ALSu DCCT Test Setup & Procedure Checklist

This checklist guides the technician through the physical setup, instrument configuration, and software execution required to test the ALSu DCCT modules.

1. Pre-Test Preparation

- The testing laptop is connected to the local instrument network (ensure IPs `10.0.142.x` and `10.0.143.x` are reachable).
- The Python virtual environment is activated.
- Required packages from `requirements.txt` are installed.

2. Hardware Power-Up

Ensure all laboratory instruments are turned ON:

- Kepco Power Supply
- Rigol DP800 Series Power Supply
- Rigol DG4000 Series Signal Generator
- Tektronix DPO4000/MSO4000 Series Oscilloscope
- Keysight 34461A or Keithley 2100 Digital Multimeter (DMM)
- Differential Probes for Oscilloscope

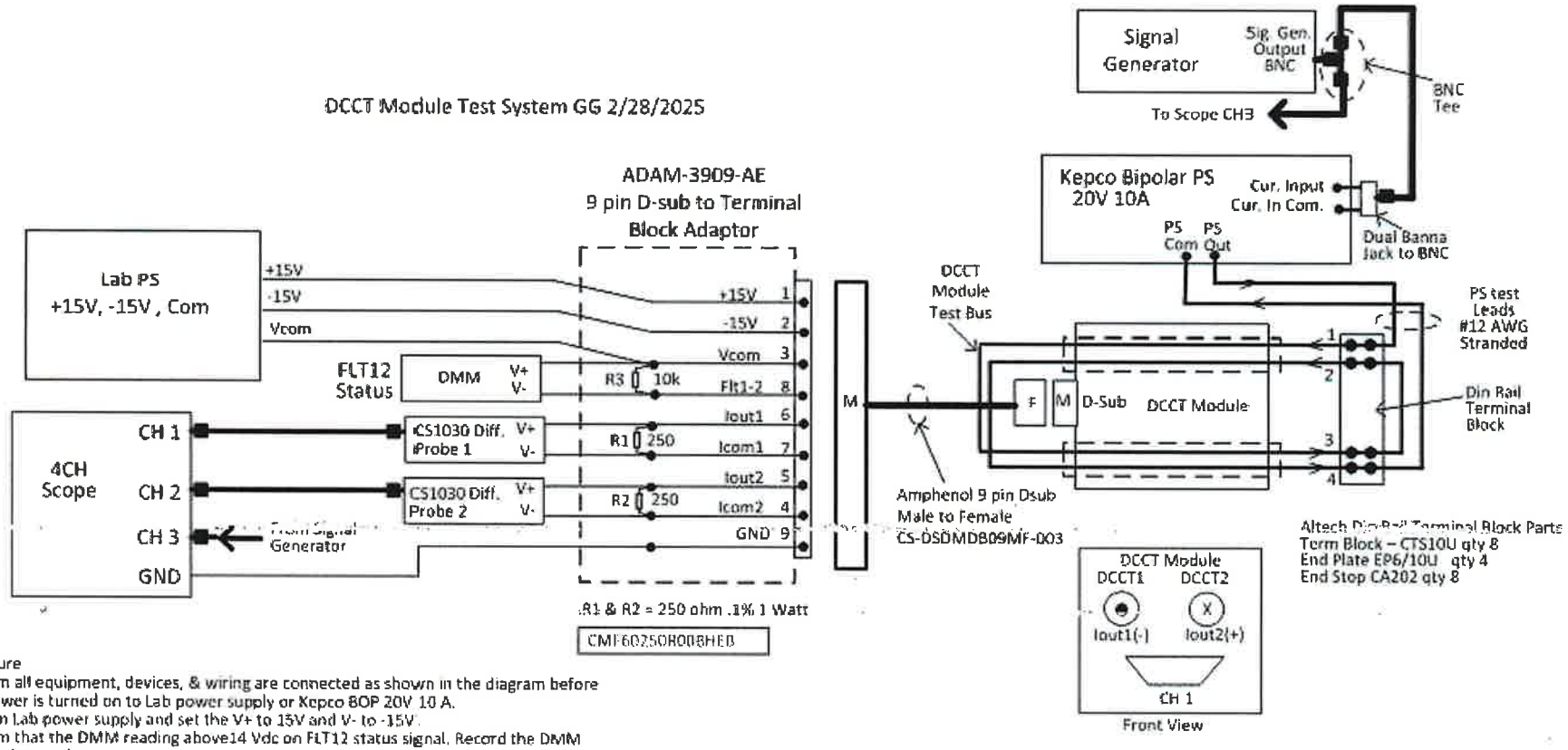
3. Physical Connections & Wiring

- **GRAY** CT conductors are routed and secured to the **GRAY** terminal blocks.
- **BLUE** conductors are routed and secured to the **BLUE** terminal blocks.
- Conductors loop through the DCCT only once, and wire is at least 2" away from rear of DCCT Chassis (Past the yellow spacer sticks)

