

Military Custom Off-The-Shelf Power Supply MVM177-12-7K

177W 7 Isolated Outputs

DC-DC Converter for Anti-Missile Radar System

Main Features:

- Ideal for all rugged applications complying with MIL-STD-810 for altitude, humidity, temperature shocks & cycles
- Soft Start at input stage the input voltage will ramp on input capacitance after 1sec to 28VDC
- Meets MIL-STD-1275D/ MIL-STD-810G/ MIL-STD-461G/ MIL-STD-704F
- Fully protected for Over-Load/ Short/ Over-Voltage/ Over-Temperature
- Transients Voltage Range: 28VDC to 0VDC at duration of 500 uSec;
100Vdc/50ms (MIL-STD-1275); 50V/50ms (MIL-STD-704)
- -40°C to +85°C full load base plate operating temperature
- External Sync. Capability/ Synchronize Lock
- Sleep Indicator/ Remote Inhibit (on/off)
- Reverse polarity protection up to 100V
- High Efficiency – Typical 90%
- Pass 40G Mechanical Shock
- Built in EMI Filter
- Digital Controls and Sense.
- Modified Off-the-Shelf Solutions
- Max. Ripple and Noise Over 20 Hz – 20 MHz 30 mV p-p
- Low Profile Size –
21 mm (H) * 135 mm (L) * 135 mm (W)

Typical Applications:

- EW Systems
- RWR Receivers
- Missile
- Navigation Systems
- Outdoors Telecom
- Military Airborne/ Ground-Fix/ Shipboard
- Ground Vehicle Radar Communication
- UAV (Unmanned Aerial Vehicle)



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Main Specification:

Input Voltage Characteristics:

Input Voltage Range 16 ~ 36VDC

Reverse Polarity Protection

Protection from Transient at Input Voltage Going Down from 28VDC to 0VDC at Duration of 500 uSec

Soft Start at Input Stage – The Input Voltage will Ramp on Input Capacitance after 1sec to 28VDC

The inrush current from +28V_IN shall be limited to 20A for 10 msec max

Output Specifications

Output Voltage and Currents

Outputs	Voltage	Current
12V_OUT_ESS_A2D	12V	10 A
3.3V_OUT_ESS_TGS	3.3V	0.260 A
12V_Out_TGS	12V	0.05 A
5.5V_Out_TGS	5.5V*	8.0 A
3.3V_Out_TGS	3.3V*	3.0 A
-5V_Out_TGS	-5.0V	0.05 A
3.3V_MB	3.3V	0.200 A

Table 1 - Output Voltages and Currents

NOTE 1: Load is power managed and load current will turn on and off at approximately a 25% duty cycle on and 75% off over with approximately a 500mS period.

NOTE 2: The unit shall be designed for 100% duty cycle for future applications.

- Line Load & Temperature regulation < +/-2%
- Max ripple and noise over 20 Hz – 20 MHz 20 mV p-p
- Current limit on each output – 125-150% of rated current – Hick-Up
- Over-Voltage on each output – Non-latch type
- All outputs will maintain regulation with no load applied.

Minimum Power Supply Efficiency 85% at Operating Temperature

Note: Design requires that outputs #4 and #5 will have the ability to be increase the voltage to 6.0 and 4.3 Volts respectively if needed at a later date if specified.

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The following figure describes the electrical ICD required:

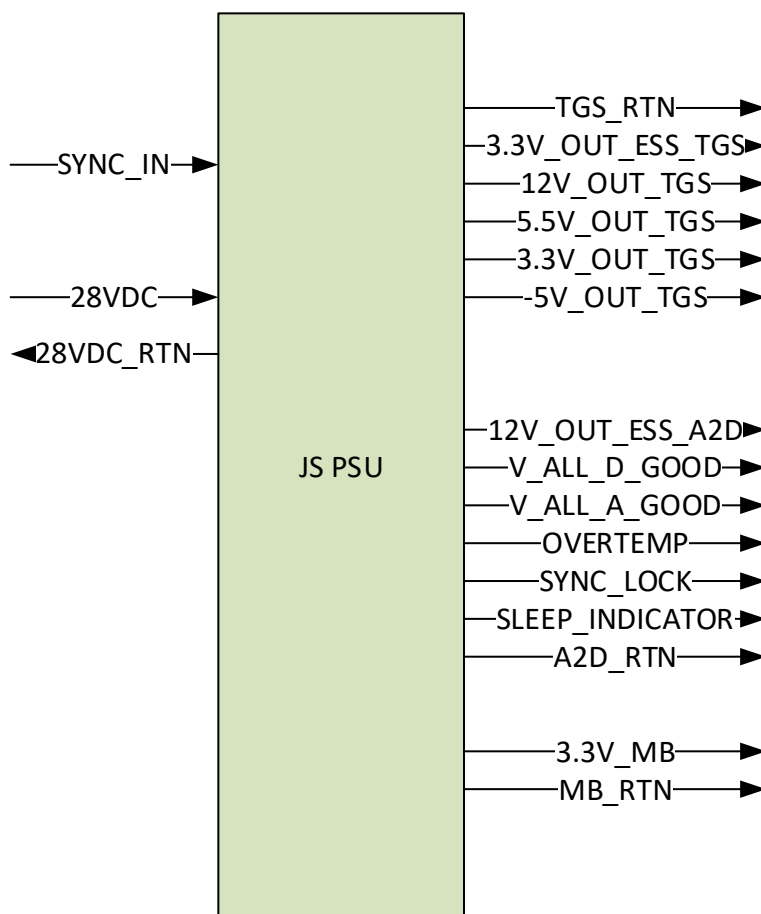


Figure 1 - Block Diagram

Hick-Up Operation

- All main supplies (A2D and TGS) if any failure occurs (over temp, over current/voltage, etc.)
- Failure indicators must stay powered while the unit hick-ups. If output voltages are off or out of range the indications shall show a fail mode.
- 3.3V_MB essential supply will remain on during a hick-up for supply of digital circuitry.
- Hick-up timing is TBD, vendor is to advise.

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Settling Time

When PS is switched ON, all output voltages shall reach the specified values within TBD milliseconds, vendor to advise.

Power Up Sequence and Holding Time

When the ON/OFF signal is off or a protective shutdown occurs, the 12V_OUT_ESS_A2D voltage shall be delayed by at least 20 mS after the Sleep signal is asserted.

Switching Frequency and Synchronization

The switching power supply shall be synchronized with an external sync. Frequency source PS_SYNC shall be a LVTTTL format signal. In the event of the external source not supplying the appropriate frequency the power supply shall not be damaged and automatically switch to operate on its own internal frequency source.

Transition to internal synchronization:

When the external synchronization signal is missing the PS shall operate with the PS internal 312.5 KHz clock. The transition indication SYNC_LOCK should be activated at less than 100 us after the external synchronization signal disappears. As soon as the external synchronization arrives, the PS will resynchronize. Synchronization is performed with no deviation from the given output voltages limits.

External frequency source range: 240 KHz to 340 KHz.

Signal source: LVTTTL – driver circuit schematic shown here for reference

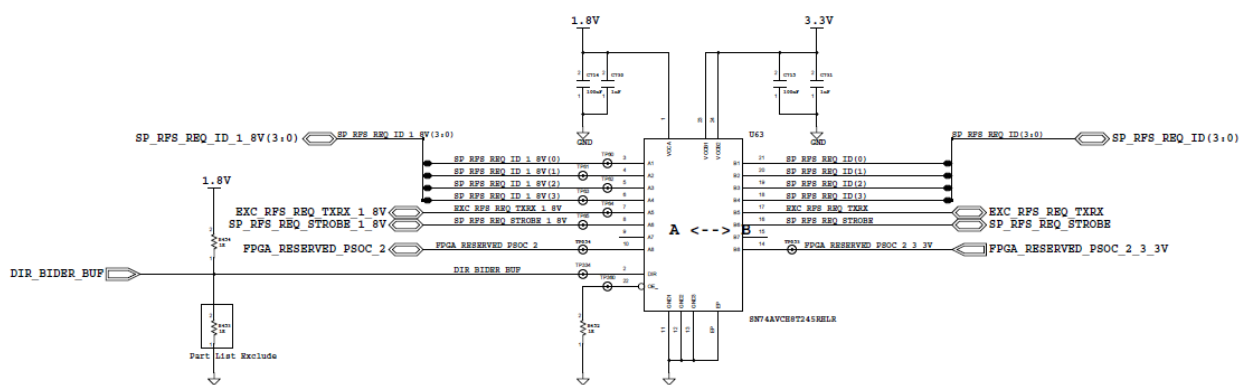


Figure 2 - Transition to internal synchronization

Note: neither in the transition from or to the external sync the output voltages level should departure from the above given voltage limits.

