**Power up procedure:**

Steps for using the W band system:

1. Setting the Spectrum Analyzer:
   1. Press “preset” button in the from panel.
   2. Set the central frequency to 75MHz,
   3. Set the span to 25MHz
   4. Activate the marker at 75MHz
   5. Activate the marker function option “Band Power” and adjust the band to 24MHz.
   6. Activate the internal low noise path and set the attenuation to 10dB (for single) or 20dB (for chain). Should probably cal with 20dB.
   7. RBW = 8MHz, VBW = 10Hz.

Most of these settings (all but letter e) are also controlled from the python code but it is important to initialize them manually before measuring just to check that everything is working during the power up procedure.

1. Setting the PNA-X as signal generator:
   1. Press “preset” button in the front panel.
   2. Using the measure menu to measure the value “R” (through measure, more, receivers).
   3. Set the PNA-X power to -25dBm
   4. Calibrate and Zero the power meter with sensor connected to reference.
   5. Perform a Source Power calibration of the port 1 of the VNA.
   6. Switch the frequency sweep to “CW type” and set the frequency to 10GHz.
   7. Add a marker to check the power of the CW tone. Usually the value of the marker is slightly higher than the value in the power setting.
2. Connect the PNA-X to the input of the X4 multiplier. Use the SMA cable that has a 2.9-2.4mm adapter.
3. Make sure that everything is correctly connected: power and coaxial cables.
4. Power Up the IF amplifier using a 5.5V power supply. The current should be ~100mA. The output power of the system measured by the marker at the spectrum analyser should increase.
5. Power up the x4 Multiplier. 6V supply. The current should be ~430mA and should change during the measurement between 400-500mA.
6. Increase the output power of the PNA-X slowly. When getting closer to 0dBm the output power measured in the spectrum analyser should increase. Set the output power to 2dBm. The marker in the VNA should be slightly higher (~1dBm), this is normal.
7. Power up the WG Switch (with 24V supply) and select the channel you are measuring using PythonANDDaq.py script. To select the channel, you need to write (using the python code) one of the following numbers into the script (task.write(##)):

|  |  |
| --- | --- |
| Position | Number |
| Port1-Port2 | 14 |
| Port1-Port3 | 13 |
| Port1-Port4 | 11 |

1. Power up the amplifiers. The output power measured at the spectrum analyser should increase as you increase the power on the transistors. (Power the drain then the gate when turning on, reverse when off, depends on power supply.)

To power down the system follow the same steps in reverse.

**Measurement procedure:**

1. Check that the GPIB cables are connecting the PNA-X, the spectrum analyser and the lakeshore unit.
2. Configure the temperature and sensor systems in the lakeshore unit.
   1. Sensor configuration: The system has 6 sensors but only two of them are used for each cryostat channel: one for the LNA and one for the load. It is important to enable and disable the channels that are being used.
      1. Press “Input setup”
      2. Select the appropriate channel according to the following table (05/10/2021):

|  |  |  |  |
| --- | --- | --- | --- |
| Device connected | Cryostat Channel | Lakeshore Channel | RTD Number |
| LNA | 1 | 7 |  |
| LOAD | 1 | 8 |  |
| LOAD | 3 | 9 |  |
| LNA | 3 | 10 |  |

* + 1. Select “Enable/Disable” to activate that channel
  1. Heater configuration:
     1. Select “Output setup”
     2. Select Warmup Heater (could also be sample heater if required)
     3. Select the sensor channel that control the load (See previous table)

1. Set the temperature of the load to the cold temperature (usually 20K)
2. Use the V1.py code to measure the output power from the cold load.
3. Set the temperature of the load to the hot temperature (usually 50K or 60K)
   1. Press the “Warm Up heater” button
   2. Set “Setpoint” to 50K
   3. Set heater range to on
4. Continue using the V1.py code to measure the output power from hot load.
5. After the code ends the measurement copy the P\_hot and P\_cold data to the excel spreadsheet.
6. Make sure to copy the bias information from the power supply to the excel spreadsheet.

