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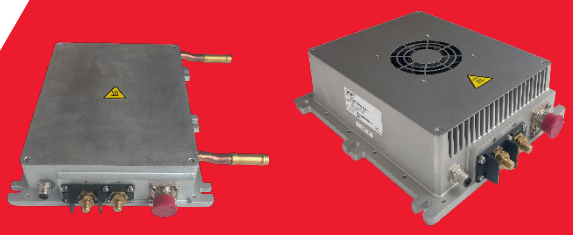
A Murata Company

400S12.3KOHVC

HVC Series 3kW DC-DC



Product Overview

400S12.3KOHVC is a series of 3 kW auxiliary power modules that provide high performance under extreme conditions. The 400S12.3KOHVC accepts input voltage from 230Vdc to 420Vdc and provides a single isolated 12Vdc output for powering auxiliary equipment.

HVC series are available in air cooled or liquid cooled rugged, fully IP rated, vibration resistant, thermally optimized enclosures. Threaded through holes to allow easy mounting or for the addition of a heatsink for extended temperature operation for further flexibility.

HVC series requires DC-DC enable ON/OFF command or PS_WAKEUP (pin #1) cycling to clear the latch.

A comprehensive CAN 2.0B digital interface is provided.

The high efficiency and impressive power density are achieved by use of advanced circuit design including low-loss synchronous rectification technology, resulting in a highly reliable product for industrial and E-mobility applications.

Features

- Wide 230-420 VDC high-side voltage input
- Supports 12Vdc battery configurations
- Efficiency >94%
- Liquid cooled and air cooled configurations
- IP6K9K Ingress protection
- Excellent shock and vibration damping
- High power density
- Fully protected and recoverable from Over-Current, Short Circuit, and Over-Temperature faults
- Highly reliable
- SAE J1939 protocol via CAN Bus interface (contact Calex for latest message support)

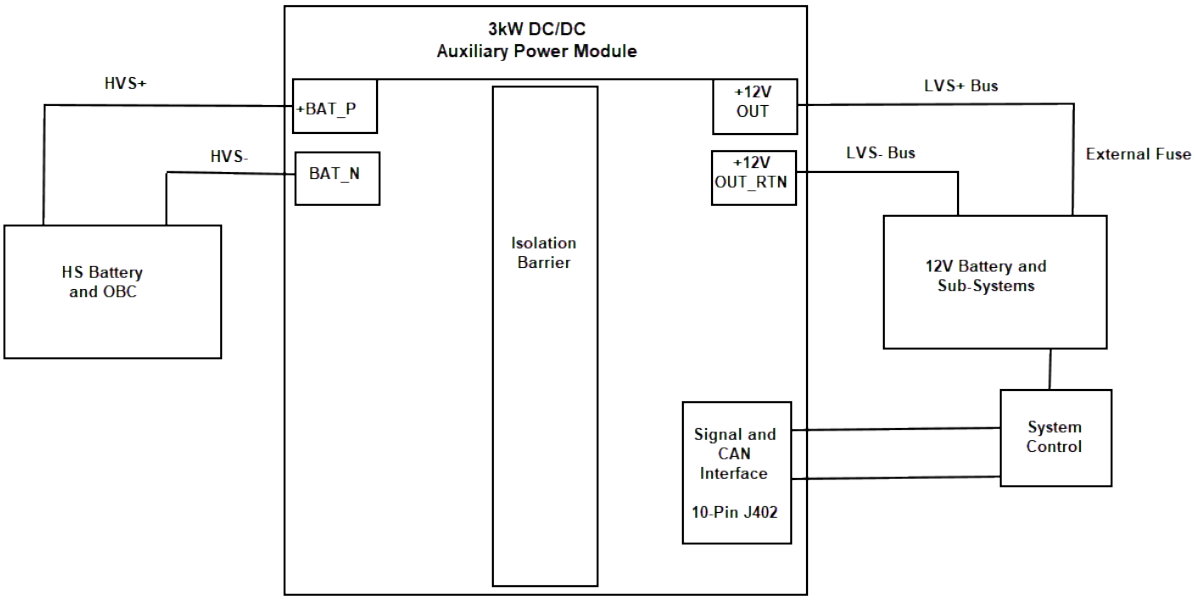
Contents

Ordering Guide

Model	Input Voltage	Output Voltage (Nom.)	Output Current	Configuration	Max. Output Power
400S12.3K0HVC-L	230-420	9-16VDC	250A	Liquid-Cooled	3KW
400S12.3K0HVC-A	230-420	9-16VDC	250A	Air-Cooled	3KW

Liquid-Cooled Model

Air-Cooled Model



Electrical Specifications

All specifications are based on 25°C Ambient, Vin = 320Vdc Vout nominal load, unless otherwise specified.

