

[illegible]


NOTES: UNLESS OTHERWISE SPECIFIED-

- 1. IF THE PRODUCT DEFINED BY THIS SPECIFICATION CARRIES REGULATORY AGENCY SAFETY CERTIFICATION, CHANGES TO THE PRODUCT SPECIFICATION REQUIRE REVIEW AND APPROVAL BY COMPLIANCE ENGINEERING.**
- 2. CUSTOMER REFERENCE: OPEN MARKET FULL FEATURED PRODUCT OFFERING.**

ALL SHEETS ARE AT THE REVISION LEVEL INDICATED BELOW.

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TITLE	Product Specification, Paramount 13.56(12.882-14.238)MHz, <u>1.5kW</u>, Half-rack Part Numbers: 3156310-106						

 Advanced Energy.	DWG NO.	5180360	REV	B	SHEET 1 OF 33
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Engineering Services

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1.0 GENERAL DESCRIPTION / INTRODUCTION

1.1 Overview

This document describes the Paramount half-rack RF power delivery system. Paramount systems capabilities include: 13.56MHz fixed and/or variable frequency, 1.25, 1.5, 2 and 3 kW maximum, multiple user interface options, high accuracy / low power feature (HALO), and pulsing options. Advanced Energy Paramount platforms, P/N 3156330-xxx (3kW), 3156320-xxx (2kW), P/N 3156310-xxx (1.5kW) and P/N 3156312-xxx (1.25kW), require a nominal 208 VAC 3 phase, 50 Hz or 60 Hz power from AC mains and a nominal water cooling source.

Optional "User interfaces" are: RS-232C, DeviceNet, and Ethernet typically running an AE Bus Command set.

An optional match control interface is also available for Paramount tuning control of match systems (eg: AE Navigator).

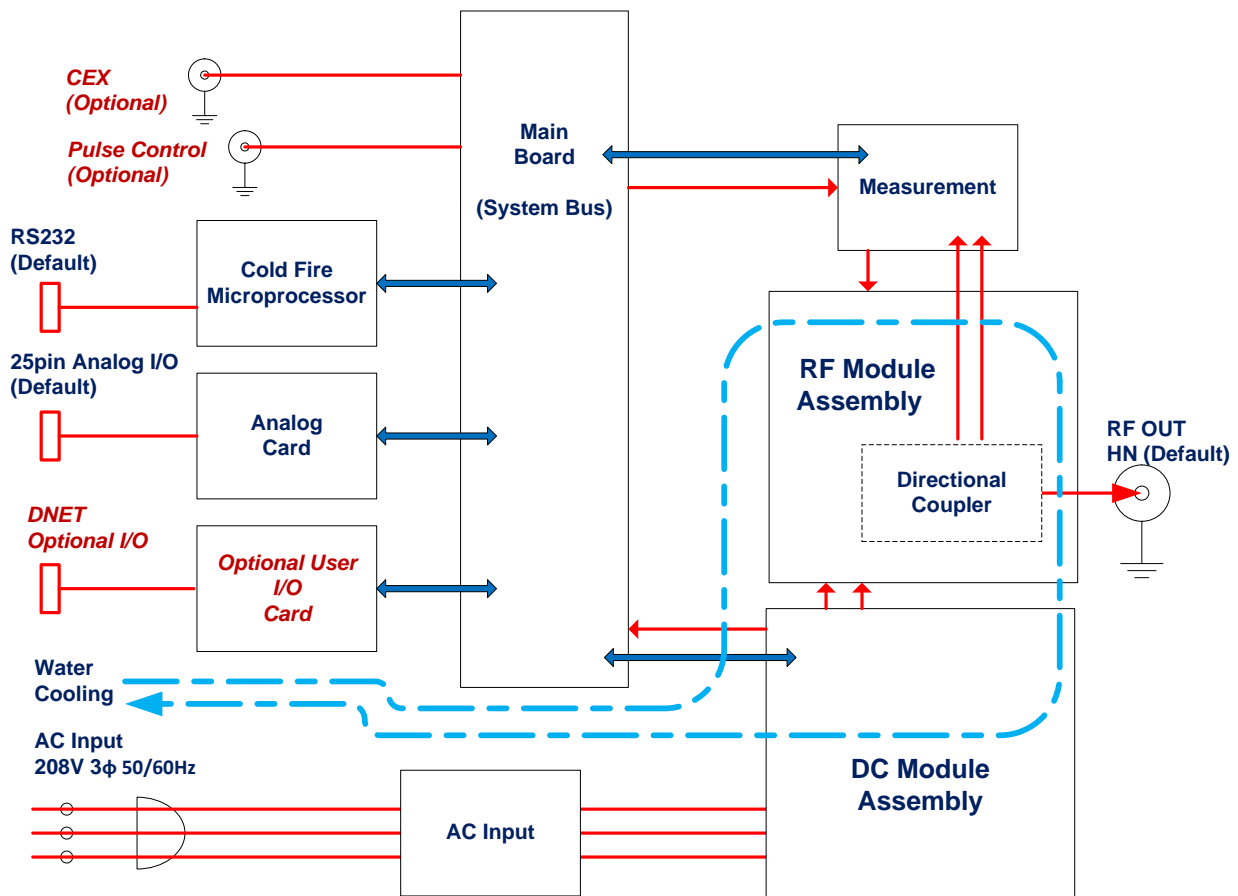


Figure 1.1 High Level System Block Diagram

2.0 CONFIGURATION TABLE

Paramount product PIN numbers contain 23 characters. The first, "P", defines the product as a Paramount platform product. The next 22 characters define the configuration of the specific product. These 22 configuration attributes covered under this specification are summarized below.

Paramount: P 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
2	B	0	A	A	0	0	0	A	0	0	0	A	A	A	0	2	2	2	A	0	0

Position	Category	Pin #	Description
1	Power Output	2	1500W Advanced HALO (5-1500W, w/ 0.1W setpoint)
2	Output Frequency	B	Frequency Tunable 13.56 MHz +/-5%
3	Input Voltage	0	208Vac 50/60Hz – F47 Auto-restart <1s Sag
4	Load Impedance	A	50 Ω
5	Package	A	Frame Mount
6	Panel	0	LEDs Front/Back & Dedicated VFP Service Port-Front
7	RF Output Location	0	Utilities End ONLY
8	RF Output Connector	0	HN
9	AC Power Input	A	Harting Type Han-Q 5/0 w/Switch
10	Water Fittings	0	3/8" NPT (f) nickel plated brass
11	Serial I/O	0	RS232 (RS485) AEBus + AE Ethernet
12	Auxiliary Interface	0	None
13	Analog I/O	A	25-pin - Standard (Same as Apex)
14	Aux. RS422	A	None
15	Solenoid Control	A	Switchcraft Connector - Standard
16	RF Measurement	0	EMD – "Enhanced Measurement Device" – Standard
17	CEX In/Out	2	CEX In/Out – (Default) Phase locking on Internal Oscillator (RFG)
18	Pulsing	2	Pulsing w/ Sync. In/Out
19	AMS – "Arc Mgt Sys"	2	AMS w/ Sync In/Out
20	External Signal	A	None
21	IMD	0	None
22	Smoke Detect	0	None

Standard Test Conditions

Unless otherwise noted; all performance metrics are referenced to the following Standard Test Conditions:

AC Line Voltage	208 VAC, 60 Hz
Power Range	5W – 1500 W (HALO)
Frequency Range	12.882 MHz - 14.238 MHz, 13.560 MHz Nominal
Load	50 ohms non-reactive nominal, Tuner load up to VSWR 3:1
Time after AC on and Water on	2 minute minimum warm-up
Ambient Air Temperature	25°C ±5°C
Input Water Temperature	20°C ±5°C
Minimum flow rate	2 gpm
Ground Benign environment	Per MIL-HDBK 217F
RF Power Measurement Standard	<i>AE Calorimeter Standard</i>

4.0 PHYSICAL SPECIFICATIONS

Physical Specs

Size (H x W x D)	133mm x 216mm x 442mm [5.23" x 8.5" x 17.4"] See Section 7.0
Weight	<16 kg [<35 lbs]
Chassis-EMI Ground	Tapped hole in chassis (M4)
Color and Finish	Black Side Panels Gray front panel
Mounting Orientation	Clearance for air flow front and back > 50.8 mm (2.0 inches) is required.

