

elite 750

RF Plasma Generator

Product Specification

PROPRIETARY DATA NOTICE	PROJECT ENG.: J. Smyka	 MKS INSTRUMENTS, INC. 100 HIGHPOWER ROAD ROCHESTER, NEW YORK 14623		
THIS DRAWING MAY INCLUDE UNPUBLISHED PROPRIETARY MATERIAL DEVELOPED BY MKS, ENI PRODUCTS, AND AS SUCH IS NOT TO BE COPIED, REPRODUCED, DISCLOSED OR USED IN ANY WAY OR FORM WITHOUT PRIOR WRITTEN AUTHORIZATION FROM MKS, ENI PRODUCTS.	ENGINEERING MGR.: W. Heist	DESCRIPTION: SPECIFICATION, 750W, 13.56MHZ 2U FULL RACK		
	DIR. OF ENGINEERING: C. Ioriatti			
	MKT. PRODUCT MGR.: A. Kazakos	PART NO.:	REV.	SHEET 1 OF 11
	PROGRAM MGR.: A. Kazakos			

1.0 Introduction

1.1 Scope

The scope of this document defines the technical definition of a 13.56 MHz, 750W RF Plasma generator. This document includes both standard and optional equipment for the Elite series generator. Optional equipment is noted in the specification. Contact MKS / ENI Sales for the generator part number which includes optional equipment.

1.2 Change Management

This is a preliminary specification. Until released (denoted by an Alpha revision code), information contained within may change without notice.

2.0 Safety/Protection Features

2.1 Mismatch Protection

Continuous operation into any impedance mismatch condition without damage or malfunction; forward power foldback shall occur as required by the RF generator protection circuits.

2.2 Transient Protection

This generator is protected against fast-load transient conditions (such as a chamber arc).

2.3 AC Line Protection

The unit shall be internally fused to protect against AC overcurrent conditions.

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3.0 Technical Specifications

3.1 Standard test conditions

- 3.1.1 Load VSWR at any phase up to 1.1:1 ref. to 50 ohms
- 3.1.2 AC Line Voltage..... 120 V $\pm$ 10%
- 3.1.3 Ambient Air Temperature 20°C $\pm$ 2.5 °C
- 3.1.4 Ground Benign Environment..... Per MIL-HDBK-217F

Unless otherwise noted, all specifications below are tested under above conditions.

3.2 RF Output Specifications

- 3.2.1 Frequency..... 13.56 MHz Fixed
- 3.2.1.1 Frequency Stability $\pm$ 0.005%
- 3.2.1.2 Frequency Accuracy..... $\pm$ 0.005%
- 3.2.2 Rated output power 750 W into 50 ohms
- 3.2.2.1 Dynamic range..... 1 – 750W
- 3.2.3 Generator load impedance..... 50 Ω nominal
- 3.2.4 Commanded power accuracy
- 3.2.4.1 Forward Power Leveling mode..... $\pm$ 2W (1W - 100W), $\pm$ 2% (101 – 750W)
- 3.2.5 Commanded power repeatability
- 3.2.5.1 Same generator 1%
- 3.2.6 Output stability Spurious signals –20 dBc (any load)
- 3.2.7 Spurious and harmonics at full rated output
- 3.2.7.1 PSU switching frequency and harmonics-30 dBc, maximum, 50 Ω load
- 3.2.7.2 Harmonic output-30 dBc, maximum, 50 Ω load
- 3.2.7.3 AC Line Hum and Noise-30 dBc, maximum, 50 Ω load

3.2.8 Set point response time (time delay from end of the command from the interface to output power within 90% of setpoint)

3.2.8.1 RS-232 or Analog< 10 msec

3.2.9 Mismatched forward power at generator output

Item	Load VSWR (Any phase)	Minimum Forward Power	Reflected Power	Load Power
3.2.9.1	1.1:1	750 W	2 W	748 W
3.2.9.2	1.5:1	600 W	24 W	576 W
3.2.9.3	2.0:1	486 W	54 W	432 W
3.2.9.4	3.0:1	384 W	96 W	288 W
3.2.9.5	∞ :1	200 W	200 W	0

3.2.10 Common Exciter (CEX) Specifications

Specification	Min	Typ	Max	Units
CEX INPUT				
Input Amplitude	0		+10	dBm
Input Frequency Range	13.555	13.56	13.565	MHz
CEX OUTPUT				
Output Amplitude (square wave output into 50ohm)	0		5	V
Output Frequency Range	13.555	13.56	13.565	MHz

3.2.11 Pulsed Operation

- 3.2.11.1 Pulse frequency (External via blanking input)1Hz – 25kHz
- 3.2.11.2 Pulse frequency (Internal or digital interface)7.6Hz – 10kHz
- 3.2.11.3 Minimum pulse width20us
- 3.2.11.4 Maximum pulse width60ms
- 3.2.11.5 Pulse rise time 5us