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Protections

There shall be no use in tranzorbes or zener diodes for over voltage protection of the Outputs, as a single voltage protection.

Over Current Protection

All the Regulated outputs are overload protected. No damage occurs if PS outputs are short-circuited, and typical maximum current is limited to: 125% to 150% of the maximal current. At over current outputs - the PS is turned off.

Over Voltage Protection

All outputs shall be over-voltage protected at 110% to 120% of their maximal rated value. Once tripped, all supplies shall be shut down.

Reverse Input Polarity

All the Power Supply inputs shall be protected against reverse polarity connection to the power source.

Over Temperature Protection

In case of PS base plate temperature rises above +105°C the PS shall be turned off and start hick-up operation.

Auto recovery to turn on @ 95°C.

Digital Controls and Sense

Logic Signals Characteristics

All signals shall be referenced to the PS A2D_RTN.

LVTTL level means – Low < 0.4V, High (3.6V > High > 2.4V)

All Digital outputs indication Signal (V_ALL_D_GOOD) output

A LVTTL level , which monitors the voltage accuracy of all the regulated outputs.

V_ALL_D_GOOD = HIGH, when the all regulated voltage outputs are > 95% of their Specified Nominal Voltage.

V_ALL_D_GOOD = LOW, when at least one of the regulated voltage outputs is < 95% of its Specified Nominal Voltage.

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All Analog outputs indication Signal (V_ALL_A_GOOD) output

A LVTTTL level , which monitors the voltage accuracy of all the regulated outputs.

V_ALL_A_GOOD = HIGH, when the all regulated voltage outputs are > 95% of their Specified Nominal Voltage.

V_ALL_A_GOOD = LOW, when at least one of the regulated voltage outputs is < 95% of its Specified Nominal Voltage.

Over Temperature Signal (Overtemp) output

A LVTTTL signal, which indicates that the power supply reached to the maximum allowed temperature.

OVERTEMP = High. PS temperature is under 90°C or according to futher requiments.

OVERTEMP = Low. PS temperature is above 90°C or according to futher requiments.

Synchronize Lock (SYNC_LOCK) output

The SYNC_LOCK is a LVTTTL logic signal indicates that the power supply is locked on the external synchronization signal. This signal is normally low and it driven high when the power supply is not locked on the external synchronization signal.

Sleep Indicator

Sleep Indicator is a LVTTTL logic signal that will provide a high output as long as the input voltage is above 16V and will go low when the input level goes below 16V.

ON/OFF input

- a. The power supply turn on shall be accomplished by activating ON/OFF signal.

Open- ON, GND- OFF. Reference to Vin_Return.

- b. The ON/OFF control will only control the main power supplies TGS and A2D.

- c. The ON/Off control shall be always fully functional including in the sleep mode.

Isolation Resistance

Input – output:	100Mohm (100 VDC)
Input – case:	100Mohm (100 VDC)
Output – case:	100Mohm (100 VDC)
Vin Return – all internal returns	100Mohm (100 VDC)
A2D_RTN – MB_RTN	<1 ohm

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All other RTN to each other and case 100Mohm

Note: RGS_RTN will be shorted to the TelGaAs RF chassis. The TelGaAs RF chassis is bolted to Power Supply Chassis. This means the power supply, and TelGaAs RF chassis are shorted to the RGS_RTN.

Mechanical Requirement

The unit shall continue to function after being subjected to the proof loads defined in MIL-STD-810F, Method 516.5, Procedure I half-sine, 30G for 11msec in each axis.

Crash Safety. The unit shall comply with MIL-STD-810F, method 516.5, Procedure V crash safety (half-sine, 30g, 11msec).

Size and Form

Weight - Vendor to provide expected weight.

