FILES ASSOCIATED WITH THIS SPECIFICATION

FILENAME	CONTENTS
SPC – P533.doc	This Document

CHANGE HISTORY

ORIGINATOR	DATE	DESCRIPTION OF CHANGE
Joe Zhou	12/02/19	Standard specification for IXS with metal ceramic tube rated for 160kV. - Input power: 220V ±10% - 80-160kV, 1-8mA, 1280W max - Fan beam 90 x10 degree - X-ray Tube Focal spot size: 1.6x1.5 - Output Rise time: 2sec - Integrated external water-air cooler - Firmware P273 - Communication: RS232 & Ethernet - Cable Length (HV tank – Control): 1.0meter
J. Zhou	7/22/20	Rev1: - Update: 24V input for Cooler (#2, #12 J4, #15 Figure 5) - Update External Circuitry diagram (#16)

TITLE: IXS160SE1K2P533	
GENERATED BY: Joe Zhou	DOC OWNER: X-ray Eng. & Sales
REVIEWED BY: J. Zhou	REVIEW DATE: 7/23/20
APPROVED BY: NY Eng. Team	APPROVAL DATE:7/23/20

Contents

1. OVERVIEW

The IXS160SE1K2P533 X-ray Generator is a 160kV, 8mA High Frequency X-Ray generator. It consists of an integrated Metal Ceramic X-ray tube, a high voltage power supply and a filament supply. It features an integrated water-air heat exchanger. The Generator is controlled, programmed and monitored via RS232 and Ethernet interface. The Generator is built in accordance to the following specifications.

2. INPUT POWER

220VAC +/-10%, 50/60Hz. Single phase. 8.6Amps RMS max.
24VDC @ 4A to be connected to Control Box for control circuitry and fan
24VDC @ 4A to be connected to Cooler

3. HIGH VOLTAGE PERFORMANCE

a. Output Power:
Normal operating output power: 160kV, 8mA, 1280W

b. Tube Voltage Operational Range:
The high voltage is programmed within the normal operating range of 80 to 160 kV.

c. kV Accuracy:
The High Voltage measured at the X-ray tube is within $\pm$1% of the selected value.

d. kV Ripple:
2% max peak to peak at Frequency greater than 10kHz
0.2% rms at Frequency less than 10kHz

e. kV Repeatability
The commanded kV shall be repeatability to within +/-0.1%

f. kV Regulation:
< 0.1% for Line Input changes over specified range
< 0.1% for Load Output changes over specified range

g. kV Rise Time:
The kV rise time: ~2sec from 0kV to nominal kV

h. kV Overshoot
The kV Overshoot will be $\leq$ 5% of full output voltage.

i. Duty Cycle
Continuous

4. TUBE CURRENT (mA) PERFORMANCE

a. Tube current Operational Range:
1 - 8mA @ 160kV max

b. mA Accuracy:
The X-ray tube current is within $\pm$0.5% of the selected value.

c. mA Regulation:

< 0.5% for combined line and load changes from 80-160kV

d. mA Rise Time at maximum power:
The mA rise time is ~2sec from 0% to 100% of the output current.

5. BEAM GEOMETRY

a. **Fan beam** 90° x 10°

6. PROTECTION AND SAFETY CIRCUITRY

a. Over-current protection:
The Over-current trip point is set for within 105% - 110% of max mA. This will disable the high voltage output. A Reset is required to clear this fault.

b. Over voltage protection:
The Over voltage trip point is set within 105% - 110% of max kV. This will disable the high voltage output. A Reset is required to clear this fault.

c. Over temperature protection:
Over temperature trip point is set within 57°C to 63°C. This will disable the high voltage output. A Reset is required to clear this fault.

d. Arc Detection Fault:
When an Arc occurred, the arc fault LED will be ON. If four (4) or more arcs occurred within 10sec, the arc fault signal will be latched. This will disable the high voltage output & a reset is required to clear this fault.