Configuration Category

5 Package Options

A	Frame mount (Mounting Holes)	
	Threads	M4 threads
	Location	See Section 8

Configuration Category

6 Panel

0	LEDs	Front & Rear Standard
	AC On	Green
	RF On	Green
	Interlock	Green, illuminates if interlock criteria is met
	Power limit	Yellow
	Over Temp	Yellow
	Alarm	Yellow

I/O

Configuration Category

7 RF Output Location

0	Utilities End Only	Standard
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Configuration Category

8 RF Output Connector

0	HN	HN is Standard
	Interlock	Connector cover w/ Magnetic Switch

Configuration Category

9 AC Power Input

		Rear panel only
A	Harting type Han-Q 5/0 w/ Switch	09 20 003 0301 (Housing), 09 12 005 3001 (Male Insert) Switch + fuses(non-resettable over-current trip) Lock Out Tag Out (LOTO) included

<i>Configuration Category</i>		
10 Water Fittings	Rear panel	
0	3/8" NPT (f) – Standard	Female / Nickel Plated Brass 3/8" NPT (f) – Standard

<i>Configuration Category</i>		
11 Serial I/O		
0	RS232/RS485 (rear panel) Protocol	9-pin D-sub female AEBus
	Ethernet port (rear panel) Protocol	RJ45 TCP/IP (Modbus FC100)
	Service Port	RS232-only on front panel 9-pin D-sub female

<i>Configuration Category</i>		
12 Auxiliary Interface	Rear panel card slot	
0	None (Standard)	Blank plate

<i>Configuration Category</i>		
13 Analog I/O	Rear panel only	
A	25-pin - Standard (Same as Apex)	25-pin D-sub, female (see Section 9.4 Option A)

<i>Configuration Category</i>		
14 Aux. RS422	Rear panel only	
A	None	9-pin D-sub male AE RESERVED – NO CONNECTION

<i>Configuration Category</i>		
15 Solenoid Control	Rear panel only	
A	Switchcraft	Switchcraft L712A

<i>Configuration Category</i>		
17 CEX In/Out		
1	CEX In/Out – (Default) Phase locking on Output (Apex)	Blank Plate SMA, female (Rear Panel)

<i>Configuration Category</i>		
18 Pulsing		
2	Pulsing w/ Sync. In/Out	SMA, female (Rear Panel)

<i>Configuration Category</i>		
19 AMS – Arc Management System		
2	AMS – “Arc Mgt Sys”	AMS w/ Sync In/Out
<i>Configuration Category</i>		
20 External Signal		

A None

<i>Configuration Category</i>

21 IMD

0 None

<i>Configuration Category</i>

22 Smoke Detect

0 None

5.0 ELECTRICAL SPECIFICATIONS

Unit Control Interfaces

Serial	Refer to section 10.1
Ethernet	Refer to section 10.2
Analog	Refer to section 10.4

RF Output Specifications

<i>Configuration Category</i>		
1 Power Output		
2 1500W Advanced HALO	<u>Control Method</u>	
Performance Criteria	Digital I/O	Analog I/O
Output power set point range	5-1500W into 50 ohm	5-1500W into 50 ohm
Frequency Range	(see <i>Output Frequency</i> section below)	(see <i>Output Frequency</i> section below)
Reflected Power Limit	Selectable 400W max	Selectable 400W max
Max. Forward Power	1,900 W	1,900 W
Load power, into	Full frequency range, AC line conditions and automatic load mismatch protection	Full frequency range, AC line conditions and automatic load mismatch protection
1.1:1 VSWR	1500 W	1500 W
1.6:1 VSWR	1500 W	1500 W
2:1 VSWR	1350 W	1350 W
3:1 VSWR	1000 W	1000 W
Power Measurement Set-point		
Minimum step resolution	0.1 W	0.5 W
Zero Set point	For ≤ 3 W set point; RF is OFF, No out of set point warning For set point > 3 W but < 5 W; RF is OFF, Out of set point warning active	For ≤ 3 W set point; RF is OFF, No out of set point warning For set point > 3 W but < 5 W; RF is OFF, Out of set point warning active
Zero Watt Output Power	< 0.5 W	< 0.5 W

Accuracy <i>Measured power accuracy is a combination of the generator and measurement equipment accuracy.</i> <i>Measured per AE Standard Test Procedure listed in the released product bill of materials in AE production facility prior to shipment to customer.</i>		
Into 50 Ω (< 1.1:1 VSWR)	$\pm 1\%$ of set point or ± 1.0 W, whichever is greater	$\pm 1\%$ of set point or ± 1.5 W, whichever is greater
Into all loads up to 1.6:1 VSWR	$\pm 1.5\%$ of set point or ± 1.0 W, whichever is greater	$\pm 1.5\%$ of set point or ± 1.5 W, whichever is greater
Into all loads up to 3:1 VSWR	$\pm 2\%$ of set point or ± 1.0 W, whichever is greater	$\pm 2\%$ of set point or ± 1.5 W, whichever is greater
Repeatability		
Over warranty period for same generator	$\pm 0.5\%$	$\pm 0.5\%$
Unit to Unit Power Measurement Variation	< $\pm 2\%$ of set point, 50 ohm non-reactive loads	$\pm 2\%$ of set point, 50 ohm non-reactive loads
Regulation		
Into 50 Ω	Regulates to within Accuracy Specification (see Accuracy above)	± 3 W or $\pm 1\%$ of set point, whichever is greater
Into 3.0:1 VSWR	Regulates to within Accuracy Specification (see Accuracy above)	± 7.5 W or $\pm 3\%$ of set point, whichever is greater

Stability & Filtering	
Stability	
As a function of AC line	< 0.1% for a 10% change in AC line voltage
Drift over time	$\pm 0.5\%$ during continuous operation over one hour
Output filtering	
Harmonics	<-50dBc (typical), into a broadband resistive 50 Ω load at full power
Spurious	<-50dBc
Total AM	<2%
Warm-up Period (All power specs)	≤ 2 min, AC On
Dynamic Response	
Rise time	< 2ms
Fall time	< 2ms
Ramp Rate Control	Provided
Settling time	2ms
Turn-on time	<10 ms from command to start of transition
Turn-off time	<10 ms from command to start of transition
Reaction time	<10 ms from command to start of transition

Overshoot	$\leq 2\%$ of set point (into 50 ohm)
Serial Response Time	<10 ms from the end of command to 90% of set point
Analog Response Time	<2mS typical from change in analog set point to 90% of change in power
Regulation Mode	
Forward power	Provided, Default State in User Card Control Mode
Load power	Provided, Default State in VFP/Serial Control Mode

Configuration Category	
2 Output Frequency	
B Frequency Tunable 13.56 MHz $\pm 5\%$	
Tuning Algorithm	<p>This generator is designed and programmed to utilize a sweep frequency algorithm to optimize power delivery and minimize load mismatch as detected by the generator's output sensor.</p> <p>The algorithm is able to minimize load mismatch, lock the generator at a tune point; track (re-tune frequency) to follow changes in load conditions to minimize load mismatch.</p> <p>Note1: Auto-tuning vs. specific frequency mode is user selectable.</p> <p>Note 2: Function operates in both Continuous and Pulse Mode operation.</p>
Center Frequency	13.560 MHz
Frequency Range	12.882 MHz - 14.238 MHz ($\pm 5\%$) User settable within 1kHz
Frequency Stability	$\pm 0.005\%$ (5 °C to 40 °C)
Tune Time ¹	<100ms (depends on user settings) Typical <10ms
Tracking and Re-tune ¹	<p><100ms (depends on user settings) Typical <10ms</p> <p>If reflected power rises above a user settable threshold, expressed as a reflection coefficient, the generator will re-tune.</p>
Tuned Frequency Repeatability	< ± 20 kHz typical Highly dependant on user application
"Unable to Tune" Fault	3s default, User selectable 1ms – 60,000ms Fault time can be disabled
Frequency selectivity of power measurement	± 2 MHz, attenuation <-30dB

Note 1 : User settable - Minimum Tune Step time is 16 μ sec, however, 48 μ sec is the recommended minimum setting. The number of steps necessary to achieve a « tuned state » is typically <100.

