Fermi National Accelerator Laboratory

Fermilab

PIP-II Project

Interface Specification Document for 162.5 MHz, 7kW Solid State Power Amplifier

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PIP-II

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Revision History

Version #	Date	Author	Comment
0.0	May 20, 2019	James Steimel	Initial Version of the document
			Changes / revisions

1. Purpose

The purpose of this document is to map out the external interfaces of the 162.5 MHz, 7kW RF solid state power amplifier (SSPA), i.e. how it interfaces with the connected systems of PIP-II and the PIP-II Injector Test. This document endeavors to cover all connections to the SSPA that will be made in the PIP-II Injector Test or PIP-II gallery.

2. Facility Environment and Utility Connections

2.1. Gallery Environment

- Mountable in 19" available width, 90" available height rack.
- Possible environment temperature: 10-40 ^{0}C.
- Possible environment humidity: 10-95%.

2.2. Water Cooling

- Maximum inlet water pressure: 150 psig
- Maximum water pressure drop: 60psi
- Required flow: 15 lpm minimum
- Cooling water temperature nominal: 25-35 ^{0}C.
- Cooling water header: Copper/SS NPT (male) of 1/4" size

2.3. AC Power

- AC input power: 3-phase, 4-wire ('Y' with ground), 480 VAC, 60 Hz
    - Maximum 480 VAC current pull: 30 amps/phase
    - 480 VAC connection: 5-pin three phase L22 NEMA male
- Separate amplifier auxiliary power, single phase 120 VAC, 60Hz.
    - Max current pull 3 amps.

3. RF Power Output

- Connection: 1-5/8" EIA flange on rear panel for 1-5/8" flexible (50 ohm), coaxial RF distribution
- Maximum output power: 7 kW at 162.5 MHz

4. RF Input (LLRF)

- Connection: 50 ohm N connector (F), 50 ohm, on rear panel for ½" flexible, coaxial cable
- Input return loss: -15 dB minimum
- Input drive for max power: 0 dBm minimum
- Input drive: +16 dBm maximum

5. Safety Permit

- Active closed relay contact input.
  - 5V open circuit nominal, 10mA nominal short-circuit current
- Connection – 2-way Phoenix connector.

6. Controls

6.1. PLC Connections

- Connection – Standard 25-pin D-connector for ribbon cable

Name	Signal Type	Connector Pin	I/O	Polarity	Signal Origin
AC ON/OFF	TTL	#19 – Connector #2	Input	High = On	PLC Controls
DC ON/OFF	TTL	#17 – Connector #2	Input	High = On	PLC Controls
SSA Reset	TTL	#16 – Connector #2	Input	Low = Reset (internal pull up)	PLC Controls
SSA Fault	TTL	#9 - Connector #1	Output	High = Fault	SSPA

6.2. Ethernet Communication

- Connection – RJ45
- Protocol – HTTP Server, text, or EPICS Stream