e. Reg. Fault:
When kV or mA output is out of regulation, the unit will disable the high voltage output. A Reset is required to clear this fault.

f. Power Limit Fault:
When the kV/mA feedback values exceed the maximum rated power limit, this will disable the high voltage output. A Reset is required to clear this fault.

g. X-ray On Relay:
The X-Ray on relay will operate when HV is enabled & there is no faults occurred.
The X-Ray on relay will de-energize when the X-Ray output is OFF.
The maximum rating of this contact is 30V DC@ 1Amp.

h. Safety Interlock:
J2-1 & J2-2 to close through external interlock switches to satisfy the safety. X-Rays will not be produced & interlock open message will be displayed unless J2-1 & J2-2 are connected together through safety switches.

7. SAFETY REQUIREMENTS

a. Safety Compliance: Designed to meet EN 61326-1 and UL 61010-1.
b. X-ray Leakage: Less than 0.5mR/hour at 5cm from the surface of the chassis at full power.

8. X-RAY TUBE SPECIFICATION

a. Maximum Power: 160kV, 8mA, 1280W
b. Focal Spot Size: 1.6mm (width) x 1.5mm (length)
c. Radiation Coverage: 90° x 15°
d. Target Material: W-Re
e. Permanent Filtration: 2mm Be

9. PHYSICAL SPECIFICATIONS

a. Environmental
- Operating ambient temperature within system: 0°C to 40°C.
- Storage ambient temperature: -20°C to +70°C
- Thermal cut off: 60ºC ± 3ºC of oil temperature

b. Humidity
Operating Humidity: 10% - 85% non-condensing

c. Dimensions
See figures in mechanical drawings

d. Weight
X-ray generator: 36kg
Control box: 10kg
Cooler: 14kg

e. Cooling method
- Cooling of the generator is by an integrated external water-air cooler.
- Cooling capability is 1280W continuously. Capable of cooling with system operating stationary at 160kV, 8mA

10. AC POWER INPUT CONNECTOR

- Voltage: 220±10% VAC, 50/60Hz
- Current: 8.6 Amps RMS

11. LED INDICATORS

X-ray On	Illuminated when Interlock is closed & HV is enabled
OV	Over Voltage Fault
OC	Over Current Fault
OP	Over Power Fault When Exceeds Rated Power
POWER	Illuminated when Power is present
REG-ERROR	Regulation Error
ARC	Arcing Fault
OT	Illuminated when oil temperature exceeds 60±3ºC

12. CONNECTORS

J1 AC Input Connector: (AMP 556882-3)

L1	Neutral
G	Ground
L2	220±10%VAC Input

J2 Connector: Analog Interface (AMP 747238-6, 25 Pin Male)

Pin Out	Name
1	Interlock Out (15VDC)
2	Interlock In (15VDC)
3	Relay Contactor (+24V) IN
4	LED (24VDC) @ 100 mA max
5	LED (24VDC Return)
6	15V Gnd
7	15V Out
8	N/A
9	N/A
10	N/A
11	N/A
12	N/A
13	N/A
14	N/A
15	N/A
16	X-ray Pre-warning
17	N/A
18	N/A
19	N/A *
20	N/A
21	N/A
22	X-ray Pre-warning Return
23	N/A
24	N/A
25	N/A

Note: J2-19 can be used as “Cooler Fault” should the cooler status be monitored. It is not necessary in the current configuration as the Anode temperature is monitored directly by a temperature sensor.