Dimension - 135.000mm x 135.000 mm x 21 mm

Cooling - Base plate

Input connector - M24308/24-25F

Output connector – M24308/23-75F

Mechanical Outline

The following figure describes the suggested preliminary mechanical ICD:

[illegible]

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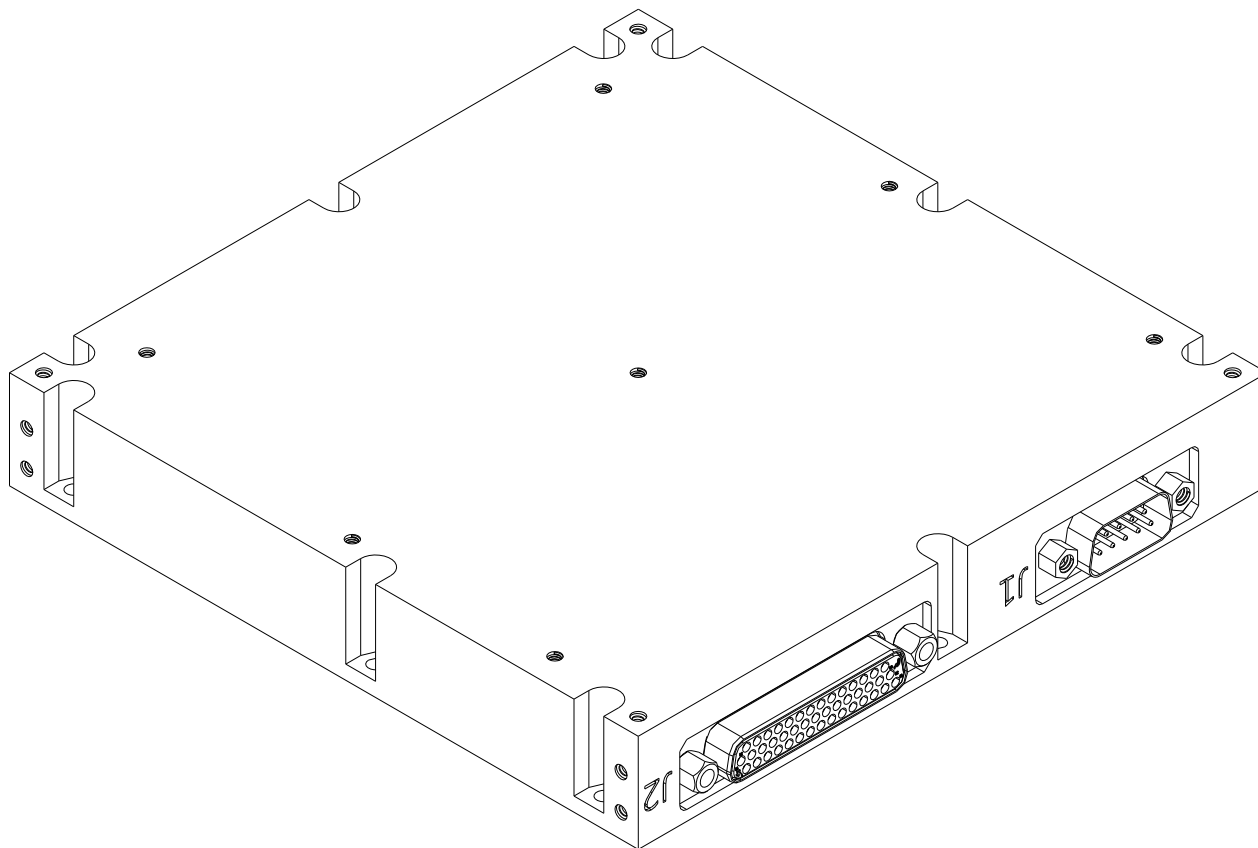


Figure 4 - suggested mechanical model

Housing Finish

The housing finish shall be a gold colored chromate per MIL-C-5541, Class 3.

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Pinout Specification and Function

Input connector pinout (J1)

Pin Number(s)	Name	Function	Comment
1,2,6	Vin_28V	Input Power Source	
4,5,9	Vin_Return	Return for Input Power Source (case ground)	
3	ON_OFF	ON OFF signal. Open- ON, GND- OFF	Reference to Vin_Return
7	+BC	External Capacitor (+)	Polarity +
8	-BC	External Capacitor (-)	Polarity -