Input Power Specifications

Configuration Category	
3 Input Voltage	
0 208VAC Auto-restart <1 sec Sag	
AC line Sag response	Auto-restart to previous state, if RF is off <1 sec
Line Voltage	200/208VAC $\pm 10\%$ Compatible with grounded "Δ" and standard "Δ" inputs
Input Power	< 2.5kVA (1.5kW Option)
Line Frequency	50 ± 3 Hz, 60 ± 3 Hz
Operating Line Current	<6.8 / 7.1A per phase @ nominal line for 208/200VAC
Inrush Line Current	<24A/phase
Leakage Current	<3.5mA for standard delta and grounded corner delta, measured at full band width per Compliance standard
Phase-current imbalance	<1Arms
Over current protection	20A fuses
Power factor	0.95
Efficiency	>64% @ 1.5kW into 50 ohms (1.5kW model)
Line imbalance	10% continuous operation

Configuration Category	
4 Load Impedance – Nominal	
A 50 Ω	$Z_{load}=50-j0$

Configuration Category	
15 Solenoid Control	
A Switchcraft	
Pin assignment	Center pin + 24VDC, <1A, safe

Configuration Category	
16 RF Measurement	
0 EMD – “Enhanced Measurement Device” Standard	

Configuration Category	
17 CEX In/Out	
1 CEX In/Out – (Default) Phase locking on Output (Apex)	
Capture range CEX bandwidth	13.56 MHz $\pm 5\%$
Locked CEX bandwidth	± 0.5 kHz
Locking conditions – phase relationship	Not limited
CEX In	2-10dBm, 13.56MHz $\pm 5\%$ 50 Ω nominal ($\leq 1.5:1$ VSWR) AC coupled, tolerant to 2.5Vpp input
CEX Out	Square wave, 13.56MHz $\pm 5\%$ 50 Ω nominal source impedance ($\leq 1.5:1$ VSWR) 2.5 Vpp when loaded by 50 Ω , 5 Vpp when unloaded AC coupled
Phase delay control	0 - 360° (Programmable)
Phase delay control linearity	± 5 degrees

Configuration Category

18 Pulsing

2 Pulsing w/ Sync. In/Out (AMS Sync not available)

Single Level Pulsing (On/Off)	Provided															
Pulsed Output Amplitude	Peak “on” pulse amplitude is controllable over the full output power range through the set point. The output goes to ~0W during the off period.															
RF Output Frequency Stability	±0.01%															
Pulse Frequency Range	2Hz-100 kHz															
Pulse Frequency Accuracy	±2%															
Pulse Duty Cycle On-Time Accuracy	= ±1% of Duty Cycle Setting – (up to 1us of On-Time).															
<div>Example: 1kHz Pulse Frequency 50% Duty Cycle</div>	<div>Actual On-Time from <u>48.9% to 51.0%</u> or <u>489 to 510us</u> Calculating the Low End of Range: $(1/1\text{kHz})*((50-1)\%)-1\text{us} = 489\text{us}$ Or as % of Duty = $489\text{us}/1000\text{us} = 48.9\%$ Calculating the Upper End of Range: $(1/1\text{kHz})*((50+1)\%-0\text{us} = 510\text{us}$ Or as % of Duty = $510\text{us}/1000\text{us} = 51.0\%$</div>															
Duty cycle	<div>The minimum duty cycle goes down to 1% with decreasing frequency below 2KHz according to the table below</div> <table><tr><th>Pulsing Frequency (Hz)</th><th>Minimum Duty Cycle (%)</th><th>Maximum Duty Cycle (%)</th></tr><tr><td>2</td><td>50</td><td>50</td></tr><tr><td>3</td><td>24</td><td>76</td></tr><tr><td>4 - 2000</td><td>1</td><td>99</td></tr><tr><td>> 2000</td><td>Limited by Minimum On or Off Time of 5 uS</td><td>Limited by Minimum On or Off Time of 5 uS</td></tr></table>	Pulsing Frequency (Hz)	Minimum Duty Cycle (%)	Maximum Duty Cycle (%)	2	50	50	3	24	76	4 - 2000	1	99	> 2000	Limited by Minimum On or Off Time of 5 uS	Limited by Minimum On or Off Time of 5 uS
Pulsing Frequency (Hz)	Minimum Duty Cycle (%)	Maximum Duty Cycle (%)														
2	50	50														
3	24	76														
4 - 2000	1	99														
> 2000	Limited by Minimum On or Off Time of 5 uS	Limited by Minimum On or Off Time of 5 uS														
Minimum pulse width (On time)	5µs – 126ms (see Pulse Frequency above)															
Off time	5µs – 126ms															
Pulse Form																
Overshoot	≤ 2% of set point (into 50 ohm)															
Pulse Rise Time	<2.5µs															
Pulse Fall Time	<2.5µs															
Pulse Sync Delay (from input)	0 to 10 µ s less than the pulse repetition period for pulsing frequencies ≤ 1 kHz 0 to 5 µ s less than the pulse repetition period for pulsing frequencies > 1 kHz															
External Input	Pulse on High Level Z=50Ω 0 to 5 V DC Maximum,(Vth = 0.85 VDC) [Supports TTL levels]															
External Output	Pulse on High Level Z=50Ω source impedance 0 to 5 VDC unloaded, 0 to 2.5VDC across a 50Ω load.															
Pulsed Output Timing Accuracy	0.5µs edge uncertainty															

Configuration Category	
19 AMS – Arc Management System	
2 AMS w/ Sync In/Out (Pulse Sync not available)	
Arc Suppression Wave Shape	See Figure 4.1 below
Arc Response Time (a)	3 μ s
Arc Shut Down Time (b)	<2 μ s
Initial Arc Suppression Time (first attempt n=1) (c)	5 μ s to 511 μ s
	Note: 0=disabled
Turn-on time (d)	<2 μ s
Proportional parameter 'c'	Hard coded to double Arc Suppression Time every attempt until maximum attempts are reached or max off time of 65.5 ms is reached.
Arc Suppression Attempts 'n'	0 to 250 attempts
	Note: 0=infinite attempts
Arc initial RF-on delay, time from RF ON to Arc Handling enabled	0 ms to 10 s \pm 10 ms
Arc setpoint delay, time from > 10 W setpoint change to Arc Handling enabled	0 ms to 245 ms \pm 10 ms
Arc Management System with Sync. In/Out	
External Input	TTL levels, Z = 50 Ω , Trigger on rising edge = arc detected
External Pulse Output	TTL levels, Z = 50 Ω , HI when arc detected

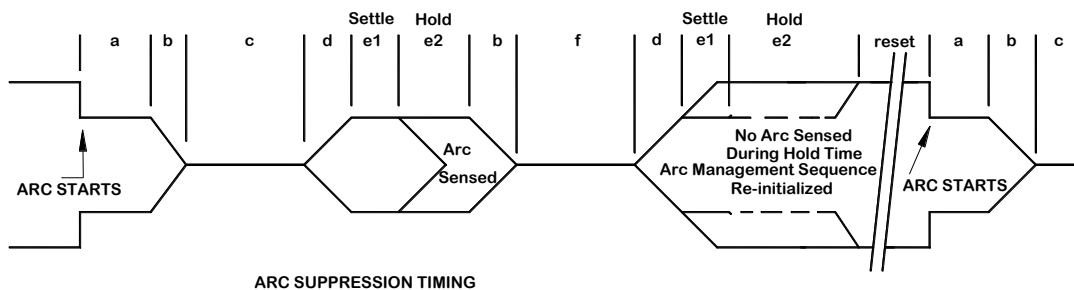


Figure 5.1 Arc Suppression Timing Diagram

Configuration Category	
20 External Signal	
A None	

Configuration Category	
21 IMD	
0 None	

22 Smoke Detect

Configuration Category

0 None

Reliability

Power Cycling (Power Amplifier – cycling zero to full power)	
in 50 ohm load	>20 Million cycles
High dissipation load	> 2 Million cycles
Preventive Maintenance	None
MTBF (design verified)	>150,000 hours
Annualized Failure Rate (design capability)	≤ 4%, during expected useful life
Expected Useful Life	~5 years

Protection Features

Mismatch	Capable of continuous operation into any impedance mismatch condition without damage.
Over temperature (air and water)	Output power is disabled on high internal temperature.
Control signal protection	Not provided
Out of Set Point Warning Delay	Provided
VA limiting	Provided
Dissipation limit	Provided
Low/ High AC line	Provided
Reflected power limit	Provided
Air Flow	Provided