Parameter Input Characteristics	Conditions		Min.	Typ.	Max.	Units
Voltage Range			230		420	Vdc
Turn-on Threshold	Default, ramping up		220		230	
Turn-off Voltage	Default, ramping down		210		220	
Overvoltage Protection	Self-recoverable. Absolute maximum voltage is 500V (exceeding this value can cause hardware damage).		421		437	Vdc
Input Current	100% full load; 220Vdc input			14.2		Adc
Peak Inrush Current	420Vdc input; cold start;excludes inrush due to EMI filter x-cap.) <200ms			20	50	Adc
Input Fuse	20A, 420V fast-acting, non-resettable.					
Efficiency	Steady state operation, 25°C; Liquid Cooling model; 50% max. load, Vin: Nominal (refer to the plot for typical performance example).			94		%
Output Characteristics						
Initial Voltage Set-Point [1]	Vin=350Vdc; Iout 50% full load, constant current load.		11.7	12.0	12.4	Vdc
Voltage Range	Refer to Output Voltage vs. Current and Output Voltage vs. Temperature curves for Voltage & Load characteristics (CAN programmable) and limits.		9	12	16	Vdc
Voltage Regulation[2]	% of Vout Set-Point		-2		+2	%
Output Ripple & Noise[2]	20MHz Bandwidth; Full load; Ripple and noise are measured with 0.1 µF of ceramic capacitance and 10 µF of tantalum capacitance on each of the power supply outputs. A short coaxial cable to the scope termination is used.				±120	mV p-p
Output Current Range[2]			3		250	Adc
External Load Capacitance	Full load (resistive); -40 °C < Ta <+105 °C	CEXT	470		4700	µF
		ESR	10		100	mΩ
Over Current Protection	Continuous retry = up to 6 times; vout UV (8.5V) brickwall and then latches-off.		251		300	Adc
	CC Inception starting from ≥12V to 16V from 250A to 187.5A respectively. For vout < 12V down to 9V CC inception is 250A.					
	Brick wall Limit -> the greater of 3kW or 250A					
Short Circuit Protection	Refer to Output Voltage vs. Current Curve for Voltage/Load characteristics. Latch/retry behavior is not CAN configurable.				560	Apk
Overvoltage Protection	Requires DC-DC enable ON/OFF command or PS_WAKEUP (pin #1) cycling to clear the latch.		16		19	Vdc
Standby Leakage Current	HV input side, "command off" condition (Converter is disabled and in hibernation) 220Vin.			1.3		ma
	LV input side, "command off" condition (Converter is disabled and in hibernation) 12V			4.4		
Output Turn-On Delay	Output turn-on time from receiving the CAN Enable command.			3164	5000	

[1] Commanded Vout setpoint via CAN Bus replaces the default setpoint and gets stored in the DC-DC.

[2] Operates safely under "no load" without shutting down; however, a minimum load of 5A is required to meet output regulation and ripple specifications.

Note: All specifications are based on 25°C Ambient, VIN = 320Vdc Vout nominal load, unless otherwise specified.

Isolation Characteristics

Parameter	Min.	Typ.	Max	Units
Input to Output - Reinforced	4242			Vdc
Input to Chassis - Basic	2121			
Low Voltage Side Output return internally connected to Chassis	0			Vdc
Isolation Resistance; Test voltage (Class 0)	500			OHM/V