J3 Connector: RS232 Digital Interface (9 Pin Female)

Pin Out	Name
1	N/A
2	TX- (Transmit)
3	RX+ (Receive)
4	N/A
5	Signal Ground
6	N/A
7	N/A
8	N/A
9	N/A

J4 Connector: 24VDC Input

Pin Out	Name
1	+24VDC @ 4A (for control circuit & fan)
2	24VDC Return
3	N/A
4	N/A

Note: Additional 24VDC@4A Input required for Cooler (pump and fan).
See Layout (item#15 Figure 5)

RJ45 Ethernet Digital Interface (USR-TCP232-T)

Pin Out	Name
1	TX+
2	TX-
3	RX+
4	N/A
5	N/A
6	RX-
7	Ground
8	Ground

13. CABLES

Cable Description	Cable Length (meter)
AC Power Cable	Connector & pins are provided.
Control Cable (Control – Tank)	1m
RS232 Signal Cable	1.5m standard
Ethernet Cable	2.1m standard
24V Power cable to Cooler	1m
AC Power Cable for Cooler (if applicable)	2m flywire
Cooler Signal Cable (Temp & Flow sensor if applicable)	1m
Cooler Hose	2m each max.

14. DIGITAL INTERFACE

Refer to Document P273-IXS-FIRMWARE-P273

15. MECHANICAL DRAWINGS

Figure 1: X-ray Generator

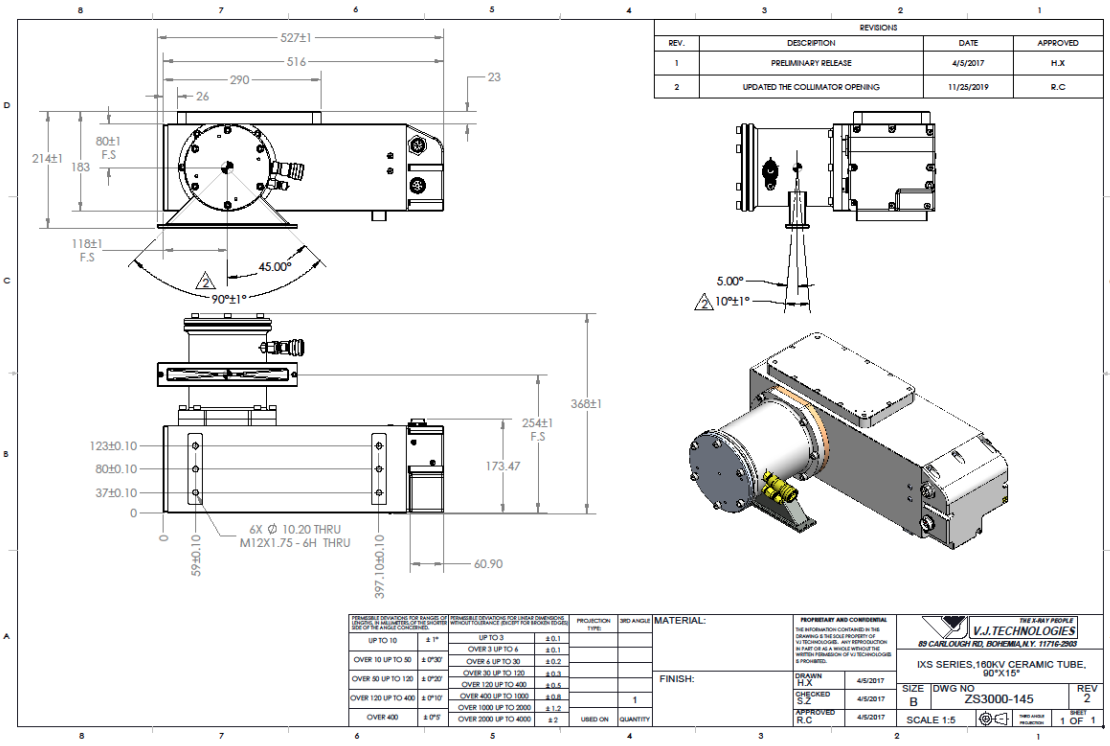


Figure 2: Control Box

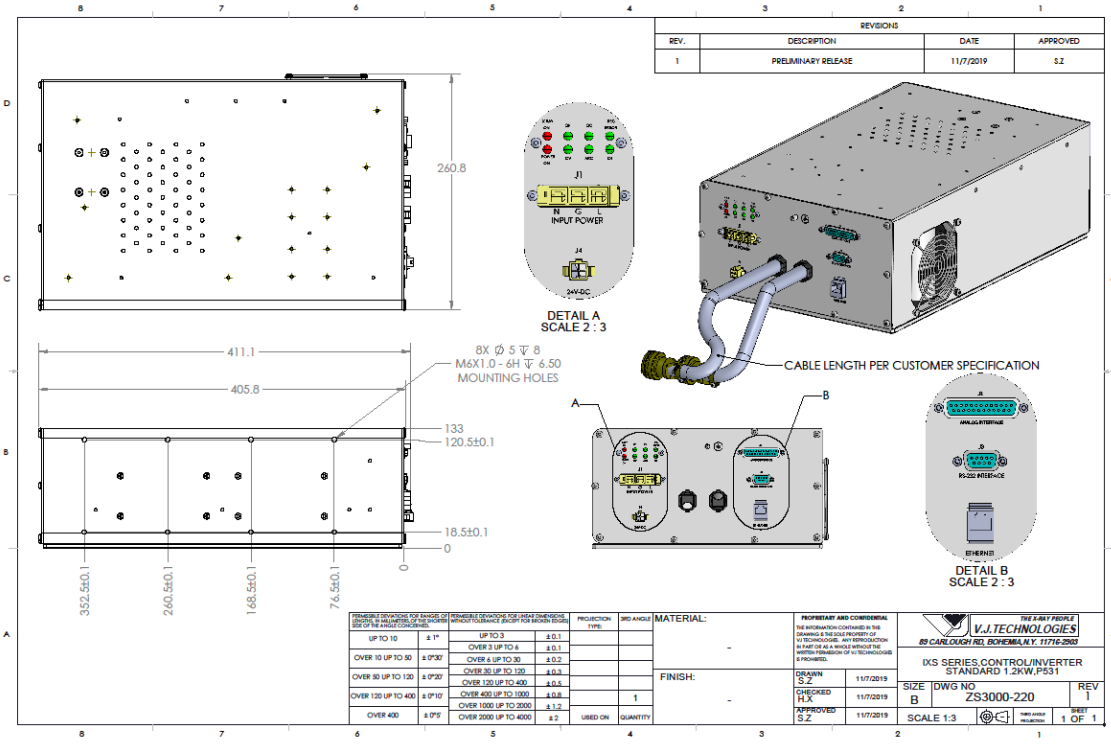


Figure 3: Cooler (for Reference only)