4. Manual Instrument Configuration

While the script handles most parameters, the following must be set manually prior to execution:

DCCT Module Test System GG 2/28/2025



Test Procedure

- Confirm all equipment, devices, & wiring are connected as shown in the diagram before any power is turned on to Lab power supply or Kepco BOP 20V 10 A.
- Turn on Lab power supply and set the V+ to 15V and V- to -15V.
- Confirm that the DMM reading above14 Vdc on FLT12 status signal. Record the DMM reading in traveler.
- Set the Kepco power supply output + 1 amp DC.
- Lower the -15V on the Lab power supply until the FLT12 status signal on the DMM goes below 1 Vdc. Record DMM reading in traveler. Restore the -15V on the Lab power supply.
- Set the Kepco power supply output - 1 amp DC.
- Lower the -15V on the Lab power supply until the FLT12 status signal on the DMM goes below 1 Vdc. Record DMM reading in traveler. Restore the -15V on the Lab power supply.
- Setup Scope CH 1 & 2 are set to 0.1 V/Div. and 50 msec/Div. for the two probes and CH 3 is set to 10 V/ Div.
- Turn on signal generator and set it up for sin wave with an amplitude of +10 V to -10 V at a 10 Hz frequency. Use the scope CH 3 to confirm the waveform amplitude.
- Turn on the two probes and make sure they are connected as shown in the diagram.
- Turn on the Kepco power supply and confirm the CH1 & CH2 have a sine wave signals with the CH21 in opposite polarity of CH1 & CH3.
- Take a Snapshot on the scope and transfer data to traveler.
- Record DCCT module serial number on traveler.
- Turn off signal generator and Kepco power supply.
- Finish traveler – make sure all data is recorded.

ALSu_DCCT_Testing

This repository contains an automated Python-based testing suite for ALSu DCCT (Direct Current Current Transformer) Modules. This suite controls various lab instruments via PyVISA to perform rigorous fault and current tests, analyzes the acquired waveforms, and automatically generates comprehensive PDF test reports.

Features

- **FLT12 Fault Testing:** Tests the FLT12 fault output status (an open emitter output) by decrementing the -15V supply in 250mV steps and measuring the voltage to verify assertion and de-assertion thresholds.
- **AC Current Testing:** Drives an AC signal into a Kepco supply to push current through the DCCT. It verifies that Channel 1 and Channel 3 are matched in phase, Channel 2 is 180 degrees out of phase, and output signals meet valid amplitude levels.
- **Waveform Analysis:** Unpacks ADC waveform data from the oscilloscope and calculates frequency and phase shift using Fast Fourier Transform (FFT).
- **Automated PDF Reporting:** Generates a complete PDF report with ReportLab, detailing pass/fail statuses, technician demographics, and embedded waveform plots.
- **Modular Instrument Control:** Uses PyVISA utilities to connect to and control instruments via USB or Ethernet/IP connections.

Hardware Requirements

The testing suite is designed to interface with the following lab equipment:

- **Power Supply:** Rigol DP800 Series (e.g., DP832, DP831, DP822, DP811).
- **Signal Generator:** Rigol DG4000 Series.
- **Oscilloscope:** Tektronix DPO4000 or MSO4000 Series.
- **Digital Multimeter (DMM):** Keysight 34461A or Keithley 2100 Series.
- **Additional PSU:** Kepco Power Supply (driven by the signal generator for AC current testing).
- **Other Equipment:** Other equipment may be substituted by creating a new instrument library using identical commands to others in the library, for ease of compatibility. See, for

```
└── raw_data/           # Subdirectory for raw test data
    ├── *.csv           # Technician info, raw channel data, fault data
    └── *.png           # Saved waveform plots
```

Installation

1. Clone the repository:

```
git clone [https://github.com/capotostobnl/ALSu_DCCT_Testing.git]
(https://github.com/capotostobnl/ALSu_DCCT_Testing.git)
cd ALSu_DCCT_Testing
```

2. Create and activate a virtual environment (optional but recommended):

```
python -m venv .venv
source .venv/bin/activate  # On Windows use: .venv\Scripts\activate
```

