1. Introduction and Specifications

1.1 Introduction

The EN2CORE technology EN2RA® Arctic is the high frequency high power generator for plasma applications

1.2 Electrical Specifications

AC input

Line voltage	3 phase, 440 VAC
Line current	50 A maximum at the rated power into nominal 50 Ohm load
Line frequency	47 ~ 63 Hz

RF Output

Frequency	400kHz ± 0.005%
Dynamic range	100W ~ 15,000W
Accuracy	±1% or ±5W whichever greater
Output impedance	TBD
RF stability	±1.0%
Harmonics	≤ -30 dBc
Spurious	≤ -30 dBc
Rising time(CW)	≤ 10 msec, from 10% to 90% of set power
Falling time(CW)	≤ 10 msec, from 90% to 10% of max. power
Power ramping(CW)	TBD
Dynamic Frequency Tuning(CW)	Available
Frequency tuning range	400kHz +/- 10%.
	* CW: non-pulsed mode
Regulation	Delivered power regulation
Pulse rise and fall time	<10us
Pulse	Frequency : 10 Hz ~ 10 kHz
	Duty : 10 ~ 90 %
	Ext. source : Available
Min. pulse width	50 usec

Pulse Level to level	TBD
Pulse ramping	TBD

2. System Integration

2.1 Water Connection

The EN2RA® Arctic equipment is cooled by recirculating water according to the Table 1.
• Securely connect a water line to the input 3/8” bulkhead water connector. This water line will carry cooling water to the EN2RA® Arctic equipment. The cooling water system must be capable of dissipating the maximum cooling load while provided a maximum inlet temperature of 30°C.

2.2 Power Connection

Refer to the technical specifications provided in Table 1 for the power requirements.

Table 1 380 V_{AC} *Input Cable Lead Out*

380 V_{AC} *Input Cable Pinouts*	
Type: MS Connector Panel mount MS Connector Male inserts, 22-22	
Pin No.	*Name*
A, B, and C	370 - 380 VAC
D	Earth Ground

• Make sure the facility power cable circuit breaker is in the OFF position.
• Follow local guidelines for wire size and type.

2.3 Remote-Control Connection

The EN2RA® Arctic equipment is operated with a remote control by means of a 25-pin cable terminating in a male DB-25 connector. The inputs and outputs are configured for externally sourced 24V logic. Attach the 25-pin connector to the 25pin female D connector on the front panel. Refer to Table 3 for cable pinouts and Figure 1 for the internal circuit interface and an example of a remote-control interface, respectively.

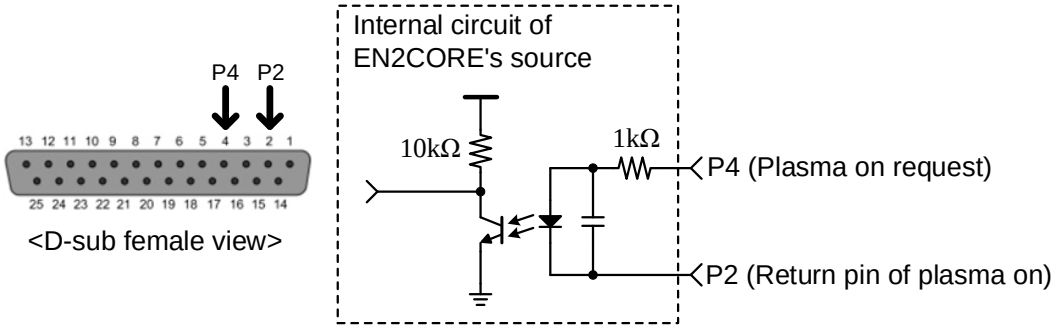

Figure 2.3.1 Internal I/O interface diagram

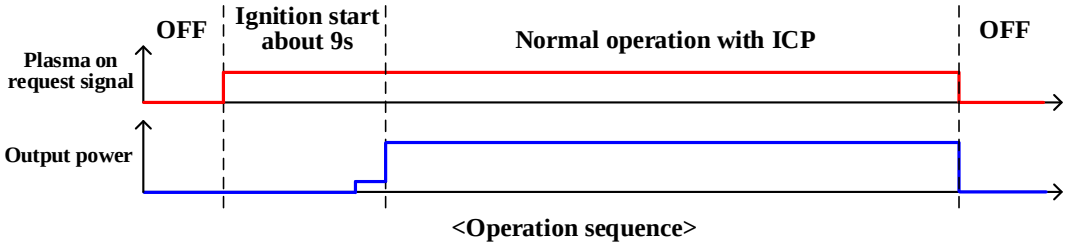

Figure 2.3.2 Operation example

2.4 Digital-Control Connection

The EN2RA® Arctic equipment provides digital control for setting and reading the RF power in real-time. Attach the RS-232 9-pin connector to the 9pin female D connector on the front panel. Refer to Table 4 for cable pinouts and RS-232 serial communication protocol.

Table 4 ***Digital control cable pinouts***

Remote control cable pinout		
Pin no.	**Name**	**Remark**
2	RXD	Receive Data
3	TXD	Transmit Data
5	GND	Ground

1. Serial Interface Setting

- Baud rate : 9600
- Data bit : 8
- Parity : none
- Stop bit : 1
- Flow control : none
- All command is ASCII code.
- Transmit delay : 10msec/char, 60msec/line
- It is Recommended to use an electrically separated(isolated) cable for RS232 cable.

2. Serial Command Scheme

- PC is master, and En2Ra Arctic is slave.

- Slave is waiting for "R" for SOP(start of packet). And it will response after receiving "T" for EOP(end of packet) or "X" for flushing receiving buffer. "X" is designed to dispose miss-typed packet by manual commanding.

3. Sending Packet Protocol

- "R" + "command" + " " + "param0" + " " + "param1" + " " + "param2" + " " + "param3" + " " + "T"

- Each command has 1 to 4 parameters.

- "command" is single character.

- ex) R8 500 10000 0 T

4. Response Packet Protocol

- "r" + "received command" + " " + "param0" + " " + "param1" + " " + "param2" + " " + "param3" + " " + "t" + "n" +"r"

- ex) r8 t<LF><CR>

- If "X" is received after receiving "R", it will response "x" only.

5. Packet List

5.1 Set Power Command

- command : 8

- param0 : 200

- param1 : set power(in Watt). If you want the set power of 10000W for example, type 10000 for this parameter.

- param2 : 0

- param3 : not in use

- ex) command packet : "R8 500 10000 0 T", response packet : "r8 t<LF><CR>"

6. Detailed Operation Example

6.1 Parameter Change Procedure (Before Ignition)

- Before ignition start, Set the required power or minimum power

ex) R5 48 T (initialize power set recommended for safe operation)

R8 500 10000 0 T (10kW power set)

6.2 Parameter Change Procedure (After ICP generation)

- After ICP generation, Set the required power

ex) R8 500 30000 0 T (30kW power set)

ex) R8 500 50000 0 T (Full power below current interlock about 40kW)