MBS601 Series

600 W AC-DC Power Supplies
Sealed IP66/67/68

The MBS601 Series of AC-DC power supplies provides up to 600 W of regulated output power through a wide input voltage range 85 – 264 VAC in a single output of 24 VDC or 48 VDC.

The MBS601 Series comes in a 4.92 x 9.86 x 2.36 inch form factor with a full set of protection features.

The MBS601 Series is available in an aluminium extruded chassis having fins for an optimal heat dispersion via natural convection. The input / output connections are fixed to the chassis through water tight glands, which combined with the sealed enclosure, give the power supply an IP66/67/68 ingress protection grade.

The -SL option offers a 5 V_{DC} stand-by output and a set of control signals: +/- remote sense, remote On/Off (-PS_Inhibit), power good (PS_Ok), I-share (ISHARE1+V_SLOGIC).

The MBS601 Series complies with the latest edition of the IEC/EN 60601-1 safety standards for medical equipment requiring 2x MoPP protection grade and displays the CE Mark for the European Low Voltage Directive (LVD).

Key Features & Benefits

- Sealed enclosure, IP66/67/68 Ingress Protection grade
- High efficiency up to 94% (50% to 100% load)
- Low stand-by power consumption (< 0.35 W)
- Universal input voltage range 85 – 264 VAC
- Input inrush current limiting <30 A
- 800 W peak power (up to 10 s)
- Single 24, 48 VDC voltages
- Active PFC, EN61000-3-2 compliant (Class C, >25% load)
- Low earth / touch leakage current
- Over temperature, OV, OC and SC protections.
- Stand by +5 V, 1.5 A output.
- Remote On / Off signal
- Overall dimensions 125.0 x 250.5 x 60.0 mm (4.92 x 9.86 x 2.36 in)
- Medical safety approval to IEC 60601-1 3rd edition,
  2xMoPP protection grade BF appliances compatible
  IEC 60601-1-2 4th edition EMC compliant

Applications

- Clinical Analysers
- Dental units / chairs
- MRI / Full Body TC Systems
- Medical Diagnostic & Imaging Systems

1. MODEL SELECTION

MODEL NUMBER	PACKAGE & COOLING	INPUT VOLTAGE RANGE [VAC]	NOM. OUTPUT VOLTAGE [VDC]	MAX. OUTPUT POWER [W]	MAX. OUTPUT CURRENT [A]	DIMENSIONS
MBS601-1T24	Sealed Chassis Natural Convection	85 - 305	24	600	25	125.0 x 250.5 x 60.0 mm 4.92 x 9.86 x 2.36 in
MBS601-1T24-SL	Sealed Chassis Natural Convection + Control Signals	85 - 305	24	600	25	
MBS601-1T48	Sealed Chassis Natural Convection	85 - 305	48	600	12.5	
MBS601-1T48-SL	Sealed Chassis Natural Convection + Control Signals	85 - 305	48	600	12.5	