3.3 AC Power Input Specifications

3.3.1 AC power input

3.3.1.1 Voltage 100VAC – 253VAC (+/-10%) Single Phase

Note: When operating below 100Vac, output power of the unit will be limited to approximately 500W

3.3.1.2 Line frequency 50/60 Hz

3.3.1.3 Power consumption 1.2kW

3.3.1.4 Current at nominal line voltage 9 A typ. (@120VAC)

3.3.1.5 Power factor > 0.90 at rated power

3.4 Environmental Specifications

3.4.1 Cooling

3.4.1.1 Unit is air-cooled

3.4.2 Operating ambient temperature range +5 to +40 °C

3.5 Interfaces, Front Panel

3.5.1 Front Panel LCD

3.5.1.1 Main Display.....Operating Mode (Pulse / CW), Setpoint (W), Forward Power (W), Reverse Power (W), MW Capacitor positions (when enabled) and MW Tune mode (Auto / Manual – when enabled)

3.5.1.2 Sub-Menu display.....Pulse mode parameters – Duty Cycle (%), Frequency (Hz)

3.5.1.3 Keypad6-button, allows modification of operating mode, RF setpoint, C1 / C2 position (when enabled), pulse frequency, pulse duty cycle

3.5.2 ON / OFF Switch..... Mounted on Front Panel

3.6 Interfaces, Rear Panel

3.6.1 RF output connector Type N

3.6.2 AC Input connector..... IEC Compliant Inlet, user to supply linecord capable of carrying 15A and less than 3m long to maintain NRTL compliance.

3.6.3 Chassis grounding 6 mm ground stud provided with 2 nuts

3.6.4 LED Indicators

3.6.4.1 PWR LEDGreen – Ready

Green Flash – RF ON

Red – Fault

Amber – Interlock Fault

3.6.4.2 STAT LEDGreen – Ready

Green Flash – RF within regulation

Amber Flash – Warning code (see manual)

Red Flash – Fault code (see manual)

3.6.5 Remote digital RS 232 interface

3.6.5.1 Connector 9-pin type DB9F

3.6.5.2 Pin configuration See table below

Pin	Function	Description
2	TX RS232	RS-232 Tx data output
3	RX RS232	RS-232 Rx data input
5	Digital Ground	Connected to the digital ground of the controller.
shell	Cable Shield	Chassis ground

3.6.5.3 Protocol ENI Standard Lite

3.6.6 CEX I/O

3.6.6.1 CEX IN and OUT connectors BNC

3.6.7 External Interlock / Pulse Blanking Interface (Analog I/O Connector)

3.6.7.1 Mating Connector25-pin type DB25F

3.6.7.2 External Interlock – Dry contact closure needed across pins 10 & 23 to satisfy interlock scheme.
Defeat jumper included.

3.6.7.3 Pulse Blanking Input – TTL-high signal on pin 24 blanks RF output.

3.6.8 Profibus Interface (750FP)

3.6.8.1 ProtocolProfibus (see document 1037458 for additional detail on generator operation via the Profibus interface)

3.6.8.2 Mating connector9-pin type DB9F

3.6.8.3 Pin configurationSee table below

3.6.8.4 Address Select.....7 bit selectable via DIP switches

Pin #	Description	Voltage (V)			Current (mA)		
		Min.	Typical	Max.	Min.	Typical	Max.
1	Digital Ground	-	0	-	-	-	-
2	NC	-	-	-	-	-	-
3	RxD/TxD Data Positive (A)	+4.75	+5.00	+5.25	-	60	-
4	Ready to Send	+4.50	+5.00	+5.50	-	4.0	-
5	Digital Ground	-	0	-	-	-	-
6	Positive Digital Rail	+4.75	+5.00	+5.25	100	300	600
7	NC	-	-	-	-	-	-
8	RxD/TxD Data Negative (B)	+4.75	+5.00	+5.25	-	60	-
9	NC	-	-	-	-	-	-

3.6.9 AIFC / DeviceNet Interface (750FD) – This optional interface includes both a 25-pin Analog Interface as well as a DeviceNet Interface.

3.6.9.1 Analog Interface

3.6.9.1.1. Mating connector.....25-pin DB25F

3.6.9.1.2. Pin Configuration.....See Table A

3.6.9.2 DeviceNet Interface

3.6.9.2.1. Mating connector.....5-pin sealed micro style

3.6.9.2.2. Pin Configuration.....See table below

3.6.9.2.3. MAC ID Select.....Address 0 – 63 selectable via rotary switches

3.6.9.2.4. Baud Rate SelectSelectable via rotary switch

3.6.9.2.4.1. Switch Setting '0'.....125 kbps

3.6.9.2.4.2. Switch Setting '1'.....250 kbps

3.6.9.2.4.3. Switch Setting '2' and above.....500 kbps

3.6.9.2.5. IndicatorsBi-color LEDs for NET / MOD

DeviceNet Pin Configuration

Pin	Function	Description
1	Drain	Shield
2	V+	24V Power
3	V-	24V Common
4	CAN_H	DNET Signal
5	CAN_L	DNET Signal