Environmental Characteristics

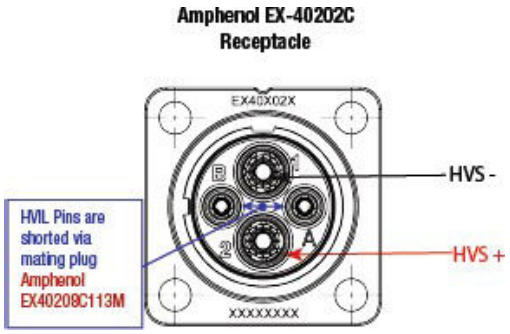
Parameter	Condition	Min.	Typ.	Max	Units
Operating Temperature (Ambient)	Liquid Cooled	-40		+85	°C
	Air Cooled	-40		+65	°C
Storage Temperature		-40		+85	°C
Over Temperature Shutdown	Liquid Cooled		90		°C
	Air Cooled		69		°C
Coolant Temperature Range	Optimum temperature is (15C-25C) for maximum efficiency.	-40		+65	°C
Liquid Cooling	50% water, 50% ethylene glycol			+65	°C
Coolant Flow Rate	Pressure drop <100mbar		6		L/min
Coolant Max Volume			6		L
Ingress Protection		IP6K9K			
Operating Altitude	4,000M				
Product Life	Telcordia SR-332, Method I Case 1 50% electrical stress,40°C components; 27°C coolant, full load		10		Years
EMC Requirements Component/ ESA (Planned)	Compliance with the following sections of UN ECE R10 (planned performance): • Conducted Emissions – CISPR25 Class 2 • Radiated Emissions - CISPR25 Class 2 & ECE Reg 10.6 Sec 6.5, 6.6 • BCI Radiated Immunity – ECE Reg 10.6 Sec 6.8 • ALSE Radiated Immunity – ECE Reg 10.6 Sec 6.8 • Conducted Transient Immunity ECE Reg 10.6 Sec 6.9, ISO7637-2 Pulses 1, 2a, 3a/b • EFT – IEC61000-4-4 level 3 • Surge – IEC61000-4-5 level 3 • ESD – IEC61000-4-2 level 2				

Environmental Characteristics (continued)

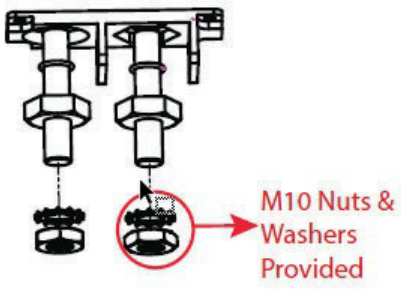
Parameter	Compliance				
Shock and Vibration, Ingress	400S12.3K0HVC is designed to meet the following environmental standards and test requirements applicable to body mounted (sprung masses) in passenger and commercial vehicles: • ISO 16750-3 SECTION 4.1.3.2.3 - Random Vibration; 32 hours/axis in 3 axes • ISO 16750-3 SECTION 4.2.2 - Mechanical Shock; 500 m/s², 6ms half-sine, 10 shocks per direction • ISO 16750-3 SECTION 4.3 - Free Fall; 2 falls, steel plate from 1m • ISO 16750-4 SECTION 5.1.1 - Low Temperature; -40°C for 24 hours • ISO 16750-4 SECTION 5.1.2 - High Temperature; +85°C for 48 hours • ISO 16750-4 SECTION 5.2 - Temperature Steps; -40°C to +70°C • ISO 16750-4 SECTION 5.3.1 - Temperature Cycle; 30 cycles (240 hours) • ISO 16750-4 SECTION 5.3.2- Rapid Change of Temperature; 300 cycles, 60 minutes at each extreme • ISO 16750-4 SECTION 5.5.1 - Salt Spray, Corrosion; severity: 2 weeks • ISO 16750-4 SECTION 5.5.2 - Salt Spray, Leakage and Function; severity: 6 days • ISO 16750-4 SECTION 5.6 - Humid Heat, Cyclic; test No. 2, 10 cycles • ISO 16750-4 SECTION 5.7 - Damp Heat; severity 1 • ISO 20653 IP6KX - Dust Tight • ISO 20653 IPX9K - High pressure/Steam-jet Cleaning				
Regulatory Compliance					
Safety Agency Approvals					
Note: This product is not IATF/AECQ certified, contact Calex for additional details.					
CAN Signal Reporting Accuracy					
Voltage, Input / Output	% Full-scale	-2		+2	%
Current, Input / Output t		-5		+5	%
Power, Input / Output		-10		+10	
Mechanical					
Weight	Liquid-Cooled model, excluding		4.9		kG
	Air-Cooled model		4.7		kG
Case Dimension	Liquid-Cooled model		267 x 240 x 59.85		mm
	Air-Cooled model		267 x 240 x 70		