2. INPUT SPECIFICATIONS

PARAMETER	DESCRIPTION / CONDITION		MIN	NOM	MAX	UNIT
AC Input Voltage	MoPP grade MoOP grade PS starts and operates at 85 V_{AC} at all load conditions		85 85	100-240 100-277	264 305	V_{RMS}
DC Input Voltage	Built in fuses has been safety certified up to 250 V_{DC}. Operating the MBS601 above that limit up to 300 V_{DC} does require an external fuse protection.		170	-	300	V_{DC}
Input Frequency	440 Hz with reduced PFC and output power rating. Consult factory for details.		47	50/60	63	Hz
Input Current	RMS at 180 V_{AC}, maximum load, 50 / 60 Hz RMS at 85 V_{AC}, maximum load, 50 / 60 Hz		-	-	4.0 8.5	A
Inrush Current	Cold start, 25 °C ambient, full load	115 V_{AC} 230 V_{AC}	- -	- -	20 30	A
Fusing	High breaking, 10 A, 250 V on each AC lines.		-	-	10	A
Efficiency	At 115 V_{AC}	20% rated load 50% rated load 100% rated load	89 93 92	- - -	- - -	%
	At 230 / 264 V_{AC}	20% rated load 50% rated load 100% rated load	90 94 94	- - -	- - -	
Input Power Consumption	Power on, 115 V_{AC}, no load Power on, 230 V_{AC}, no load Stand by, 115, 230 V_{AC}, no load		- - -	- - -	5 4 0.35	W
Power Factor	From 50 to 100% of rated load, 230, 115 V_{AC}, 50 / 60 Hz input voltages.		0.90	-	-	-
THDi	From 50 to 100% rated load, 115, 230, 264 V_{AC} 50 / 60 Hz.		-	-	20	%
Harmonic Current Fluctuations and Flicker	Complies with EN 61000-3-2 at 230 V_{AC}, 50/60 Hz, Class A, D. Complies with EN 61000-3-2 Class C at 230 V_{AC}, 50/60 Hz, >150 W load. Complies with EN 61000-3-3 at nominal voltages and full load.					
Earth Leakage Current	Normal conditions 115 V_{RMS}, 60 Hz 230 V_{RMS}, 50 Hz 264 V_{RMS}, 60 Hz (worst case)		- - -	170 290 -	- - 460	µA

3. OUTPUT SPECIFICATIONS

PARAMETER	DESCRIPTION / CONDITION	MIN	NOM	MAX	UNIT
V1 Output Voltages	±0.5% set point accuracy RS+ closed on +V1, RS- closed on V1 RTN, at 20% load (option SL).	-	24 48	-	V
V1 Output Power Rating *	Convection cooling (Refer to the de-rating curves below) Peak (less than 10 s, after P_OK high)			600 800	W
V1 Output Current *	V1: 24 V_{DC} V1: 48 V_{DC}			25.0 12.5	A
V1 Voltage Adjustment Range	Manually by push up and down buttons	-	±5	-	%V1
V1 Line Regulation	V_{AC}: 85 – 264 V_{RMS}	-	-	±0.1	%V1
V1 Load-Line-Cross Regulation	V_{AC}: 85 – 264 V_{RMS}; I1: 0 – 100%	-	-	±2	%V1
V1 Ripple and Noise	Rated load, Peak-to-peak, 20 MHz BW. (100 nF ceramic, 10 µF tantalum at load)	-	-	1	%V1
Transient Response: V1, $5V_{SB}$ Voltage Deviation	25% load changes at 1 A/µs 24 V at 1000 µF load / I_{OUT} > 2.5 A 48 V at 560 µF load / I_{OUT} > 1.25 A 5 V_{SB} at 560 µF load / I_{OUT} > 0.1 A	-	-	±5	%V1 %V_{SB}
V1 Start-up Rise Time	85<V_{IN}<264, any load conditions.	10	-	100	ms
V1 Hold-up Time	At nominal V_{IN}, full load	16	-	-	ms
V1 Current Sharing Accuracy	Two units in parallel at I1 rated load. VS-Logic and I-Share signals connected together. RS^+, RS^- signals connected together and to the load	45.5	-	54.5	%I1
Start-up Delay	V1 in regulation after de-asserting PS_Inhibit V1 in regulation after AC is applied (worst case: 85 V_{AC}) $5V_{SB}$ in regulation after AC is applied (worst case: 85 V_{AC})	- - -	- - -	450 2050 1500	ms
Turn-on Overshoot		- -	- -	10 10	%V1 %V_{SB}
Minimum Load	V1, $5V_{SB}$	0	-	-	A
Maximum Load Capacitance	V1: 24 V_{DC} V1: 48 V_{DC}	- -	- -	16000 8000	µF
5 V_{SB} Output Voltage	±3% set point accuracy, 20% load.	-	5	-	V
5 V_{SB} Output Current		-	-	1.5	A
5 V_{SB} Load-Line-Cross Regulation	V_{AC}: 85 – 264 V_{RMS}; I_{SB}: 0 – 100%	-	-	±5	%V_{SB}

* Rated currents and combined power are referred to 55 °C ambient and V_{AC} ≥ 180 V_{RMS}.