3. Install the required Python packages:

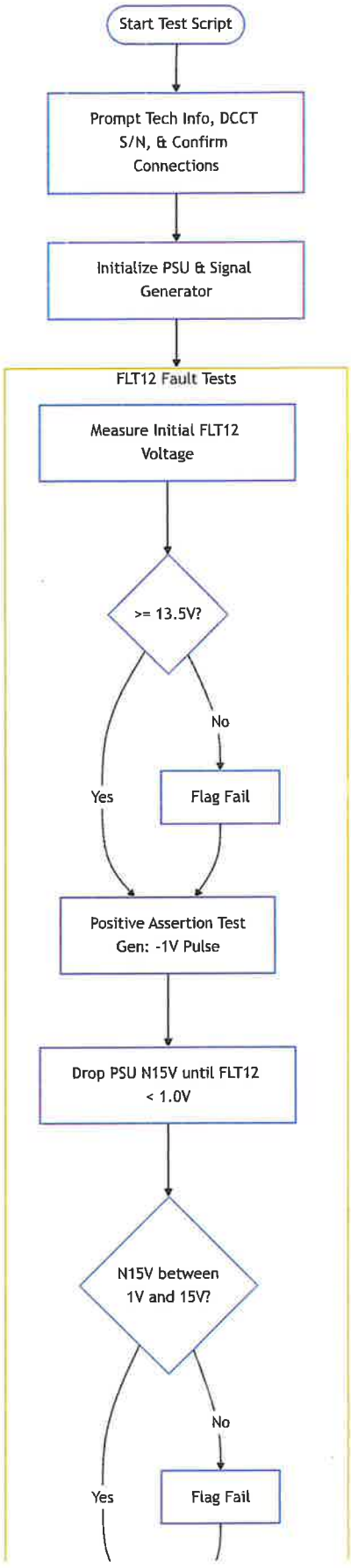
```
pip install -r requirements.txt
```

Configuration

Before running the tests, ensure your instrument IP addresses and USB VISA resource strings are correctly configured at the top of `main.py` :

```
# ***********************************************************************
# ******Set Insturment IP Addresses******
PSU_IP_ADDRESS = "10.0.142.1"  # Set PSU IP Address here
SIG_GEN_IP_ADDRESS = "10.0.142.2"  # Set signal generator IP Address here
SCOPE_IP_ADDRESS = "10.0.142.3"  # Set oscope IP Address
# DMM_ADDRESS = "USB0::0x05E6::0x2100::8020357::INSTR"
DMM_ADDRESS = "10.0.143.23" # Set DMM Address here
# ***********************************************************************
```

If needed, change object instantiation below the address settings, as well.


Start Test Script
Prompt Tech Info, DCCT S/N, & Confirm Connections
Initialize PSU & Signal Generator
FLT12 Fault Tests
Measure Initial FLT12 Voltage
>= 13.5V?
No
Yes
Flag Fail
Positive Assertion Test Gen: -1V Pulse
Drop PSU N15V until FLT12 < 1.0V
N15V between 1V and 15V?
No
Yes
Flag Fail


End

files) and waveform plots (`.png` files) are also saved in a `raw_data` subdirectory for archival purposes.

DCCT Test Results for DCCT S/N: DCCT-M-B-0011

Technician: Mike, Life #: 26357

Test performed: 03/16/25, 08:45 PM

Raw Serial Number/Sticker Data: DCCT-M-B-0011-70000000006-BZ20130002-HBA20030148-222110
30016-BZ22020423-HBA22170043-CTP-6303-50-A

FLT12 Fault Signal 1 and 2 Test Results

Test	Value	Status
FLT12 Overall Testing	N/A	Pass
FLT12 Positive Assertion	N/A	Pass
FLT12 Negative Assertion	N/A	Pass
FLT12 De-Assertion	N/A	Pass
FLT12 Initial Voltage	14.77 V	Pass
FLT12 Positive Fault Voltage	-0.00 V	Pass
FLT12 Negative Fault Voltage	-0.00 V	Pass

Pass/Fail Threshold Voltage for FLT12 Initial Voltage: >14.3V
Pass/Fail Threshold Voltage for FLT12 Fault Voltage: 1V
FLT12 Fault testing carried out with +/-1A current through DCCT

Test Current for IOUT Measurement: +/-10A at 10Hz Sinusoidal
20Vpp sine into Kepco current control input)

DCCT Test Results for DCCT S/N: DCCT-M-B-0011

Technician: Mike, Life #: 26357

Test performed: 03/16/25, 08:41 PM

Raw Serial Number/Sticker Data: DCCT-M-B-0011-70000000006-BZ20130002-HBA20030148-222110 30016-BZ22020423-HBA22170043-CTP-6303-50-A

FLT12 Fault Signal 1 and 2 Test Results

Test	Value	Status
FLT12 Overall Testing	N/A	Pass
FLT12 Positive Assertion	N/A	Pass
FLT12 Negative Assertion	N/A	Pass
FLT12 De-Assertion	N/A	Pass
FLT12 Initial Voltage	14.77 V	Pass
FLT12 Positive Fault Voltage	-0.00 V	Pass
FLT12 Negative Fault Voltage	-0.00 V	Pass

Pass/Fail Threshold Voltage for FLT12 Initial Voltage: >14.3V
Pass/Fail Threshold Voltage for FLT12 Fault Voltage: 1V
FLT12 Fault testing carried out with +/-1A current through DCCT

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