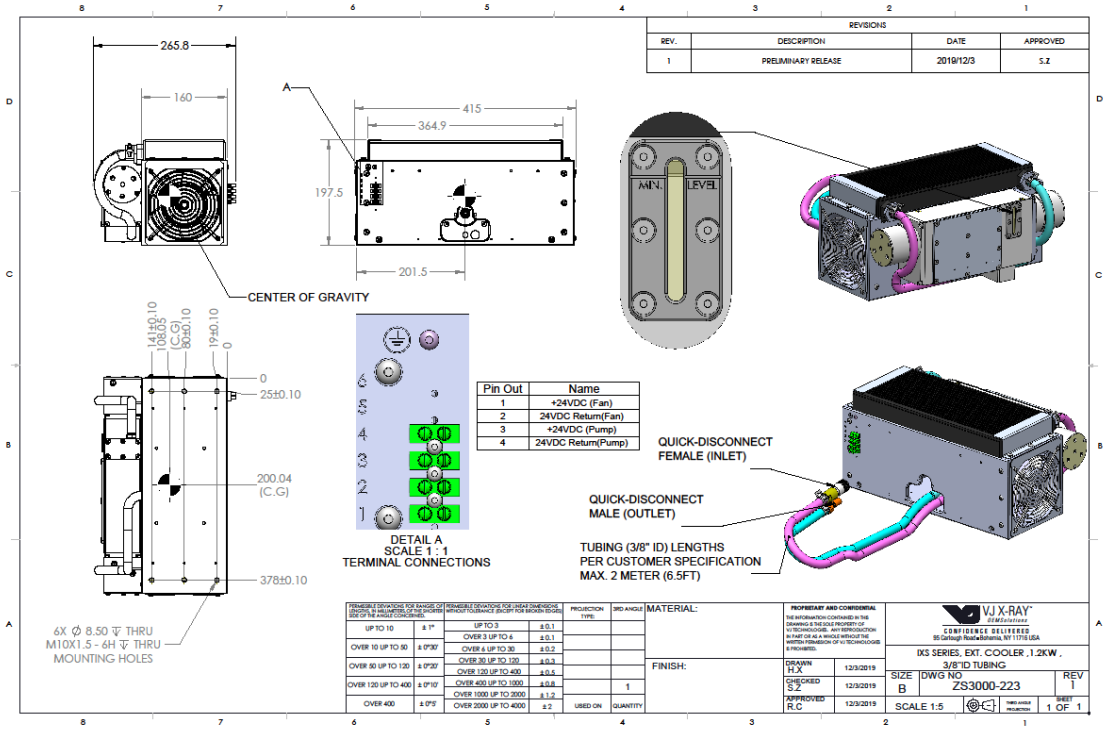


Figure 4: Panel

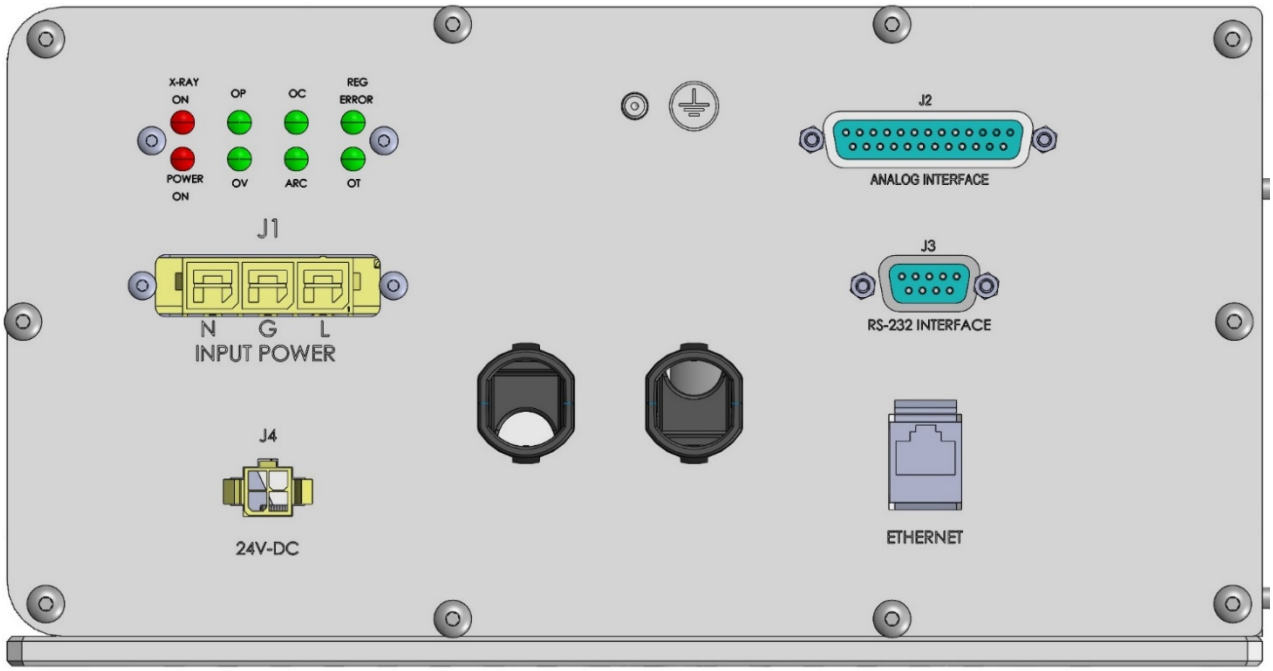