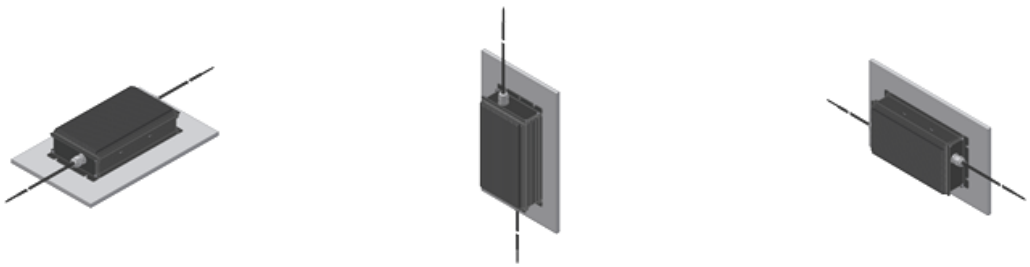


Figure 1. Mounting Orientation

3.1 OUTPUT POWER DE-RATING CURVES

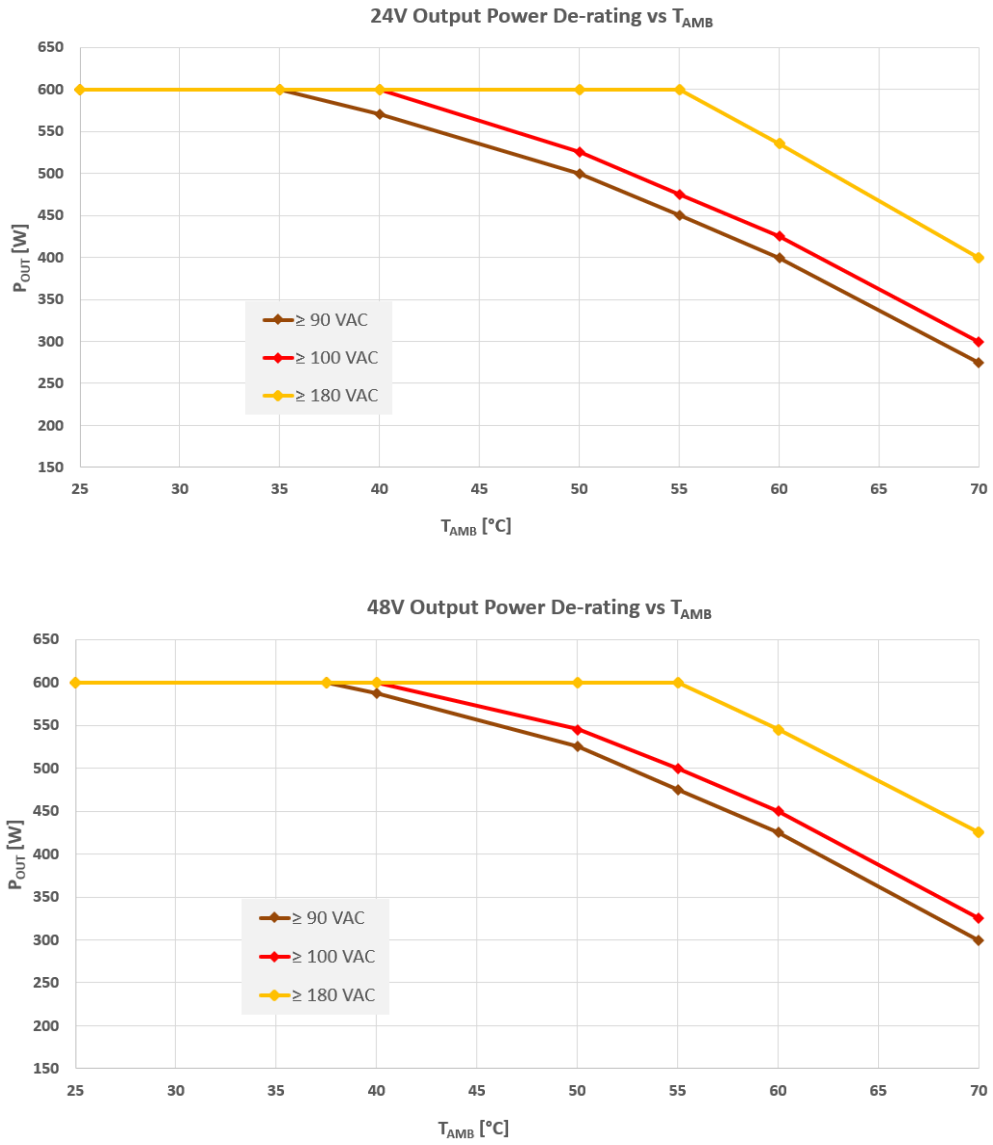


Figure 2. Power Derating Curves of MBS601 Series V1 P_{OUT} to T_{AMB}

Note: The de-rating curves are effective regardless mounting orientation

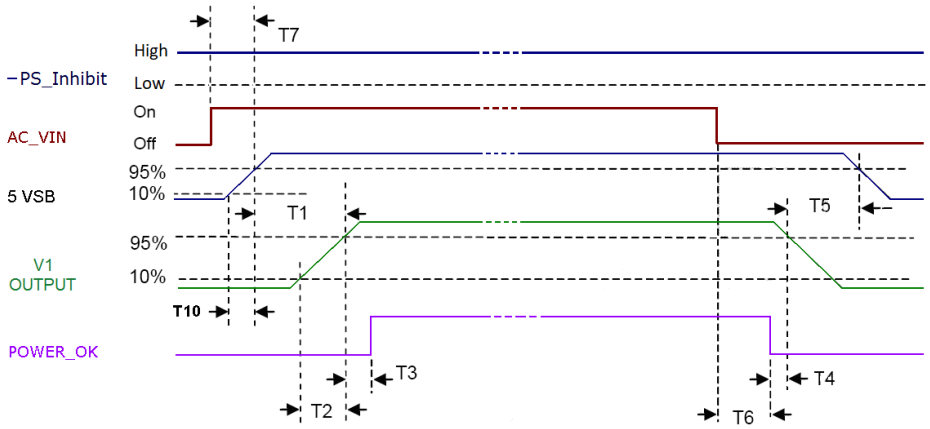
4. SIGNALS, CONTROLS & TIMING SPECIFICATIONS

Base signals and controls are accessible from signal connector P204.

SIGNAL	DESCRIPTION / CONDITION	MIN	NOM	MAX	UNIT
-PS_Inhibit	Active low. Input low voltage	0	-	1.5	V
	Input high voltage (I_{IN}= 300 µA)	3.5	-	5.5	V
	V1 disabled when -PS_Inhibit is pulled low				
	$5V_{SB}$ not affected by -PS_Inhibit				
	V1 enabled when -PS_Inhibit is floating or high				
P_OK*	Logic level low (<10 mA sinking)	-	-	0.7	V
	Logic level high (100 µA sourcing)	2.4	-	5.5	V
	Low to high time after V1 in regulation	40	-	350	ms
	Power down warning time	1	-	-	ms
$5V_{SB}$ Output	Active and in regulation after a 85<V_{AC}<264 is applied	-	-	1500	ms
	$5V_{SB}$ not affected by PS_Inhibit				

