 0-10V dimming curve can be set as the corresponding dimming voltage by the 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 a zener.
3. When the dimming voltage X point is set to be smaller than the Y point, the dimming curve is positive logic; conversely, when the X point is set to be bigger than the Y point, the dimming curve is negative logic.
4. For best dimming accuracy, the difference between the 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 Adapting- Percentage and Traditional Timer.

- Self Adapting-Midnight: Automatically adjust the dimming curve based on the on-time of the past two days (if the difference <15 minutes), assuming that the centre 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 powering 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

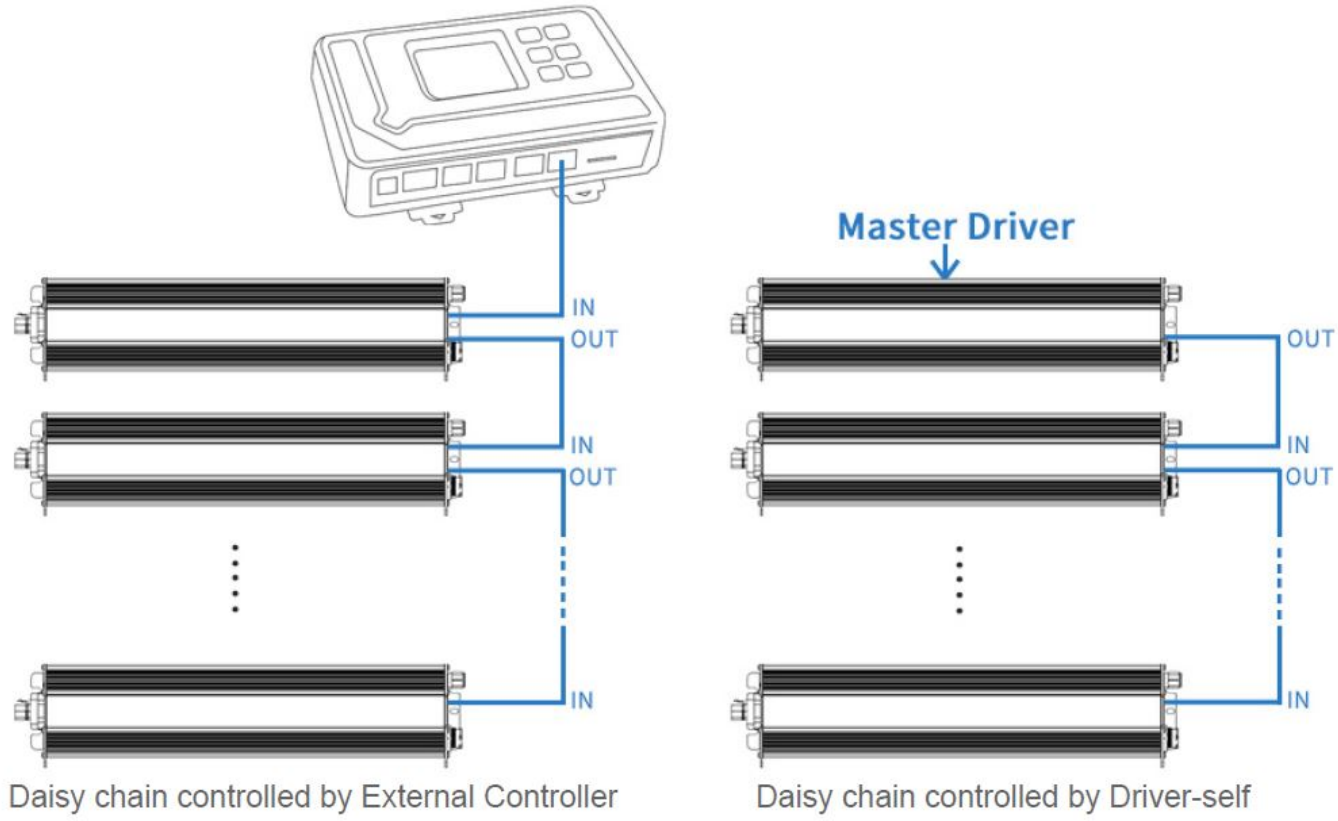
End-of-Life (EOL) is providing a visual notification to a user that the LED module has reached the end of manufacturer-specified life and that the replacement is recommended. Once active, an indication is given at each power-up of the driver, which the driver indicates this through a lower light output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