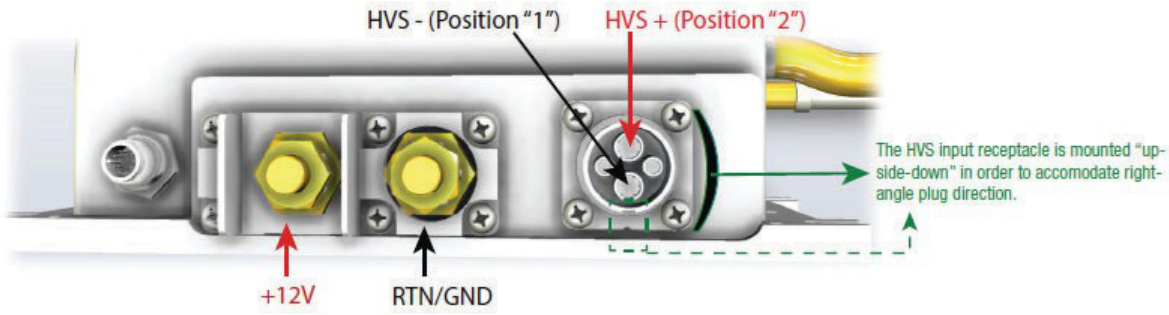
Connectors

Part Number	Qty.	Description
EX40202C	1	Main body, Flange Seal, Dust Cover (Type C Yellow)
EX30F6	2	Power Pins for 6mm² wires
EX16F1	2	Signal Pins HVIL



LS Output and HVS Chassis View



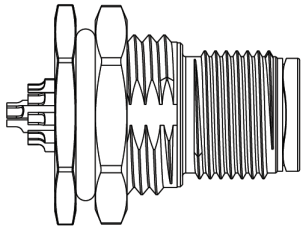


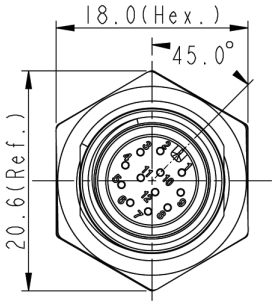
Note: This illustration is an artist rendering of connector locations on the chassis. Actual product coloration and texture might vary.

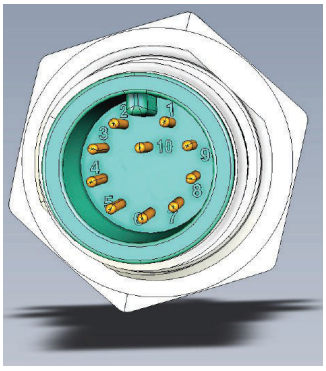
Torque, M10 nuts, +12V and RNT/GND stud: 60in-lbs.

Communication Connector Details

Side Signal Connector:
AMPHENOL LTW P/N **M12A-10PMMS-SF8001**







Mating Signal Connector options (Amphenol LTW M12 series):,

P/N: **M12A-10BFFA-SL8001** (IP 68) & **M12A-10BFFA-SL7001** (IP67), see Fig 1), **M12A-10BFFM-SL8Dxx** (IP68 over-mold, Fig. 2)