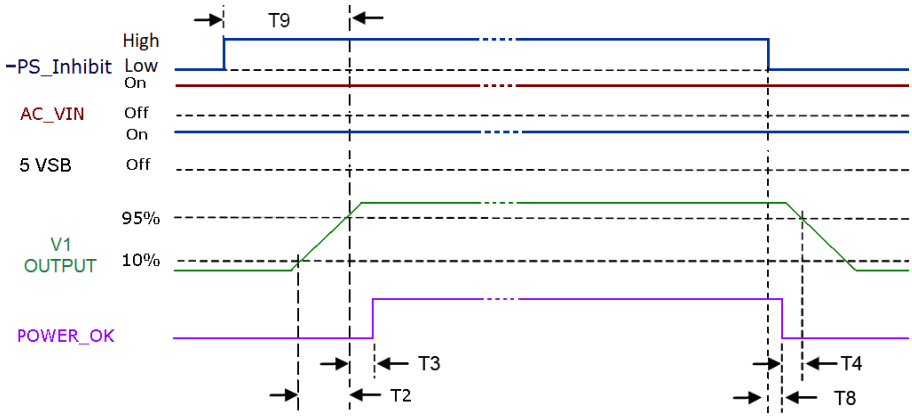
* When V1 is On, a P_OK low may indicates V1 under voltage condition. When two MBS601 operate in parallel, P_OK low in one unit indicates that it is not sharing the expected amount of current (current sharing fault). A 10 kΩ internal pull up to $5V_{SB}$ is used; do not add any other external pull up.

AC/DC INPUT OFF-TO-ON AND ON-TO-OFF TIMINGS



$5V_{SB}$ On – V1 On	250 ms ≤ T1 ≤ 550 ms
V1 rise time	10 ms ≤ T2 ≤ 100 ms
$5V_{SB}$ rise time	3 ms ≤ T10 ≤ 40 ms
V1 On – POWER_OK delay	200 ms ≤ T3 ≤ 350 ms
Power down warning	T4 ≥ 1 ms
V1 Off – $5V_{SB}$ Off	T5 ≥ 0.5 s (V1 load > 25 W)
AC Off – POWER_OK low	T6 ≥ 15 ms
AC_On – $5V_{SB}$ turn on time	T7 ≤ 1.5 s

PS_INHIBIT OFF-TO-ON AND ON-TO-OFF TIMINGS



V1 rise time	10 ms ≤ T2 ≤ 100 ms
V1 On – POWER_OK delay	200 ms ≤ T3 ≤ 350 ms
Power down warning	T4 ≥ 1 ms
PS_Inhibit – POWER_OK low timing	T8 ≤ 2 ms
PS_Inhibit – V1 On delay	T9 ≤ 450 ms

5. PROTECTION SPECIFICATIONS

PARAMETER	DESCRIPTION / CONDITION	MIN	NOM	MAX	UNIT
Input Under Voltage	Auto-recovering	58	75	82	V_{AC}
Input Fuse	High breaking, 10 A, 250 V on L and L1.	-	-	10	A
Over Current	At nominal input voltages V1: Hiccup mode, auto-recovering (>10 s) V1: Hiccup mode, auto-recovering (<10 s) 5 V_{SB}: Hiccup mode, auto-recovering:	 108 135 1.6	 - - -	 132 163 3.6	 %$I1_{Rated}$ %$I1_{Rated}$ A
Short Circuit	At nominal input voltages V1: Hiccup mode, auto-recovering. 5V_{SB}: Hiccup mode, auto-recovering.	-	-	-	
Over Voltage	V1, Power shut down, latch off. 12V_{SB}, Hiccup mode, auto-recovering.	120 -	- -	145 150	%V_{NOM}
Over Temperature (on primary stage)	Shut down, latch off.	-	-	-	°C
Over Temperature (on secondary side)	Hiccup mode, auto-recovering.	-	-	-	°C
Isolation: Primary-to-Secondary	Reinforced (2x MoPP)	5660 4000	- -	- -	V_{DC} V_{AC}
Isolation: Input-to-Earth	Basic (1x MoPP) Production tested at 2121 V_{DC}	2121 1500	- -	- -	V_{DC} V_{AC}
Isolation: V1-to-5V_{SB}	Basic	100	-	-	V_{AC}
Isolation: Output-to-Earth	Basic (1x MoPP)	1500	-	-	V_{AC}
Equipment Protection Class	Class I, compatible with BF (Body Floating) ME (Medical Equipment)				