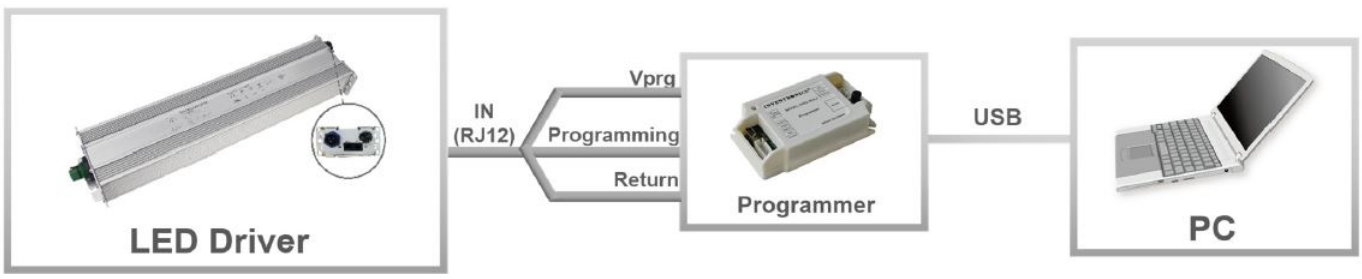
Daisy Chain application

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.



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

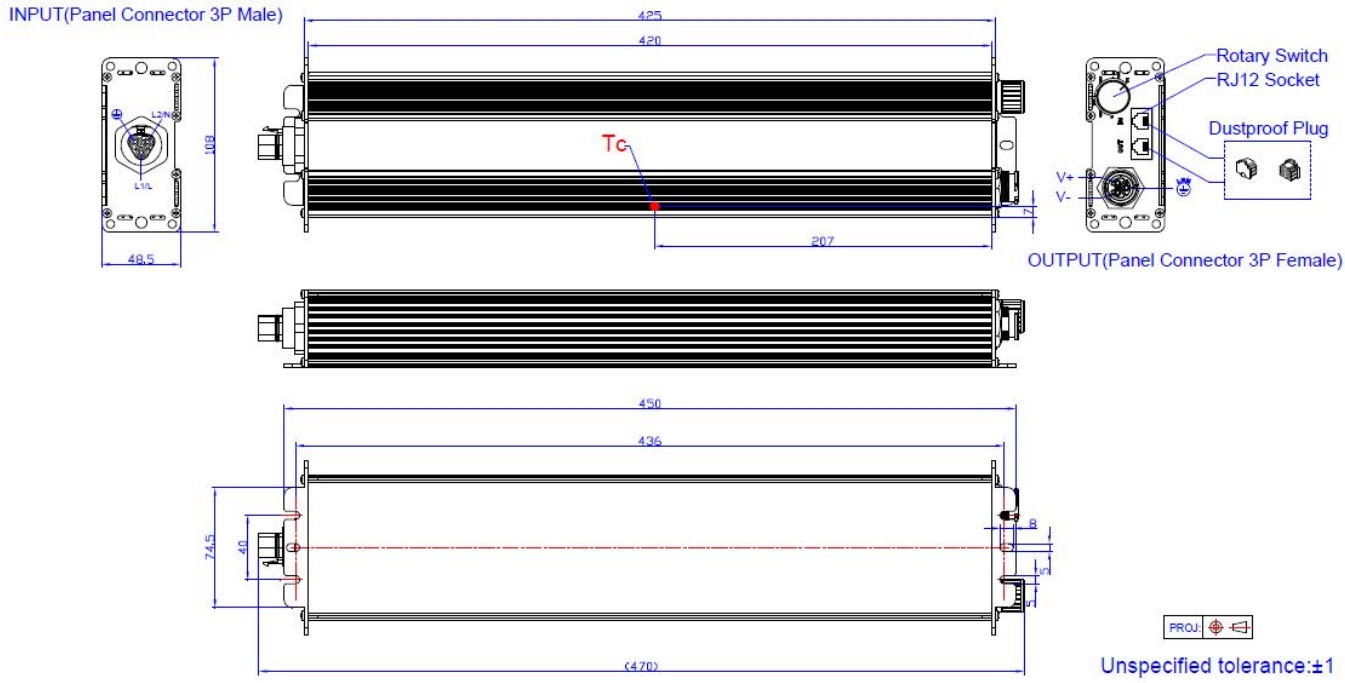
Programming Connection Diagram



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 pushlock.

Location	Series	Rating voltage /current	PN of connector on drive r	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
2023-05-16	A	Datasheet Release	/	/
2023-12-29	B	Format	/	Updated
		Features	/	Updated
		Inrush Current Waveform	/	Updated
		Dimming	/	Updated

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Documents / Resources

	INVENTRONICS SSM-1K0SxxxMGR 1000W Programmable Driver with INV Digital Dimming [pdf] Owner's Manual SSM-1K0SxxxMGR 1000W Programmable Driver with INV Digital Dimming, SSM-1K0SxxxMGR, 1000W Programmable Driver with INV Digital Dimming, Programmable Driver with INV Digital Dimming, Driver with INV Digital Dimming, INV Digital Dimming, Digital Dimming

References

- PRG-MUL2 - Inventronics
- Application Notes - Inventronics
- User Manual