General Requirements

Boot time	< 2s
Real-time clock	Provided
Non-volatile storage of key parameters	Provided
Internal data logging (Critical Stats Only)	Provided
Load Z Measurement	Provided
Self diagnostic	Provided

7.0 ENVIRONMENTAL SPECIFICATIONS

Parameter / Options	Value / Units
Micro-environment	Pollution degree 2
Over Voltage Category	Category II
Climatic Conditions	Derived using EN50178 (see table below)

	Temperature	Relative Humidity	Air Pressure
Operating	+5°C to +40°C (+41°F to +104°F)	5% to 85% (Note 1) +1 g/m ³ to 25g/m ³	78.8 kPa to 106 kPa (788 mbar to 1060 mbar) Equiv. altitude 2000 m to - 500m (6562 ft to -1640 ft)
Storage	-25°C to +55°C (-13°F to +131°F)	5% to 95% +1g/m ³ to 29g/m ³	78.8 kPa to 106 kPa (788 mbar to 1060 mbar) Equiv. altitude 2000 m to - 500m (6562 ft to -1640 ft)
Transportation	-25°C to +70°C (-13°F to +158°F)	95% (Note 2) 60 g/m ³ (Note 3)	65.6 kPa to 106 kPa (656 mbar to 1060 mbar) Equiv. altitude 3500 m to - 500m (11480ft to -1640 ft)

Notes:

1	Non-condensing, no formation of ice
2	Maximum relative humidity when the unit temperature slowly increases, or when the unit temperature directly increases from -25°C to +30°C
3	Maximum absolute humidity when the unit temperature directly decreases from +70°C to +15°C

Cooling Requirements	
Cooling Medium	Water + Forced Air
Temperature Maximum water temperature at minimum flow rate and maximum ambient air temperature (+40°C).	+35°C
Water temperature Inlet range (Minimum Temperature)	+5°C
Flow rate (minimum)	Liters (gallons) per minute 7.6 (>2)
Pressure Minimum pressure differential (supply to drain) required to achieve specified minimum flow rates, at 7.6 liters/min (2gpm)	Bar (PSI) (kPa) 0.6 (8) (60)
Maximum pressure rating:	6.9 (100) (690)
Contaminants Cooling water quality recommended:	<ul style="list-style-type: none"> pH between 6 and 9. total chlorine < 20 ppm. total nitrate < 10 ppm. total sulfate < 100 ppm. total dissolved solids < 250 ppm.

	<ul style="list-style-type: none"> total hardness expressed as calcium carbonate equivalent less than 250 ppm. specific resistivity of 2500 Ω centimeter or higher at 25°C. total dissolved solids (TDS) as estimated by the following: TDS $\leq \frac{640,000}{\text{specific resistivity (in ohm centimeter)}}$ specific resistivity (in ohms per centimeter) Deionized water may be substituted for "filtered house water". All surfaces in contact with the cooling water must be copper, brass, bronze or superior materials (aluminum with or without coatings is expressly forbidden)
Air Cooling	Forced air intake on front panel Exhaust on rear panel Minimum clearance required for both front and rear panels: > 50.8mm (2.0 inches)
Input Air Temperature range	5°C to 40°C (maximum)
Air Flow	< 9 m ³ /min.
Air Heat removal	< 400W at full rated output power

8.0 EXTERIOR VIEWS

Note: Unless otherwise specified, all graphics and dimensions are for reference only.