6. ENVIRONMENTAL SPECIFICATIONS

PARAMETER	DESCRIPTION / CONDITION	MIN	NOM	MAX	UNIT
Operating Temperature Range	No de-rating up to 55°C, at ≥ 180 V_{AC}	-30	-	55	°C
Operating Temperature Range with Derating	See derating curves and conditions in the Output Specifications section	-	-	70	°C
Storage Temperature Transportation Temperature	As per IEC/EN 60721-3-1 Class 1K4 As per IEC/EN 60721-3-2 Class 2K4	-40	-	85	°C
Humidity	RH, Non-condensing Operating. Non-operating	-	-	90 95	% %
Operating Altitude	Medical grade MoPP (100-240 V_{AC}, 50/60 Hz) Medical grade MoOP (100-277 V_{AC}, 50/60 Hz)	- -	- -	4000 5000	m
Shock	**EN 60068-2-27** Operating: Half sine, 30 g, 18 ms, 3 axes, 6x each (3 positive and 3 negative). Non-Operating: Half sine, 50 g, 11 ms, 3 axes, 6x each (3 positive and 3 negative).				
Vibration	**EN 60068-2-64** Operating: Sine, 10 – 500 Hz, 1 g, 3 axes, 1 oct/min., 60 min. Random, 5 – 500 Hz, 0.02 g^2/Hz, 1 g_{RMS}, 3 axes, 30 min. Non-Operating: 5 – 500 Hz, 2.46 g_{RMS} (0.0122 g^2/Hz), 3 axes, 30 min.				
MTBF	Full Load, 40 °C ambient 80% Duty cycle, Telcordia SR-332 Issue 2	200000	-	-	Hours
Useful Life	Nominal V_{IN}, 80% load, 40 °C ambient (IPC9592)	-	10	-	Years

7. ELECTROMAGNETIC COMPATIBILITY (EMC) – EMISSIONS

PARAMETER	DESCRIPTION / CONDITION	STANDARD	PERFORMANCE CLASS
Conducted	115, 230, 277 V_{RMS}, Maximum load	EN 55011 (ISM) EN 60601-1-2 (Medical) FCC Part 15	B
Radiated	The "SL" variant compliance to the Class B is conditioned by the use of a common ground plane between the power supply and its load	EN 55011 (ISM) EN 60601-1-2 (Medical) FCC Part 15	B
Line Voltage Fluctuation & Flicker	At 20%, 50% and 100% maximum load Nominal input voltages	EN 61000-3-3	
Harmonic Current Emission	230 VAC input voltage, 50 / 60 Hz 230 VAC 50 / 60 Hz, >150 W load	EN 61000-3-2 EN 61000-3-2	A, D C