**JBO cryostat and compressor:**

*It needs to be used with the air cooled Oxford Instruments compressor, and I think that normal procedure is to start the compressor and then to immediately (well as close as you can) start the drive.*

Graphical user interface, text, application

Description automatically generated



Notes:

- Increased pressure on the Helium compressor to 260psi.

- Changes: KU waveguides connected on the outside of the cryostat to avoid any hit between the 2stage and the waveguides. One thread to hold the 2stage plate is broken so the screw got removed.

**Cryostat thermal system wiring:**

Table 1 explains the connections between the 50 Pin D sub, the 55 Way circular connector and the function of each pin.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 50 Pin D sub Connector | 55 way Circular Connector | RTD Number | Function | Approximate color |
| 5 | R | 6 | I+ | White/light blue |
| 6 | P | 6 | V+ | Yellow/light blue |
| 7 | N | 5 | I+ | Red/blue |
| 8 | M | 5 | V+ | White |
| 9 | L | 4 | I+ | Yellow |
| 10 | K | 4 | V+ | Red/black |
| 11 | J | 3 | I+ | Pink |
| 12 | H | 3 | V+ | Red/blue |
| 13 | x(lowercase) | 2 | I+ | Blue |
| 14 | y(lowercase) | 2 | V+ | Red |
| 15 | FF | 1 | I+ | Light blue |
| 16 | EE | 1 | V+ | Red/gray |
| 22 | z(lowercase) | 6 | V- | Purple |
| 23 | j(lowercase) | 6 | I- | Black |
| 24 | i(lowercase) | 5 | V- | Green |
| 25 | h(lowercase) | 5 | I- | Green/brown |
| 26 | g or G | 4 | V- | White/red |
| 27 | f or F | 4 | I- | Yellow/red |
| 28 | e(lowercase) | 3 | V- | White |
| 29 | d(lowercase) | 3 | I- | Yellow/light blue |
| 30 | AA | 2 | V- | Orange |
| 31 | BB | 2 | I- | Brown |
| 32 | GG | 1 | V- | Pink |
| 33 | HH | 1 | I- | Gray |
|  |  |  |  |  |
| 50 Pin D sub Connector | 55 way Circular Connector | Heater Number | Function | Approximate color |
| 47 | v(lowercase) | 2 | N.A. | Small Cable Red |
| 48 | w(lowercase) | 2 | N.A. | Small Cable Black |
| 49 | CC | 1 | N.A. | Small Cable Red |
| 50 | DD | 1 | N.A. | Small Cable Black |

Table1: Letters and functions highlighted in Yellow might be different, please check.

The temperature sensors are then connected to 25-pin connectors to the lakeshore channel selector:

A picture containing table

Description automatically generated

The RTDs are related to the lakeshore channels and sensor series number according to the table2(05/10/2021). Some of these sensors have been calibrated down to 1K and other only to 10K.

|  |  |  |  |
| --- | --- | --- | --- |
| Lakeshore channel | RTD | Sensor Series number | Calibration Temp (K) |
| 5 | 1 |  | 1 |
| 6 | 2 | X167618 | 1 |
| 7 | 5 | X167616 | 10 |
| 8 | 6 | X167627 | 10 |
| 9 | 4 | X167626 | 10 |
| 10 | 3 | X167617 | 10 |

Table 2: Sensor series and lakeshore channel number.

Heater Connection:

|  |  |
| --- | --- |
| Heater Connection | Resistance (Ohm) |
| H1 connected to sample heater | 100 |
| H2 connected to warm-up heater | 50 |

Table 3: heater connection (05/10/2021)

Heater resistance at Room temp=111 Ohm

Heater resistance at 12K: 124 Ohm

Cryostat internal sensor setting for lakeshore:

DT-470 2.5V silicon diode

**VNA receivers**

Diagram

Description automatically generated