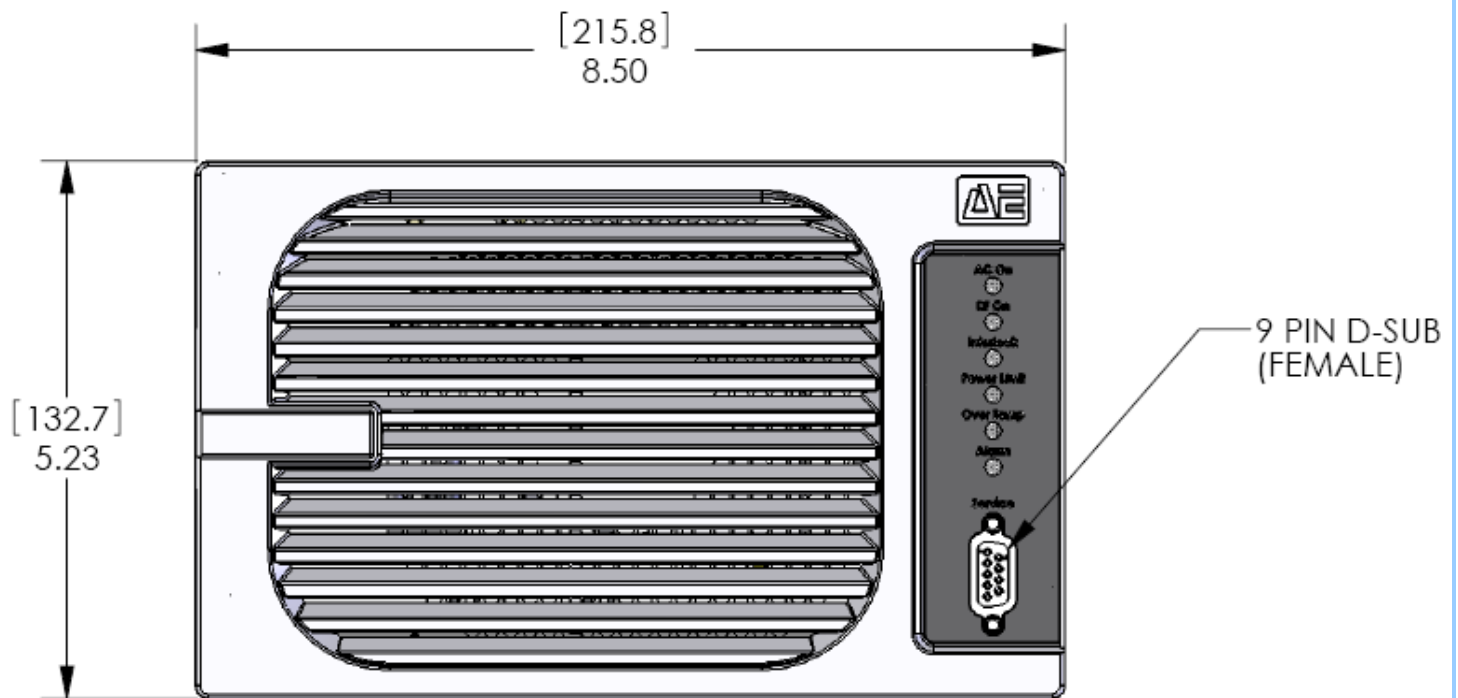


Figure 8.1 Front

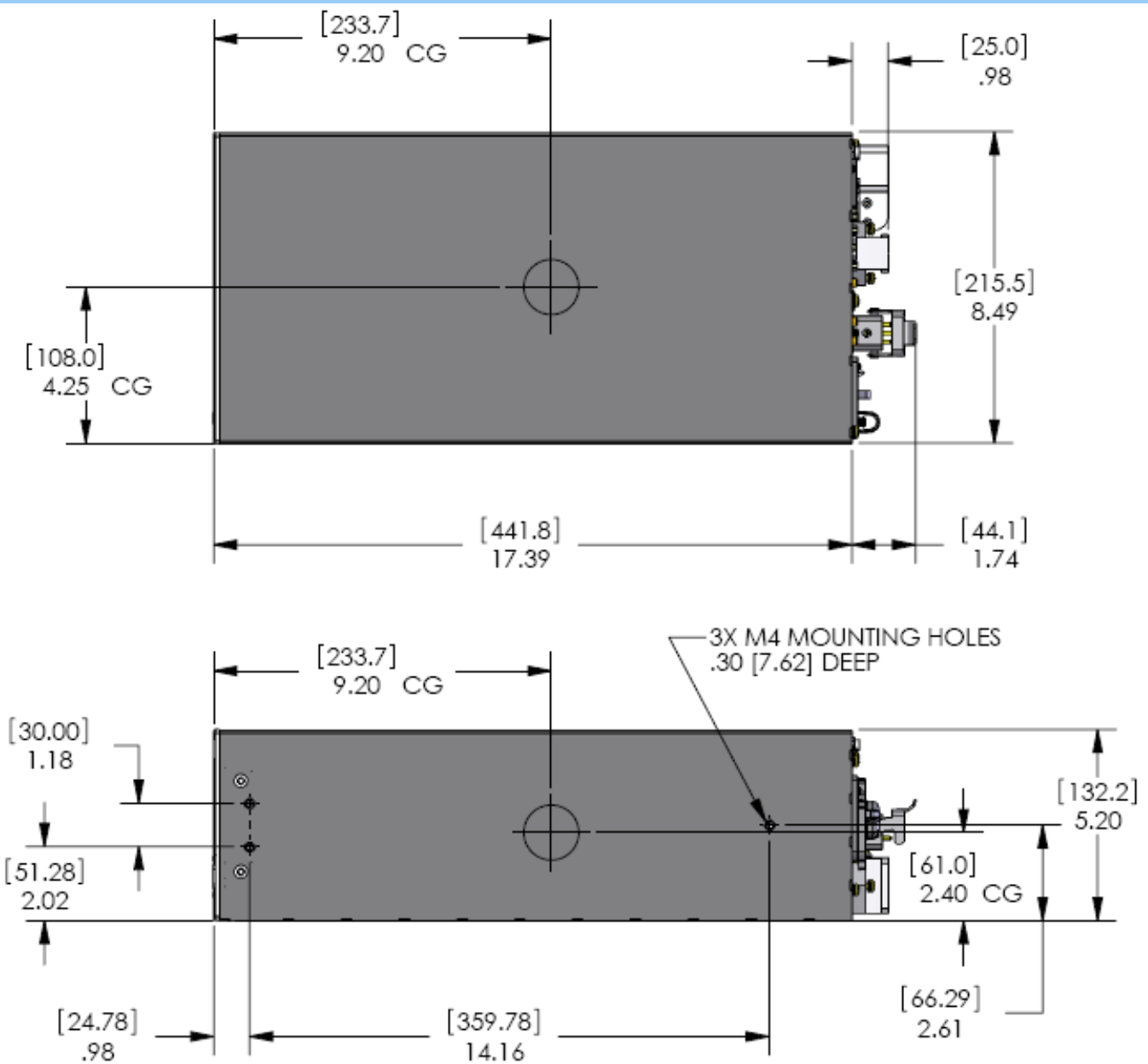


Figure 8.2 Top and Right Side

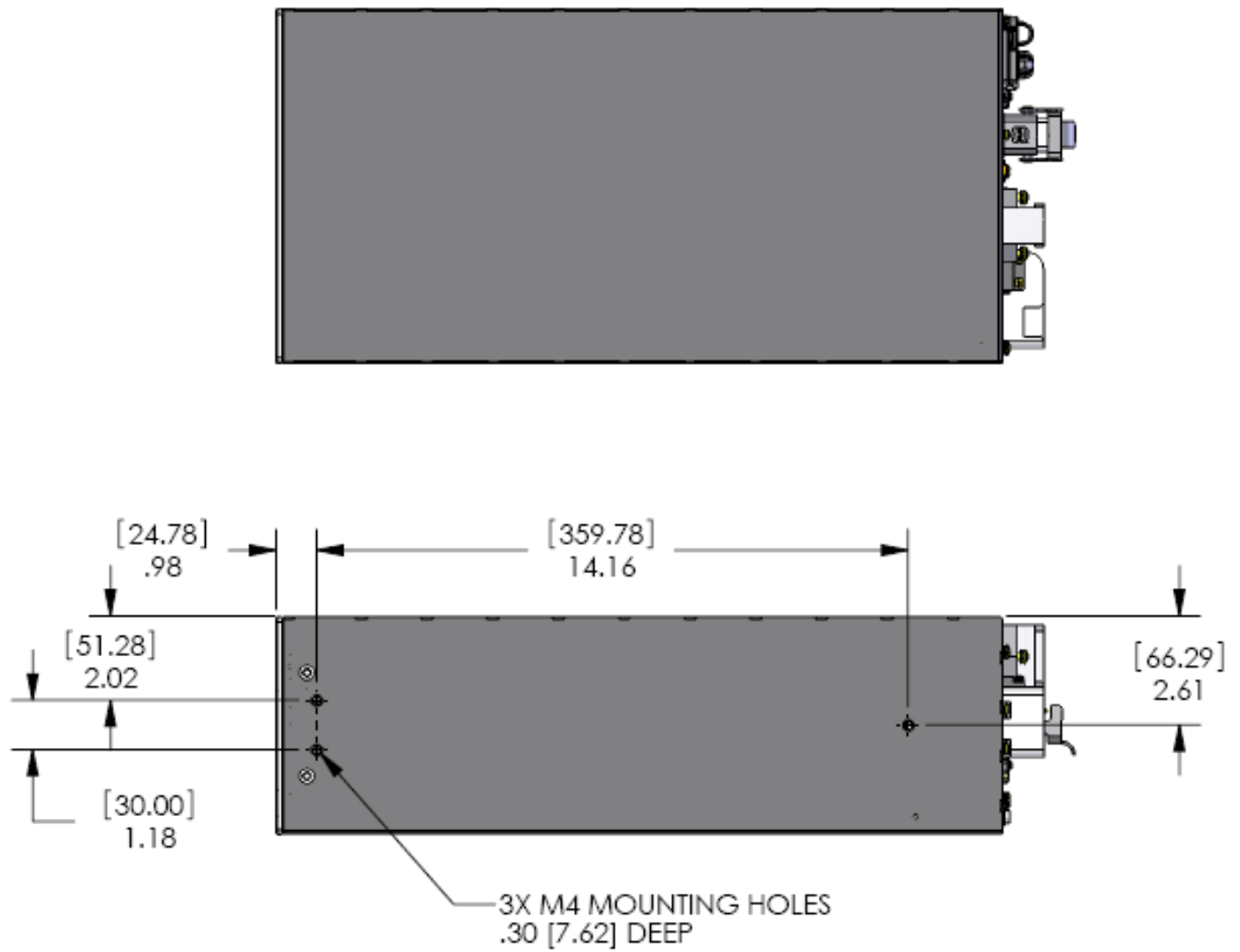


Figure 8.3 Left Side and Bottom

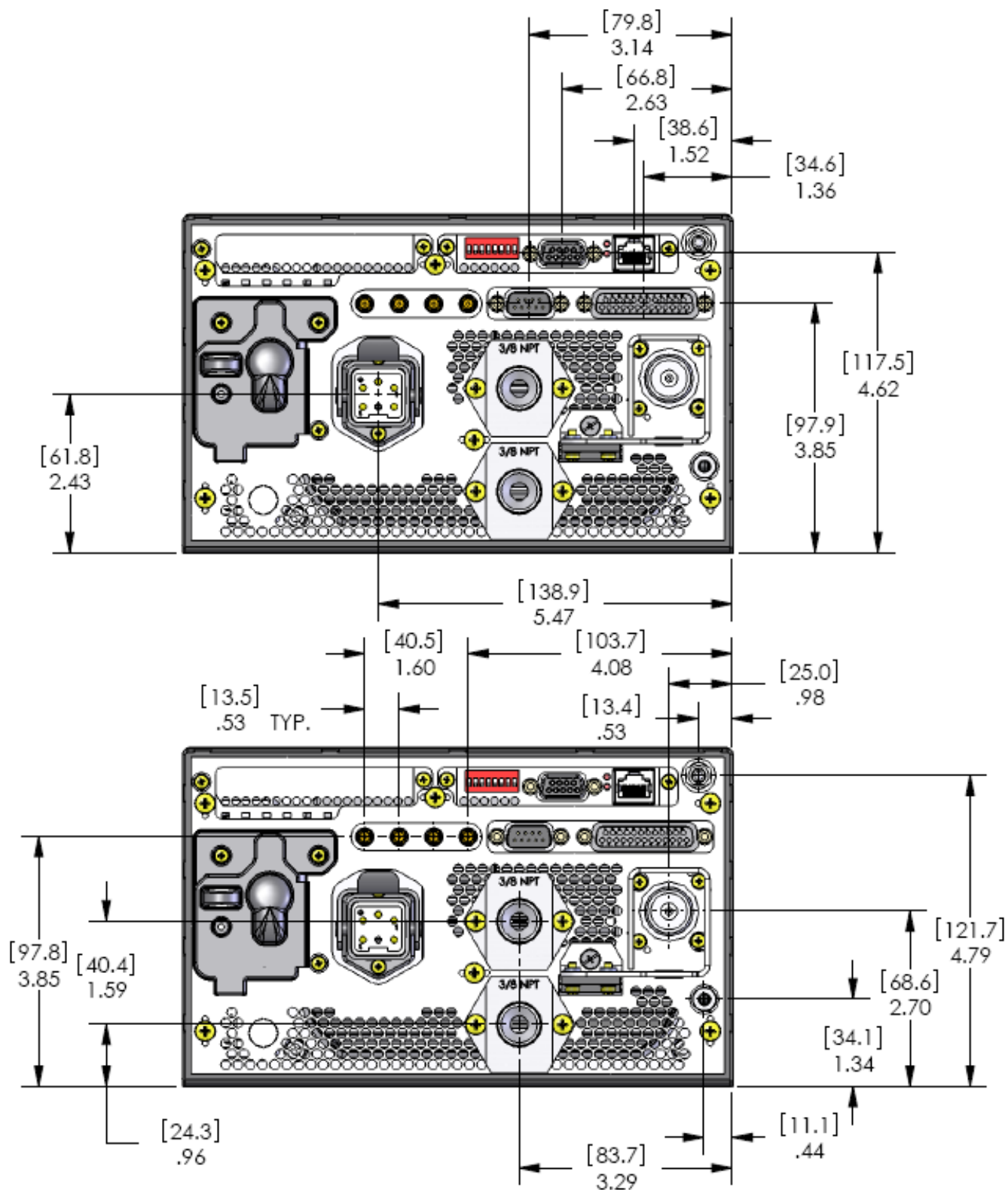


Figure 8.4 Rear Panel

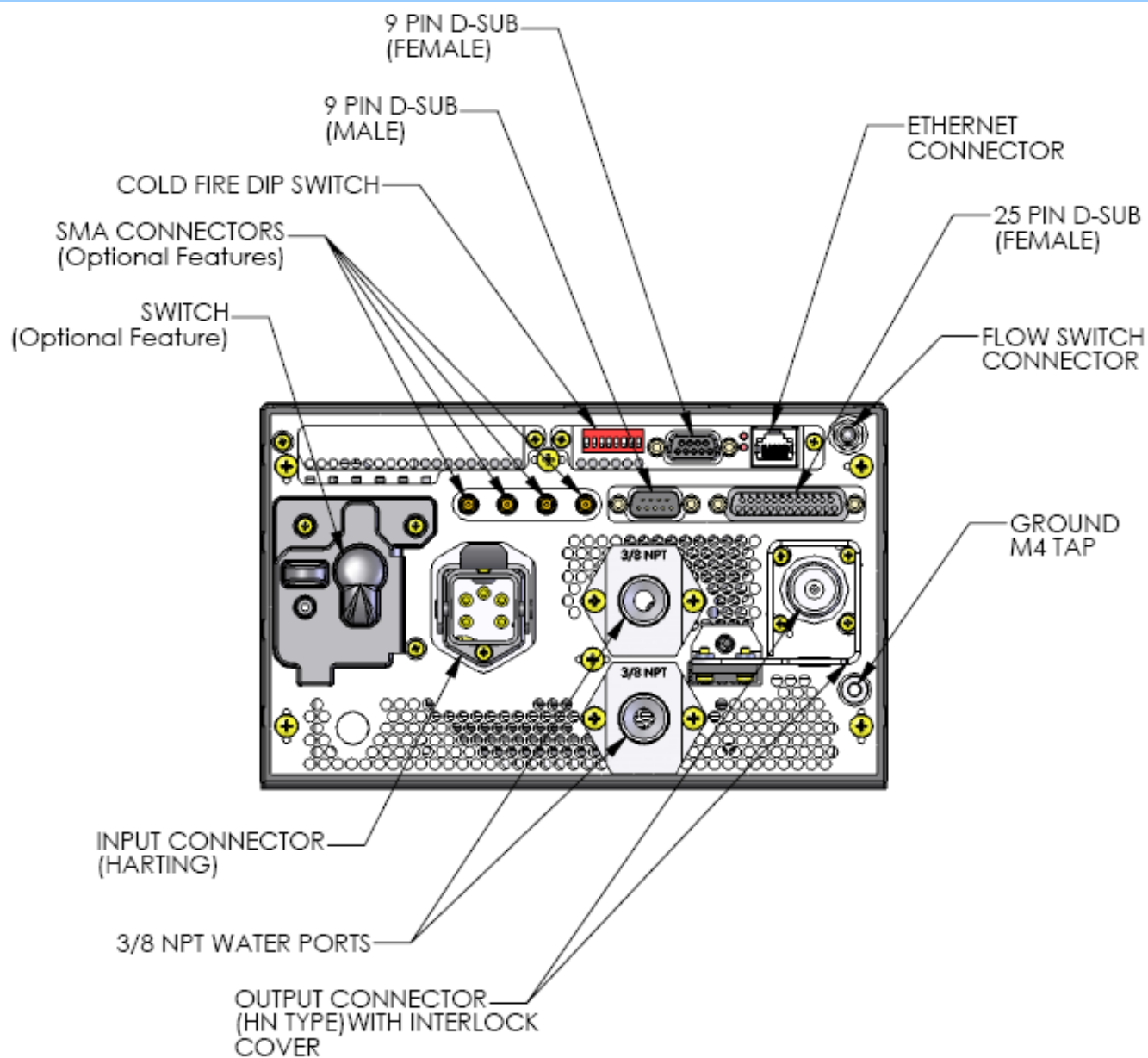


Figure 8.5 Rear Utilities and Connections

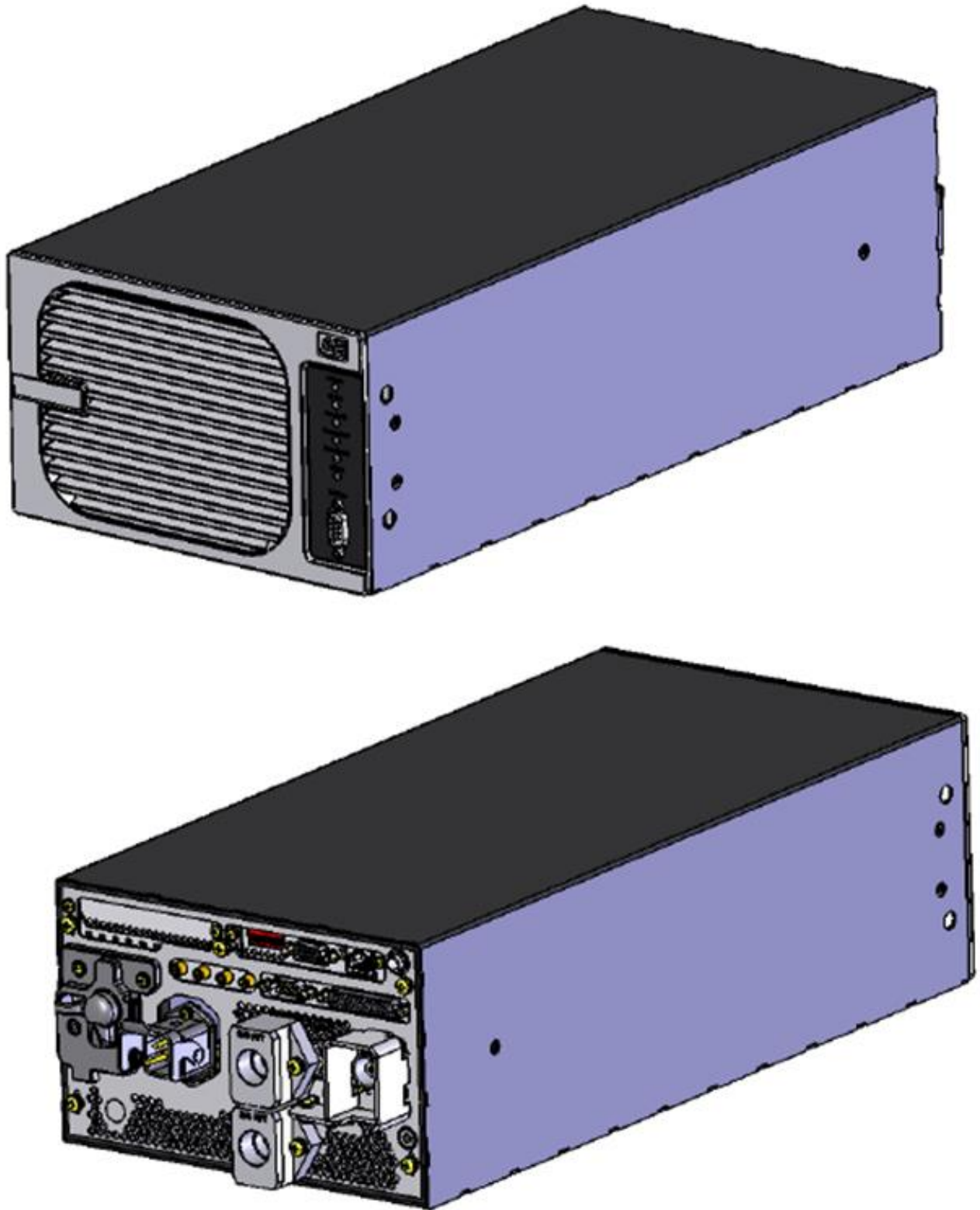


Figure 8.6 Isometric

9.0 OPERATIONAL GRAPHS

NOTE: Power profiles not shown (Refer to User Manual Assembly)

Typical Cooling Water Pressure vs Flow Rate Curve

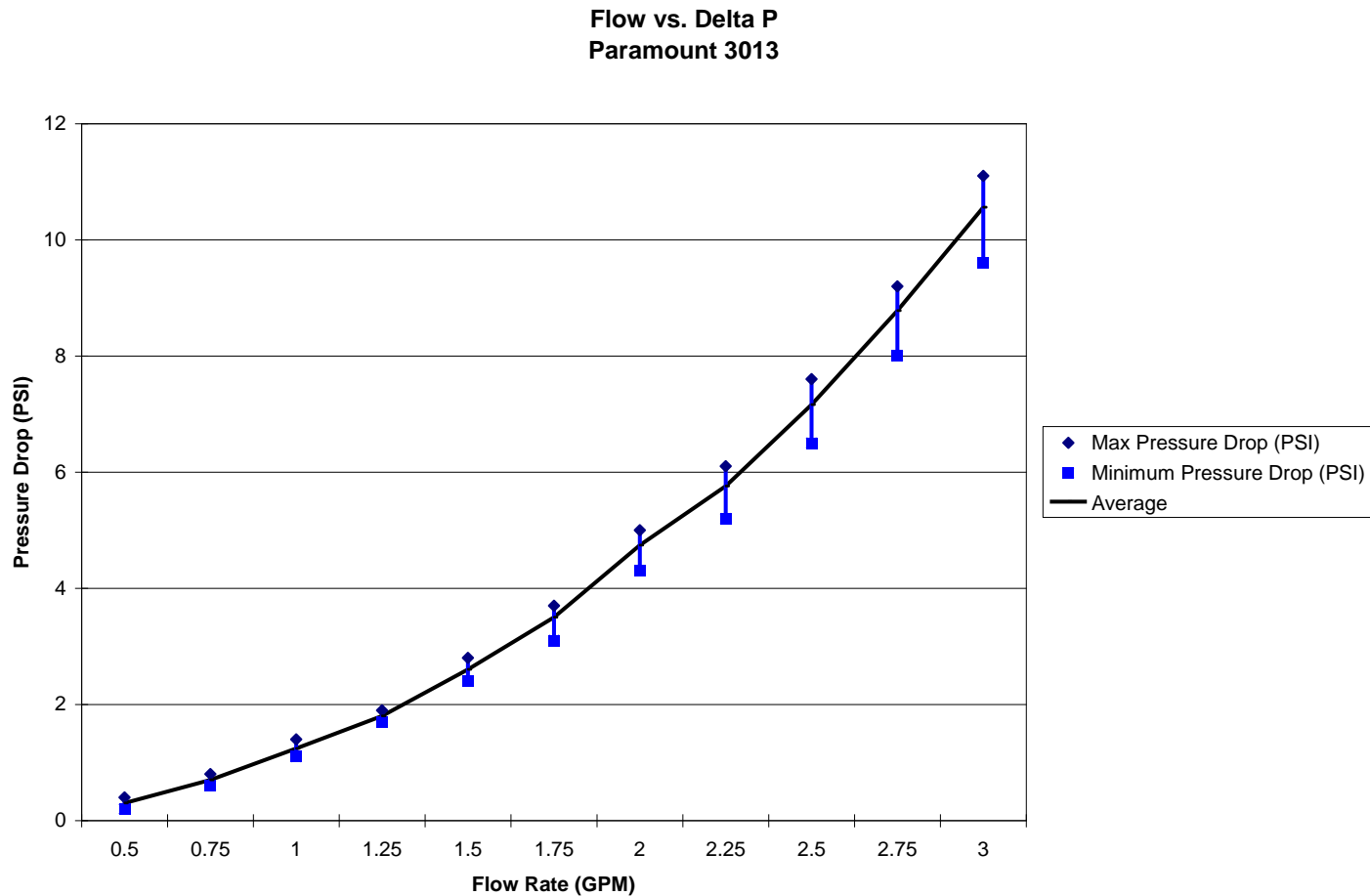


Figure 9.1 Typical Cooling Water Pressure vs Flow Rate Curve

10.1 RS-232 Serial Interface Pin-outs

PIN	FUNCTION	DESCRIPTION
1	N/A	N/C
2	TX RS-232	RS-232 TX Data Output
3	RX RS-232	RS-232 TX Data Input
4	N/A	N/C
5	Digital Ground	This Pin is connected to the digital ground of the controller