8. ELECTROMAGNETIC COMPATIBILITY (EMC) – IMMUNITY

PARAMETER	DESCRIPTION / CONDITION		STANDARD	TEST LEVEL	CRITERIA
	Reference standard for the medical version		EN 60601-1-2, 4th edition		
ESD	15 kV air discharge, 8 kV contact, at any point of the system.		EN 61000-4-2	4	A
Radiated Field	10 V/m, 20-2700 MHz, 1 KHz, 80% AM.		EN 61000-4-3	3	A
Electric Fast Transient	±2 kV on AC power port for 1 minute		EN 61000-4-4	3	A
Surge	±2 kV line to line; ± 4 kV line to earth on AC power port		EN 61000-4-5	4	A
Conducted RF Immunity	10 V_{RMS}, 0.15-80 MHz, 1 kHz, 80% AM		EN 61000-4-6	3	A
Dips and Interruptions	200 – 277 V_{AC}:	Drop-out to 0% for 10 ms	EN61000-4-11		A
		Dip to 40% for 5 cycles (100 ms)	EN61000-4-11		A
		Dip to 70% for 25 cycles (500 ms)	EN61000-4-11		A
		Drop-out to 0% for 5 s	EN61000-4-11		B
	100 – 127 V_{AC}:	Drop-out to 0% for 10 ms	EN 61000-4-11		A
		Dip to 40% for 5 cycles (100 ms)	EN 61000-4-11		A (derate to 150 W)
		Dip to 70% for 25 cycles (500 ms)	EN 61000-4-11		A (derate to 400 W)
		Drop-out to 0% for 5 s	EN 61000-4-11		B

9. SAFETY AGENCIES APPROVALS

CERTIFICATION BODY	SAFETY STANDARDS	CATEGORY
CSA / UL	CSA C22.2 No.60601-1, ANSI/AAMI ES60601-1 3rd edition + A1 Including Risk Management Assessment	Medical
IEC IECEE CB Certification	IEC/EN 60601-1 3rd edition+A1 Including Risk Management Assessment	Medical
CE	Directive 93/42/CEE: Safety Requirement of the Medical Device Directive 2014/30/EU: Electromagnetic Compatibility (EMC) Directive 2011/65/EU: RoHS 2	Medical
	Designed to meet IEC/EN/UL/CSA 61010-1 2nd edition	

10. MECHANICAL SPECIFICATIONS

PARAMETER	DESCRIPTION / CONDITION
Weight	2770 g (6.11 lb) 2850 g (6.28 lb) – SL models
Overall Dimensions	125.0 x 250.5 x 60.0 mm (4.92 x 9.86 x 2.36 in)

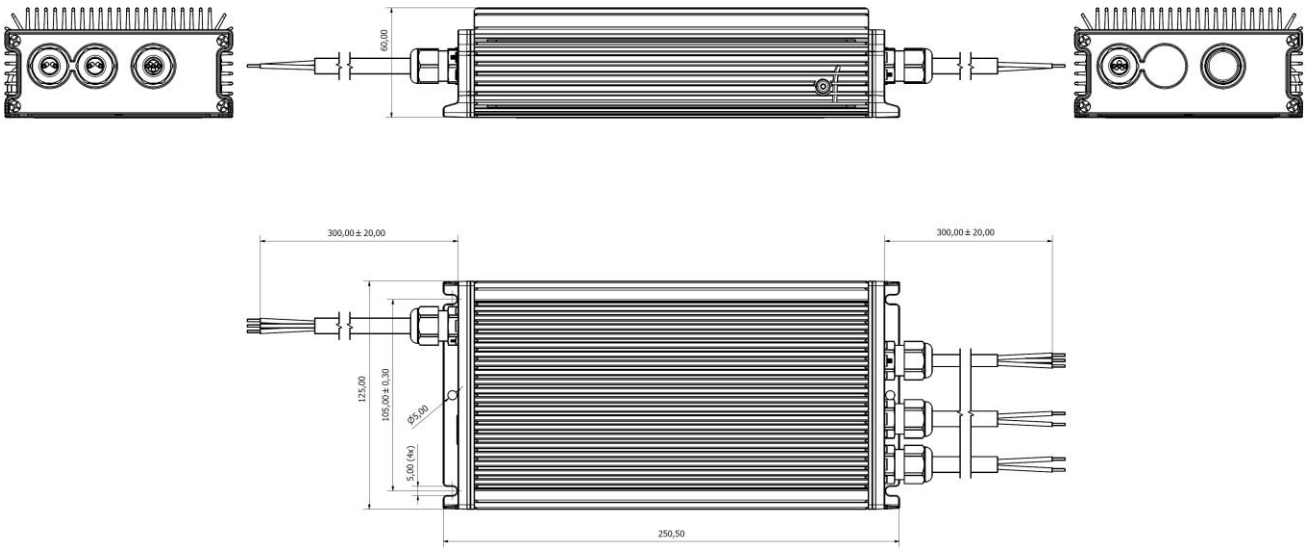
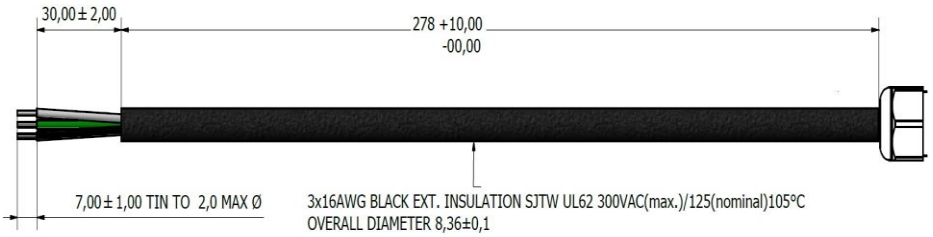