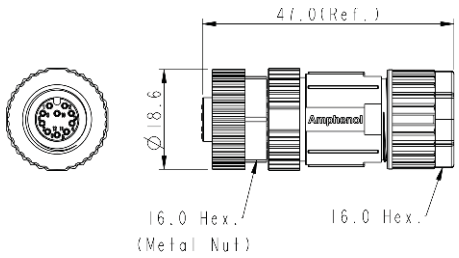


Figure 1

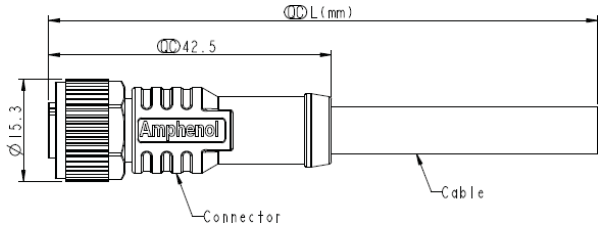


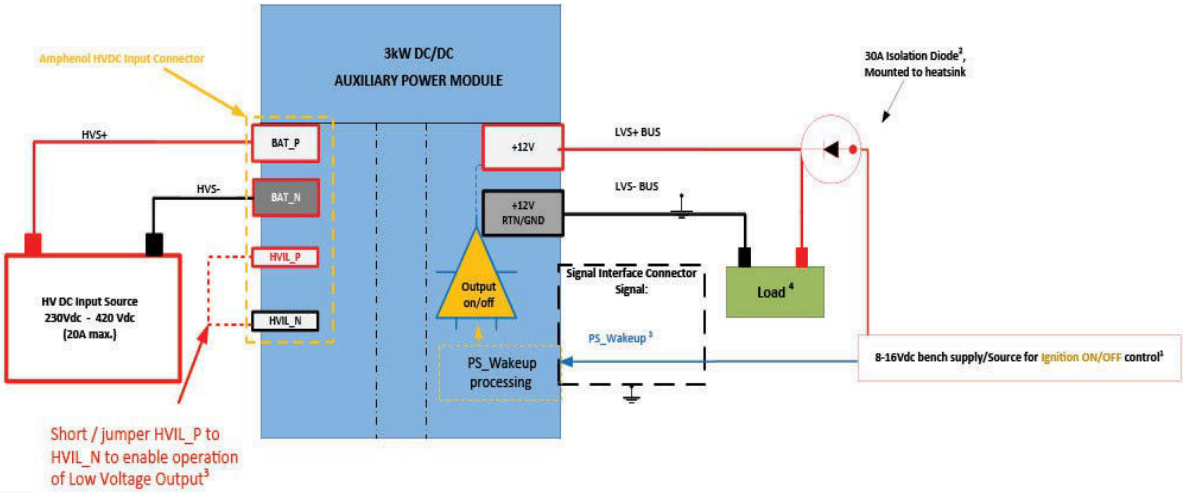
Figure 2

Signal Characteristics

Pin #	Signal Name	Input/Output	Description	Interface Details
1	PS_WAKEUP	Input	This signal is ground referenced and provides a method to enable/disable the 12V output. The auxiliary battery 8-16Vdc positive output must be applied this pin to enable the output.	Internally 3.3K Pull-down
2	Unused		Make no connection to this pin.	Internally pulled up to +12V
3	GND	Input	GND - internally connected to 12V output RTN/GND.	
4	CAN_SPEED	Input	CAN Bus speed can be selected as follows: • 250kbps: pull down to ground (externally) • 500kbps: leave floating (default, no connection) = 500kbps	Internally pulled up 100K to 3.3V
5	CAN_H	Bi-Directional	CAN A differential High line I/O – "High" in dominant state.	
6	CAN_L	Bi-Directional	CAN A differential Low line I/O – "Low" in a dominant state.	
7	-	-	Reserved for future use, no user connection.	
8	-	-		
9	HVIL_P	Input	The High Voltage Interlock provides a method for the system/host to detect when 400S12.3K0HVC is connected or disconnected. It provides a passive 0 OHM pass-through between HVIL_P and HVIL_N pins. See the wiring diagram for application details.	0 OHM link from HVIL_P to HVIL_N pins; maximum current: 30mA
10	HVIL_N	Output		
Note: A 250A external fuse must be connected between the 12V main output of 400S12.3K0HVC and battery connection.				

Wiring Diagrams

Basic Configuration with Auxiliary Battery



Connection Notes:

This configuration is useful to operate without the Aux. Battery and provides the constant current HVIL source, PS_Wakeup signal and also provide the minimum load required to enable operation of the output.