6	RS485 (-)	RS485 Low (if supported on port)
7	RS485 (+)	RS485 High (if supported on port)
8	N/A	N/C
9	AE-RSVD	Reserved for AE manufacturing. Do not use.

10.2 Ethernet Standard Pin-outs

IEEE 802.3 Standard

Pin	Name	Description
1	TX+	Transmit Data+
2	TX-	Transmit Data-
3	RX+	Receive Data+
4	n/c	Not connected
5	n/c	Not connected
6	RX-	Receive Data-
7	n/c	Not connected
8	n/c	Not connected

10.4 User Analog Interface Pin-outs

PIN	RELATED PIN	NAME	TYPE	DESCRIPTION
1	14	SETPOINT STATUS RETURN	DO	See signal pin 14
2	15	RFL PWR MONITOR	AO	This signal provides a linearly scaled read back of reflected power. 0 V to 10 V = 0 to maximum rated power output.
3	16	FWD/LOAD PWR MONITOR	AO	This signal provides a linearly scaled read back of forward power when the generator is operated in forward power regulation mode or the load power when operated in the load power regulation mode. 0 V to 10 V = 0 to maximum rated power output.
4	17	RF PWR ON	DI	Applying a positive voltage from 4 VDC to 24 VDC enables RF output. When voltage is less than 1 VDC, RF output is disabled. The interlocks must be satisfied and the set point must be within the output power range before unit will deliver power.
5	18	SETPOINT	AI	This pin linearly controls the RF output of the generator. 0 V to 10 V = 0 to maximum rated power output. Set point must be greater than the low power limit before the unit will deliver power.
6	19	DC BIAS/POWER REGULATION	DI	This pin is used in conjunction with pin 7 to allow the generator to regulate its power based on an external feedback signal. Applying a positive voltage from 4 VDC to 24 VDC to this pin (reference to ground pin 19) causes the generator to regulate on the input voltage signal on pin 7 (<i>DC BIAS INPUT</i>). When voltage is less than 1 VDC, or if there is no connection to this pin, the generator regulates power.