Table 2 - Input connector pinout

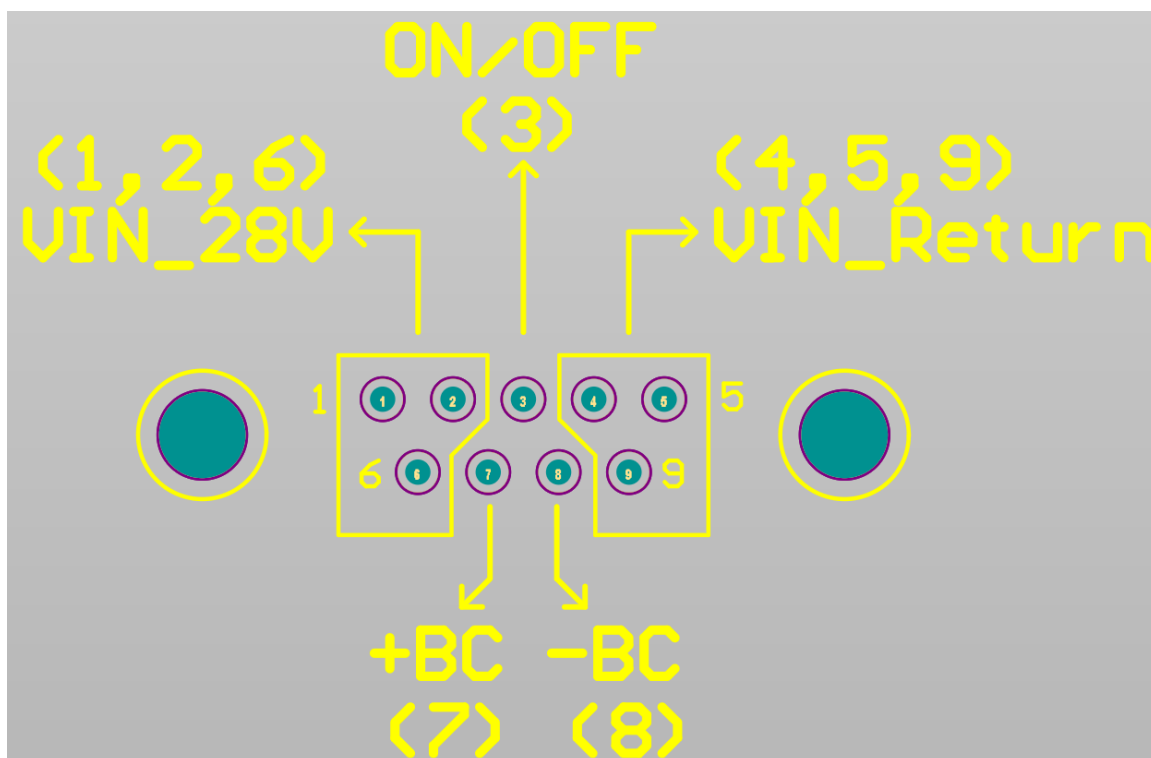


Figure 5 - pin location for input connector

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Output connector pinout (J2)

Pin Number(s)	Name	Function
3,4,18,19,33,34	A2D_RTN	Return 12V out ESS (DIGITAL)
1,2,16,17,31,32	12V_Out_ESS_A2D	12V supply DIGITAL
7	Sync_Lock	Indicator for sync lock function
22	V_All_D_Good	Indicator for all digital supply function
5	3.3V_MB	3.3V Supply (Essential) DIGITAL
36	Sleep Indicator	Indicator for low input voltage
21	V_ALL_A_Good	Indicator for all analog supply function
6	Sync IN	external synchronization signal for switchers
35	Overtempt	Indicator for over temperature condition
9,10,24,25	3.3_Out_TGS	3.3 V supply ANALOG
11,12,13,26,27,28,41,42,43	TGS_RTN	Return for all ANALOG supplies
14,15,29,30,44	5.5V_Out_TGS	5.5V supply ANALOG
38	3.3V_Out_ESS_TGS	3.3V supply ANALOG
40	-5V_Out_TGS	Negative 5V supply ANALOG
39	12V_Out_TGS	12 V supply ANALOG
20	3.3V_MB_RTN	MB_RTN
8,23,37	Spare	