1) External DC power supply (8-16Vdc @ 3-5A, should also have adjustable current limit as a precaution):

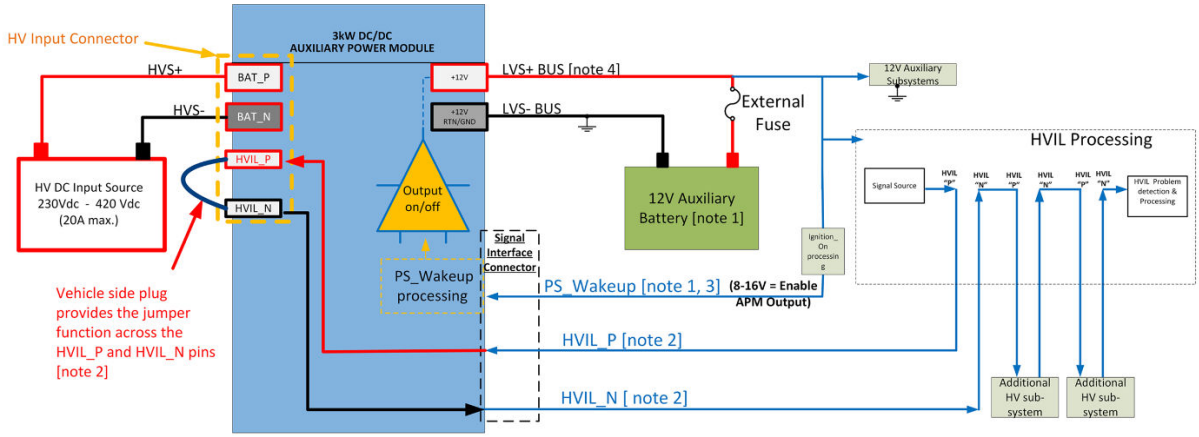
- Provides a voltage source at the output of the APM to start-up internal housekeeping circuits that would normally be supplied by the auxiliary battery.
- Provides the 8-16Vdc input voltage for the "PS_WAKEUP" signal.
- Provides a current source, required by the HVIL via two external resistors. This circuit mimics the 10-20ma constant current source typically provided by the vehicle's HVIL watchdog circuitry.

2) The output Isolation diode protects the DC bench power supply from the harmful effects of reverse voltage. Since the diode is for ward biased (provides 2A minimum load), it should be mounted to a heatsink. A 20A diode is recommended.

3) PS_WAKEUP requires 8-16Vdc input to enable output operation, sourced by the same DC bench power supply.

4) Output load current should be ≥ 2A to For jitter-free output voltage. The configuration starts-up and operates safely at lower current; however, the4 output voltager can vary.

Basic Configuration with Auxiliary Battery



Notes:

This configuration illustrates the Configuration in typical applications, auxiliary battery / typical application system

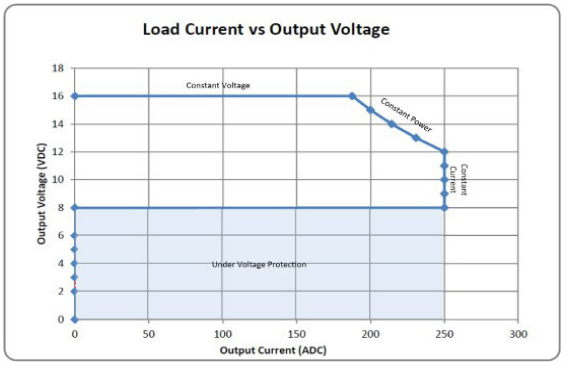
1) Auxiliary battery:
   - Provides The low voltage power source necessary to operate the low voltage system side and internal circuits, with or without presence of the HV / Motive battery
   - Provides the voltage for the "PS_WAKEUP" signal, to enable operation either directly or via system / ECU processing such as Ignition sensing/processing

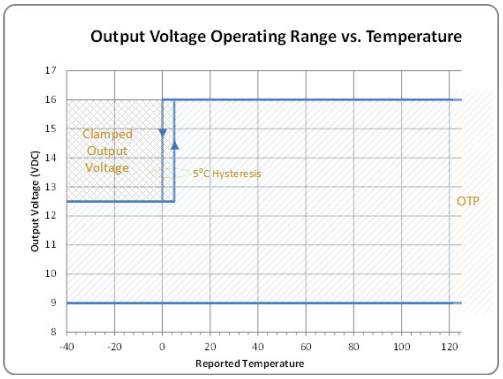
2) As illustrated above, the signal Connector's HVIL P (Pin 9) is directly connected internally within the corresponding HVIL P pin of the input receptacle. In same way, the signal connector's HVIL N (Pin 10) is directly connected internally to the input receptacle's corresponding HVIL N pin. Therefore, whenever the input power plug is connected, the HVIL P and HVIL N pins will be shorted together, since the input power plug contains the HVIL shorting jumper. Note that if using any other input power plug than specified in the datasheet, the input receptacle HVIL pins need to be shorted together in order to enable the low voltage DC output.