7	20	DC BIAS INPUT	AI	This pin is used in conjunction with the signal on pin 6 to allow the generator to regulate its power based on an external feedback signal. This user defined 0 V to 10 V signal provides an input which you can use for closing the power control loop around external components in the RF path. The unit usually uses Pin 7 for bias regulation with this input signal being a scaled representation of the DC bias measured at a match network.
8	21	FWD/LOAD PWR REGULATION	DI	Applying a positive voltage between 4 VDC and 24 VDC to this pin causes the generator to regulate on load power. When voltage is less than 1 VDC, or if there is no connection to this pin, the generator defaults to forward power regulation.
9	22	OVERTEMP RETURN	DO	See signal pin 22.
10	23	INTERLOCK LOOP		External interlock circuit, internal voltage supplied. This pin, when connected externally to pin 23, closes the interlock and allows the RF output to be enabled. The external circuit should be capable of switching 100 mA at 24 VDC.
11	24	DC BUS OK RETURN	DO	See signal pin 24.
12	25	RF ON STATUS	DO	When the generator successfully outputs RF power, a low (opto-coupler output) impedance is created between this pin and return pin 25. (6 mA maximum)
13	21	+15VDC		This pin, referenced to ground, provides a +15 VDC \pm 1 V auxiliary supply for external use. 100 mA maximum.
14	1	SETPOINT STATUS	DO	When the generator is out of set point, a low (opto-coupler output) impedance is created between this pin and pin 1 (6 mA maximum).
15	2	RFL POWER MONITOR RETURN	AO	Signal return for Pin 2
16	3	FWD/LOAD PWR MONITOR RETURN	AO	Signal return for Pin 3

17	4	RF PWR ON RETURN	DI	Signal return for Pin 4
18	5	SETPOINT RETURN	AI	Signal return for Pin 5
19		GND		Signal/Chassis ground
20	7	DC BIAS INPUT RETURN	AI	Signal return for pin 7
21		GND		Signal/Chassis ground
22	9	OVERTEMP	DO	When an internal overtemperature shutdown condition is detected, a low (opto-coupler output) impedance is created between this pin and pin 9 (6 mA maximum).
23	10	INTERLOCK LOOP RETURN		See pin 10.
24	11	DC BUS OK	DO	When the interlocks are satisfied and AC input voltage is within specification, a low (opto-coupler output) impedance is created between this pin and pin 11 (6 mA maximum).
25	12	RF ON STATUS RETURN	DO	See pin 12.

Connector is a DB-25 female.

DI = Digital Input DO = Digital Output AI = Analog Input AO = Analog Output

Note 1: For all isolated transistor outputs

Transistor OFF (switch open) - $V_{CEmax} = 30VDC$ ($I_C < 500\mu A$)

Transistor ON (switch closed) - $I_{CEmax} = 10mA$ ($V_{CE} < 2V$)

Note 2: For all ground referenced logic level inputs

HIGH = $>5mA$ into 1000Ω , 24VDC max nominal voltage. 30VDC absolute max.

LOW = 0.2VDC min to 1VDC max

10.5 Power Connection

Amp [A]	PINOUT					MANUFACTURE INFORMATION		
Max. Rated	PHASE A (1)	PHASE B (2)	PHASE C (3)	GND	Shield	Part Description	Quantity	Part number
16	1	2	3	GND	5	Harting Han Q 5/0 insert	1	09 12 005 3001
						Harting Q bulkhead housing mounting	1	09 20 003 0301
						Harting connector pin	4	09 33 000 6102

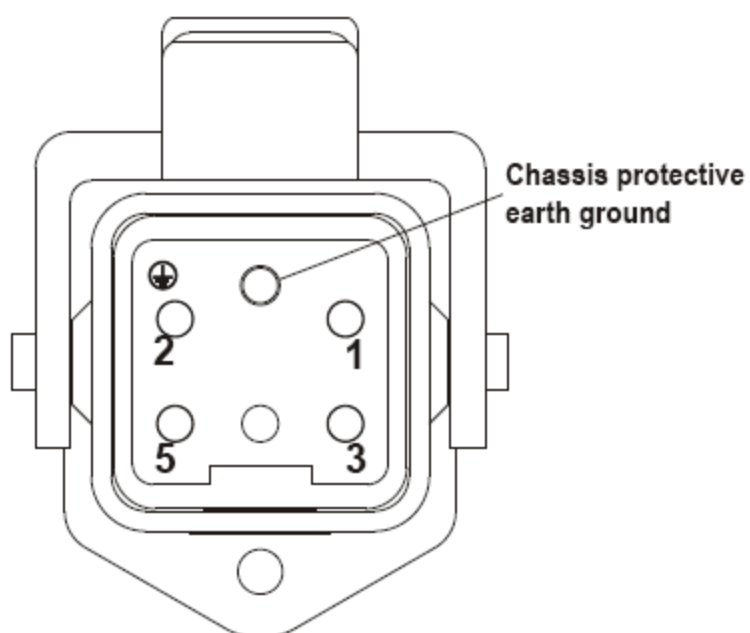


FIGURE 10.5 AC INPUT

11.0 SAFETY AND REGULATORY SPECIFICATIONS

Safety and EMC

The product shall comply with the essential requirements of the following European directives and shall carry CE marking:

- Low Voltage Directive
- EMC Directive

For detailed information concerning compliance to applicable EU requirements, refer to the EU Declaration of Conformity for this unit.

12.0 SHIPPING CONDITIONS

Documents (ship with items)	Final Test Cert. User Manual (CD)
RF Interlock cover	RF interlock prevents removal or installation of RF cable with power applied. This will be shipped with the generator.
Generator prep prior to shipment	Cooling lines shall be blown out prior to shipment. Unit shall be cleaned and bagged in a general clean environment. Clean by performing a wipe-down with a lint-free cloth and a neutral non-corrosive cleaning solution (per AE FP0163). Unit Double Bag (per AE PS0003) Option – using anti-static poly-bag (minimum 0.004" thick).
Shipment Packaging	Generator placed in ISTA suitable packaging to prevent damage from excessive moisture, vibration, stress, mechanical shock during shipment (per AE FP0163, RM0002).

13.0 APPLICABLE DOCUMENTS

Document Description

Serial Tag

Label Content

P/N: cccc-cccccc-ccc

M/N: ppppppp-ppp r

S/N: ssssss F/R f

Customer part number & Rev

Manufacture Part Number

Serial Number & Functional Revision

14.0 APPENDIX

Software Part Number:	7434660C00
Software PIN:	6232100122221011471110000000000

Configuration Note: The unit will return the Product Identification Number (PIN) when it receives the AE host command 221. The 31 characters in this PIN provide information about the configuration of the unit. You can also retrieve this PIN using Virtual Front Panel (VFP).

15.0 DEFAULT PARAMETER SETTINGS

General Operating Parameters:

User Power Limit (W)	1500
Reflected Power Limit (W)	400
Control Mode	Host
Regulation Mode	Forward

Sweep Parameters:

Tuning Start Frequency(kHz)	13560
Min Tuning Frequency (kHz)	12882
Max Tuning Frequency (kHz)	14238
Frequency Step Max (Hz)	20000
Frequency Step Min (Hz)	1000
Retuning Threshold	40
Gamma Threshold High	300
Gamma Threshold Low	10
Tuning Timeout Value (ms)	3000
Tune Start Delay (ms)	50
Tuning Gain Delay	4
Max Tuning Count	125
Step Up Gain	2
Step Down Gain	3
Scan Step Size (Hz)	23071
Tuning Step Time (us)	100
Gamma Threshold Mode	Power Profile
Ignition Mode	Fixed
Frequency Mode	Fixed Frequency

Ramp Parameters:

Ramping Mode	Inactive
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Ramp Up Value (Watts/sec or ms)	0
Ramp Down Value (Watts/sec or ms)	0
Ramping Memory Mode	RAM

Pulsing Parameters:

Pulsing Mode	Master
Pulse Sync Output	On
Pulsing Enable	Disabled
Slave Input Delay (uS)	0
Memory Mode	RAM
Explicit/Implicit Enable Mode	Implicit
Explicit/Implicit Enable State	Pulsing Off
Pulsing/Arc Mode	Pulsing Enabled
Slave Max On Time (uS)	0
Pulsing Frequency (KHz)	0
Pulsing Duty Cycle (%)	0

DPDZ Parameters: (Disabled)

Power Correction Parameters: (Disabled)

Recipe Mode: (See Product Manual)

System Parameters:

MacID	Yes
IPAddress	169.254.4.4
Gateway	169.254.254.254
Subnet	255.255.0.0
DHCP	Disabled