Table 3 - Pinout Definition

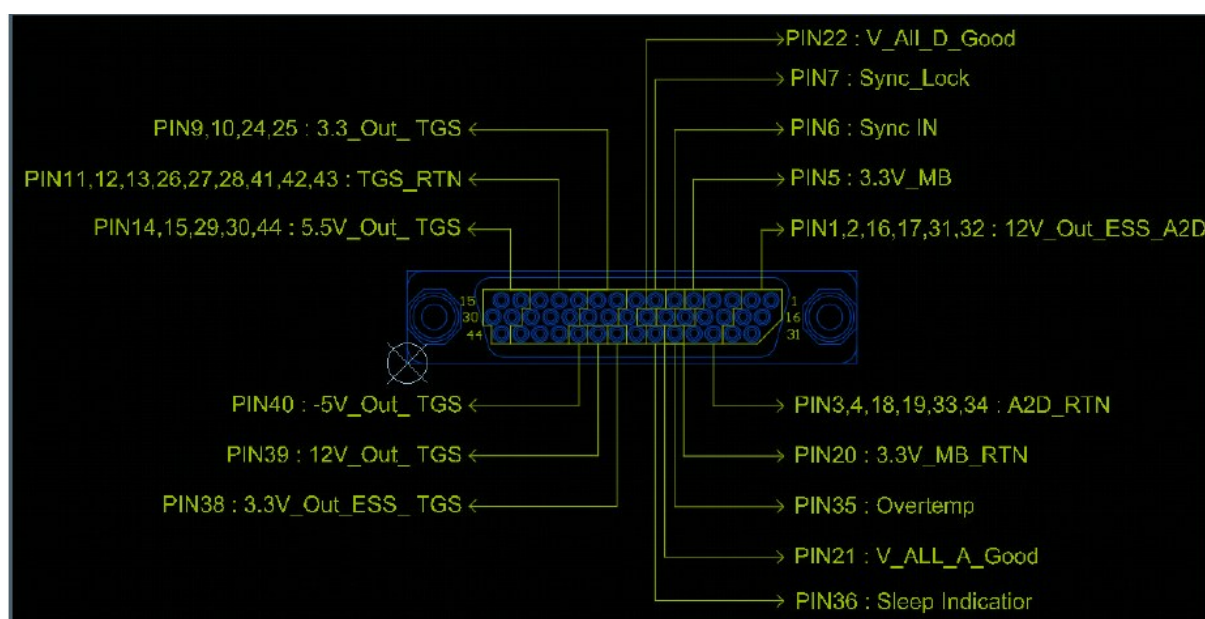


Figure 6 - Pin location for output connector

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Environmental Conditions

Units shall exhibit in-spec electrical and mechanical performance under all combinations of environmental conditions. And environmental type

For Verification Method T = Test and A = Analysis

No.	Environment	Non-Operating	Operating	Applicable Standard	Verification Method	Remarks
[1]	Temperature (Ambient)	-55°C to +85°C	-40°C to +85°C (Base plate)	Combined temperature-altitude requirement shall be justified IAW MIL-STD-810G, Method 520.3 Procedure III.	T	
[2]	Temperature variation	Temperature change rate: 2°C/min	---	RTCA/DO-160G, Section 5: Cat C. Ref: MIL-STD-810F (or more updated) Method 503.4, Procedure I	T	
[3]	Altitude	Up to 45,000 feet	Up to 45,000 feet	MIL-STD-810G, Method 520.3, Procedure III.	A	
[4]	Humidity	Up to 98%RH (including condensation)		MIL-STD-810G, Method 507.6	A	
[5]	Rapid Decompression	From 8000 ft to 40000 ft, in not more than 10 sec.		MIL-STD-810G, Method 500.6, Procedure III	A	
[6]	Fungus	MIL-HDBK-454B Guideline 4 Fungi inert materials only shall be used, In no case shall periodic treatment (like spraying of the equipment) be necessary to meet this requirement		MIL-STD-810G, Method 508.6	A	
[7]	Explosive Atmosphere	Ability to operate in fuel-air environment without causing ignition		MIL-STD-810H, Method 511.7	A	
[8]	Dynamic Requirements	Dynamic Requirement, survivalance: The system can operate without damage and withstanding dynamic requirements of Sea State 6 as specified in the following table (These requirements are derived from MIL-STD-1399 Sect 301A, based on the Caster ship dimension and Sea State 6): Roll (deg.): ±19 Pitch (deg.): ±4 Dynamic Requirement, Performance: The system is able to meet full specification at sea State 4, for		-	A	