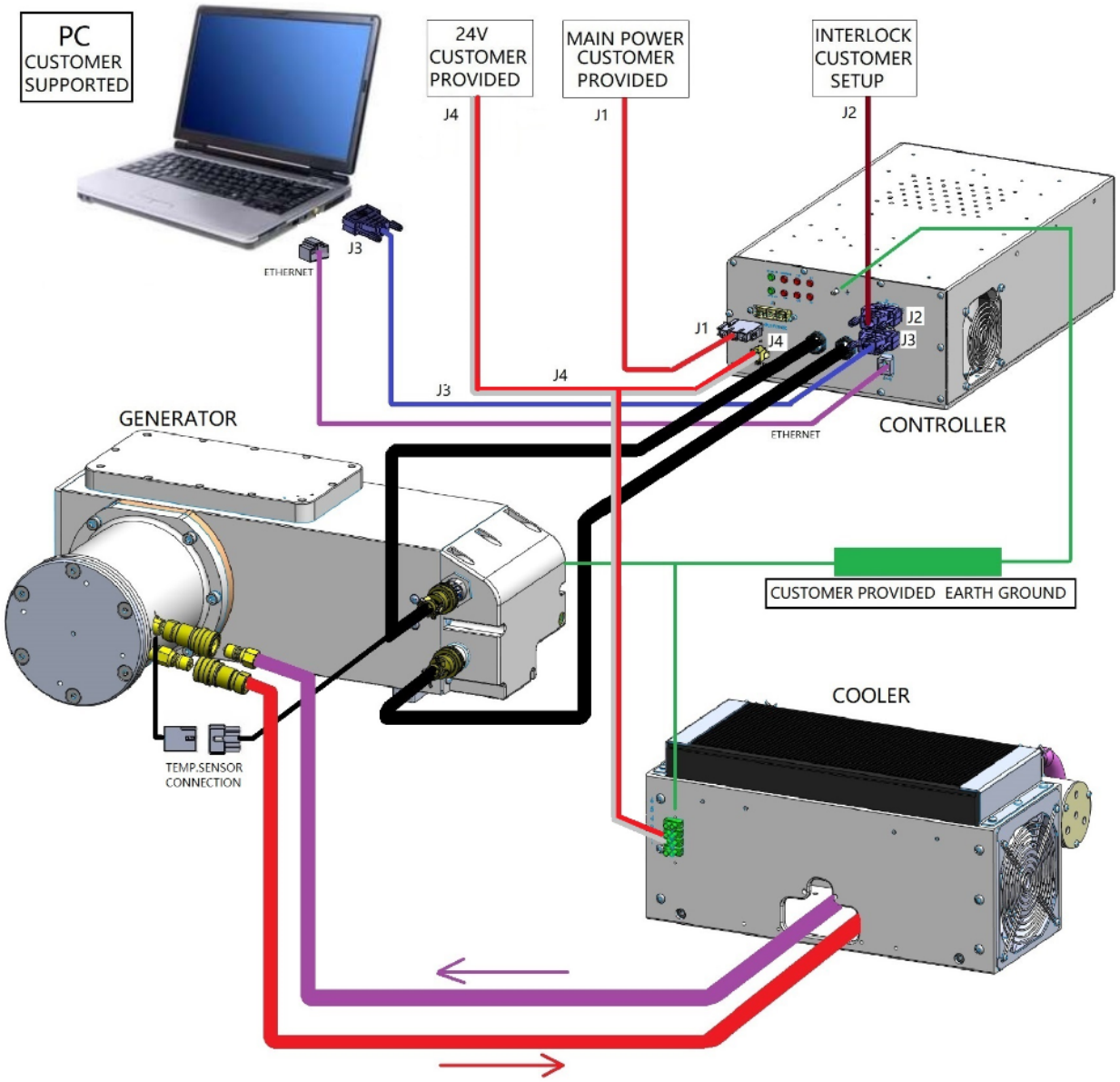
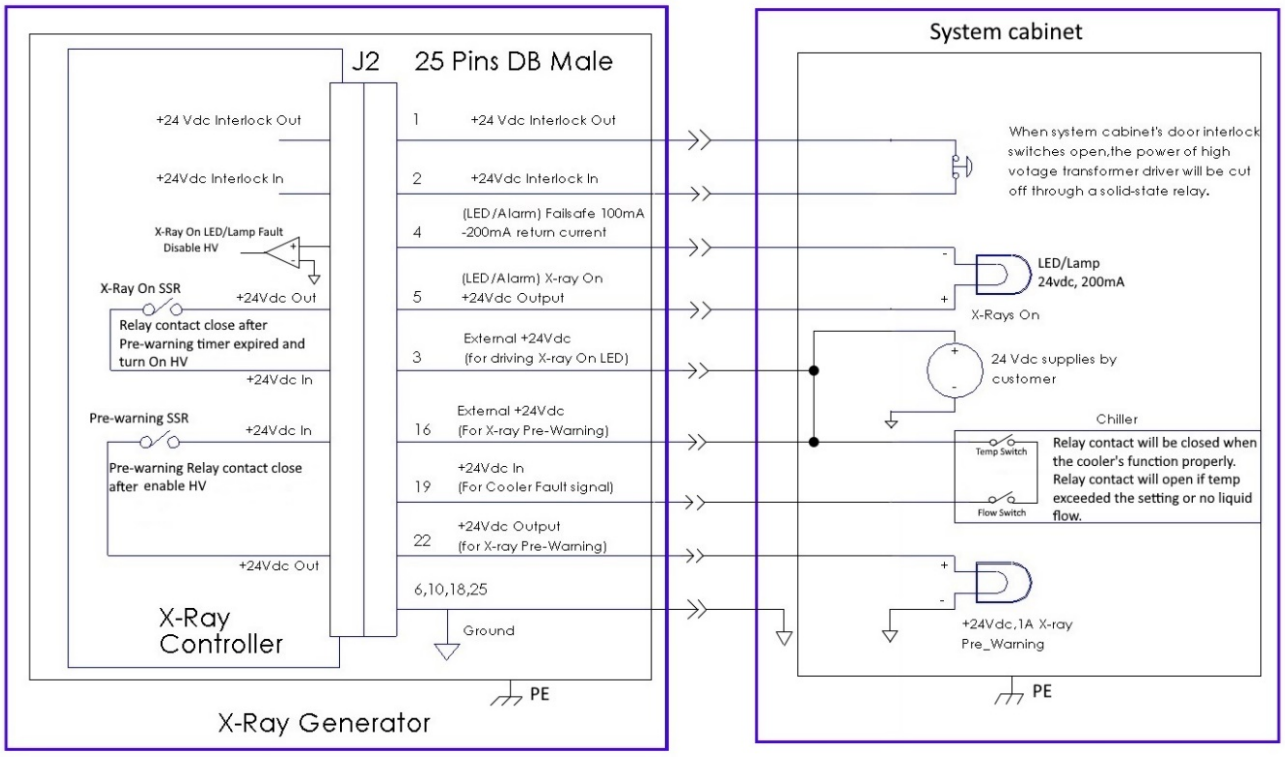


Figure 5: System Connection (for Reference only)



16. TYPICAL EXTERNAL CIRCUITS



End of Document