4.0 Mechanical

4.1 Configuration

- 4.1.1 Form Factor..... 2U, full rack
- 4.1.2 Size (exclusive of connectors, etc.)..... 17 W x 15 D x 3.5 H (Max), inches
- 4.1.3 Weight..... 25lbs
- 4.1.4 Mounting and Outline Details See Doc # 1036481

4.2 Standard Accessories

- 4.2.1 Operating Manual (supplied on request) 1036315

4.3 Part Marking

- 4.3.1 Labeling..... Serial No., MKS Part No. on top cover

- | | |
|---|---|
| <p>A. ENI MODEL NUMBER:
The number that uniquely identifies the unit.</p> <p>B. PART NO:
The assembly number that uniquely identifies product configuration.</p> <p>C. SERIAL NO:
A number that is sequentially assigned as the product is manufactured.
DATE:
Date of manufacture in MM/DD/YY format</p> | <p>D. ENI REV:
The revision letter identifying product configuration. Revision A is the initial revision level.</p> <p>E. OUTPUT:
Specifies the unit's RF output power rating
WEIGHT:
Specifies the unit's weight in kilograms and pounds.</p> |
|---|---|

Table A: 25-pin Analog Interface

PIN	NAME	TYPE	DESCRIPTION
1	MAX POWER (E)	DO	Emitter side of isolated transistor switch. (See Note 1.) Transistor ON - indicates max reverse power.
2	REFLECTED POWER (+)	AO	A linear DC voltage that represents the reflected power output level. 0 V = 0 W, 1 V = 20 W
3	FORWARD POWER (+)	AO	A linear DC voltage that represents the forward power output level. 0 V = 0 W, 1 V = 75 W
4	RF ON/OFF CONTROL (+)	DI	A voltage between this and Pin 17 will turn RF power ON. Leaving it open or applying zero voltage will turn RF power OFF. The <i>nominal</i> voltage to turn RF ON is selectable between +5 V or +24 V (default) via a jumper. Input should not exceed 30 VDC.
5	POWER SET POINT (+)	AI	A linear DC voltage to set the output power level. 0 V = 0 W and 1 V = 75 W. Input impedance is 100 kΩ balanced differential to ground.
6	+12Vdc	—	User voltage for interface purposes. Rated 10mA Max.
7	RF ON (E)	DO	Emitter side of isolated transistor switch. (See Note 1) Transistor ON—RF ON. Transistor OFF—RF OFF.
8	ANALOG REMOTE ENABLE	DI	Ground referenced logic input. (See Note 2.) LOW - Selects analog remote control mode. HIGH (or OPEN) - Disables analog remote control mode.
9	OVERHEAT (E)	DO	Emitter side of isolated transistor switch for Pin 22.
10	NOT USED	—	Not Used
11	LEVELING SELECT	DI	Ground referenced logic input. (See Note 2.) LOW (or OPEN) - Selects forward-power leveling. HIGH - Selects an alternative power-leveling mode.
12	LOAD POWER (+)	AO	A linear DC voltage that represents the load power output level. 0 V = 0 W, 1 VDC = 75 W
13	+15 VDC	—	User voltage for interface purposes. Rated 10 mA max.
14	MAX POWER (C)	DO	Collector side of isolated transistor switch for Pin 1.
15	REFLECTED POWER RTN (-)	AO	Signal return for Pin 2.
16	FORWARD POWER RTN (-)	AO	Signal return for Pin 3.
17	RF ON/OFF CONTROL (-)	DI	Signal return for Pin 4.
18	POWER SET POINT RTN (-)	AI	Signal return for Pin 5.
19	GND	—	Signal/Chassis ground.
20	RF ON (C)	DO	Collector side of isolated transistor switch for Pin 7.

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PIN	NAME	TYPE	DESCRIPTION
21	GND		Signal/Chassis ground.
22	OVERHEAT (C)	DO	Collector side of isolated transistor switch. (See Note 1.) Transistor ON—Overheat fault. Transistor OFF—No fault.
23	NOT USED	—	Not Used
24	Option V	—	Typically No Connect Optional User interface voltage (+5Vdc or -15Vdc). Contact factory for options.
25	LOAD POWER RTN (-)	AO	Signal return for Pin 12.
Shell	SHIELD	—	Cable shield.

DI = Digital Input

DO = Digital Output

AI = Analog Input

AO = Analog Output

Note 1: For all isolated transistor outputs.
Transistor OFF (switch open) - $V_{CEmax} = 40 \text{ VDC}$ ($I_C < 500 \mu\text{A}$)
Transistor ON (switch closed) - $I_{Cmax} = 10 \text{ mA}$ ($V_{CE} < 1 \text{ V}$)

Note 2: For all ground-referenced logic level inputs.
HIGH = 2 VDC min. to 30 VDC max.
LOW = -0.2 VDC min. to 1 VDC max.

Note 3: Analog outputs will drive a load impedance $> 100 \text{ K}$

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