3) PS_WAKEUP requires 8-16Vdc input to enable output operation

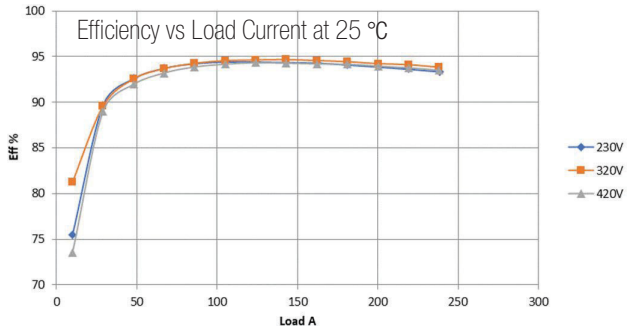
4) output load current should be ≥ 2A to For jitter-free output voltage.

Typical Performance Characteristics



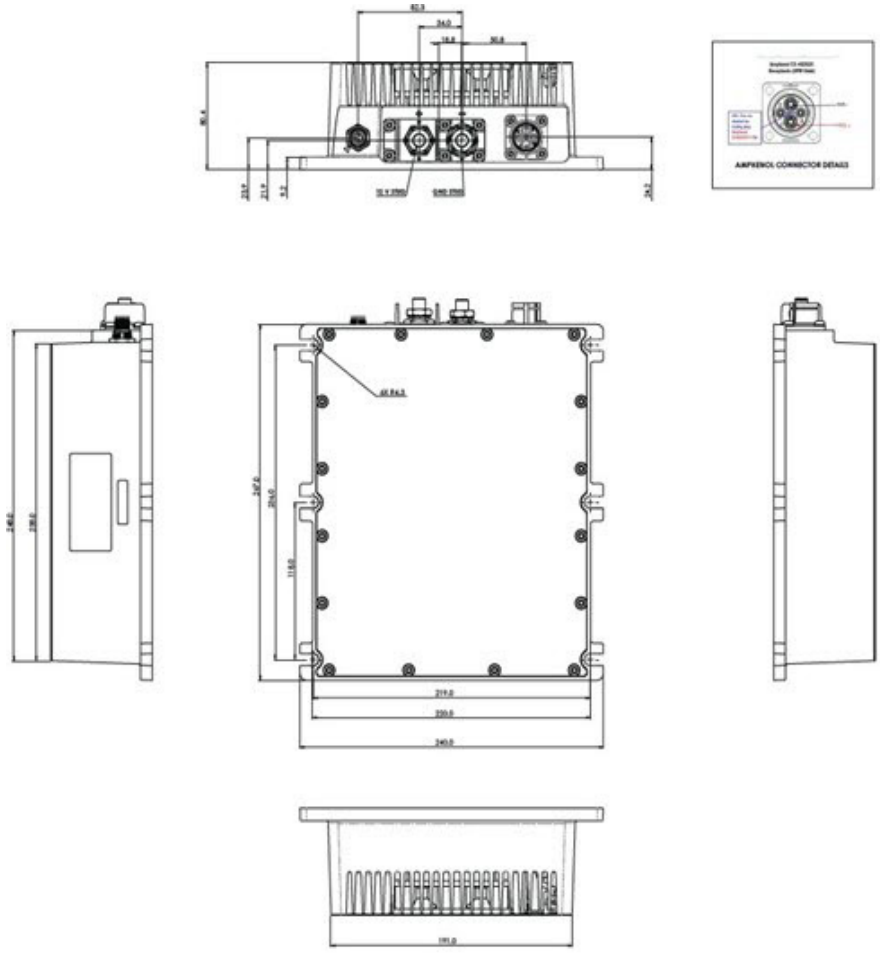


Vout limited to a 12.5V maximum @ buck/boost temperature ≤0°C/ This limitation is released when buck/boost temperature increases to ≥ 5°C