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No.	Environment	Non-Operating	Operating	Applicable Standard	Verification Method	Remarks
		which expected Roll and Pitch angles are: Roll (deg.): ± 7 Pitch (deg.): ± 2				
[9]	Vibration	RTCA DO-160G, Section 8, Equipment Rack Cat S, Curve C (4.12 Grms) & C1(5.85Grms) In frame of SOF operational vibration, a vibration session of 60 min. shall be conducted along each one of the three orthogonal axes. In frame of Qualification test, following vibration test sessions shall be conducted along each one of the three orthogonal axes: • Operational vibration session of 60 minutes; • Endurance vibration session of 120 minutes; • Operational vibration session of 60 minutes. Note: Before and after any random vibration session, a resonance Frequencies Search by Sinusoidal Sweep shall be conducted. And: MIL-STD-810G Method 514.6 and as modified in Figure 6 and enclosed Nodes table Functional and Endurance: 45 minutes at performance level (equipment operating), then 90 minutes at endurance level (equipment need not be operating) and then again 45 minutes at performance level (equipment operating). And: MIL-STD-810G Method 514.6 and as modified in Figure 7 and enclosed Nodes table. Functional vibration 60 minutes at performance level (equipment operating) along each axis. And: Excitation envelope: 0.03g²/Hz, 5-500Hz MIL-STD-810H, Method 514.8, Procedure I Vibration duration: 1 hr per axis And Naval vibration: Test Procedure MIL-STD-810G, Method 528, Type 1			N/A	Design to meet
[10]	Transportation Vibration	MIL-STD-810G, Method 514.6, Procedure I Figure 514.6C-1, Figure 514.6C-3, Figure 514.6C-5, Figure 514.6C-7, Figure 514.6D-9, Figure 514.6C-10			A	
[11]	Shock operational	MIL-STD-810G, Method 516.6, Procedure I (20g for 11msec, Saw Tooth). And: RTCA DO-160G Section 7 Operational, Cat E: Saw-Tooth, 6g, 20 msec			A	

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No.	Environment	Non-Operating	Operating	Applicable Standard	Verification Method	Remarks
[12]	Crash Shock Safety	MIL-STD-810G, Method 516.6, Procedure V Crash Safety (Non-operational), 40g, 11 msec, Saw Tooth And: RTCA DO-160G Section 7 Crash Safety (Non-operational), Cat E: Saw-Tooth, 20g, 20 msec			A	
[13]	Bench Handling (Non operational)	MIL-STD-810G, Method 516.6, Procedure VI			A	
[14]	Transit Drop (Non operational)	MIL- STD 810G, Method 516.6 Procedure IV.			A	
[15]	Acceleration	Non-operationa l (Structural): MIL-STD-810 G, Method 513.6, Procedure I 15g for all axes (X, Y, Z)	Operational: MIL-STD-810 G, Method 513.6 Proc. II 12g along all axes (X, Y, Z)	-	A	

Table 4 - Environmental Requirements

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Electromagnetic Compatibility

EMI/EMC Requirements

The unit shall support the customer to meet all the EMC requirements according to MIL-STD-461F at LRU level test as shown below:

#	Test	Description	Limits & Comments
1	CE102	Conducted Emission Power leads 10KHz – 10MHz	Figure CE102-1: Basic Curve
2	CS101	Conducted Susceptibility, Power leads 30Hz - 150KHz	Figure CS101-1: Curve#2
3	CS114	Conducted Susceptibility, Bulk cable Injection 10KHz to 200MHz	Figure CS114-1 10KHz – 200MHz @ Curve#5
4	CS115	Conducted Susceptibility, Bulk cable Injection, Impulse Excitation	Figure CS115-1, I _{max} =5A
5	CS116	Conducted Susceptibility, Damped Sinusoidal Transients, Cables & Power Leads, 10KHz to 100MHz.	Figure CS116-2, I _{max} =10A
6	RE102	Radiated Emissions, Electric Field 2MHz – 18GHz	Figure RE102-3 for "Fixed wing external and helicopters"
7	RS103	Radiated Susceptibility, Electric Field 2MHz - 18GHz.	Electric field = 200 V/m
8	ESD	Electrostatic Discharge	According to IEC 61000-4-2, Level 4
9	Electrical	According to MIL-STD-1275D	
10	Electrical	According to MIL-STD-704A	MIL-HDBK-704-8

Table 5 - Electromagnetic Requirements