Figure 3. Mechanical drawing

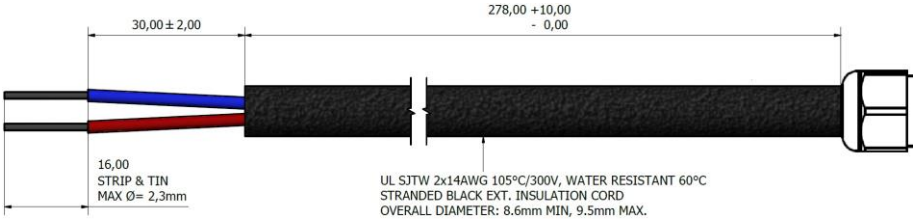
11. CONNECTIONS

INPUT CABLE

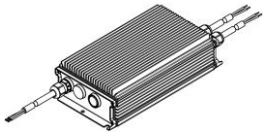


WIRE COLOR	FUNCTION
BLACK	Line
GREEN	PG
WHITE	Neutral

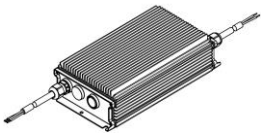
OUTPUT CABLE



WIRE COLOR	FUNCTION
RED	+V1
BLUE	V1 RTN

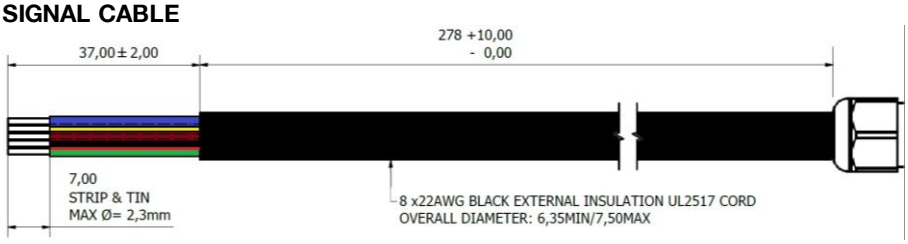


24 V

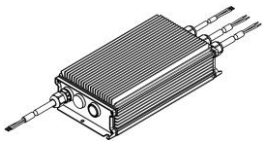


48 V

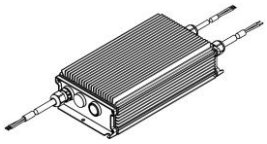
SIGNAL CABLE



WIRE COLOR	FUNCTION
BLACK	RTN
RED	+5 VSB
BROWN	RS-
GREEN	P_OK
YELLOW	- PSINHIBIT
GREY	VS_LOGIC
BLUE	I SHARE 1
WHITE	RS+



24 V



48 V

For more information on these products consult: tech.support@psbel.com

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