Mechanical Specifications

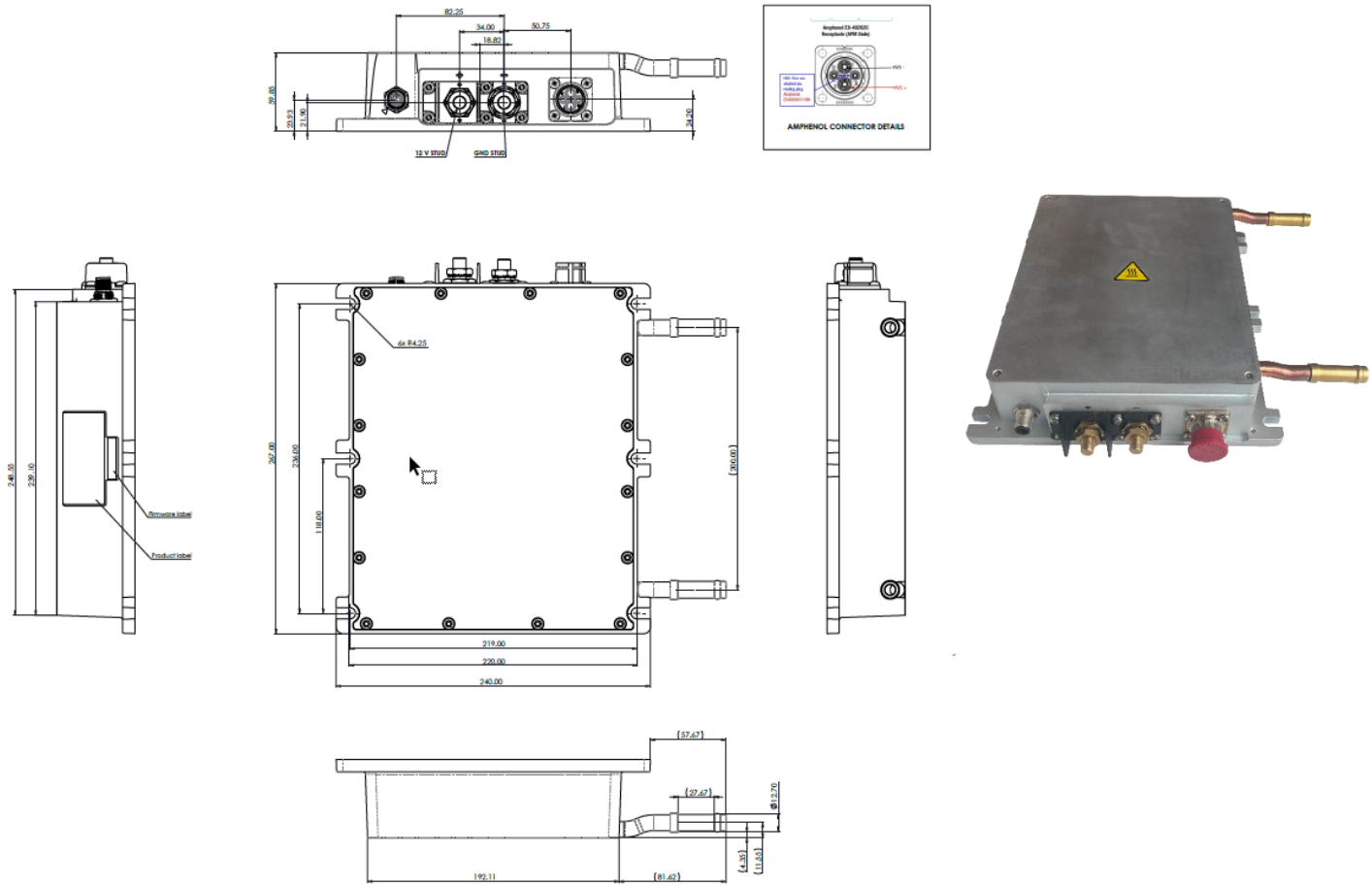
Air-Cooled Model: 400S12.3K0HVC-A



Note: (X.X) are dimensions for reference only.

Mechanical Specifications (continued)

Liquid-Cooled Model: 400S12.3K0HVC-L



Notes:

1. (X.X) are dimensions for reference only.
2. Suggested torque for M10 nuts at 60 in-lbs.