

# **AnalysisProgram**

## **User Guide**

(Version 1.6)

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#### Version Control

|     |                  |   |
|-----|------------------|---|
| 1.0 | October 27, 2015 | First program release<br>Supporting JBer/ OpticalBench/ SLT Board/ EV Board/ Keithley Multimeter/<br>Test Equity Chamber 107/205H /Agilent DSA Scopes/ Korad Power Supply<br>KA3005P/ KA3305P |
| 1.1 | November 13,2015 | Fixes to support Test Equity 205H at cold temperatures<br>Improvement in the frequency measurement  |
| 1.2 | December 1,2015  | Support to include current measurement with the existing Korad equipment  |
| 1.3 | January 8, 2016  | Update with cleaner print out<br>Program Stability  |
| 1.4 | January 27, 2016 | Plot Data support to automatically plot data for X/Y/Z Measurement to be<br>used for EM Channel and KIC sampling purposes   |
| 1.6 | April 1, 2016    | Ability to do voltage scaling with SLT 4.0 board fix the issue on the network<br>copy (done on version 1.5)   |

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## Overview

AnalysisProgram is created to assist engineers in characterizing Keyssa KSS Product families across Mechanical Misalignment, temperature, humidity, voltage, as well as register characterization. This program is written such that user will have to specify only the search criteria that is required for them.

## Program Structure

Structure of the program is developed in considering each equipment's time constraints such as soak time, settling time.

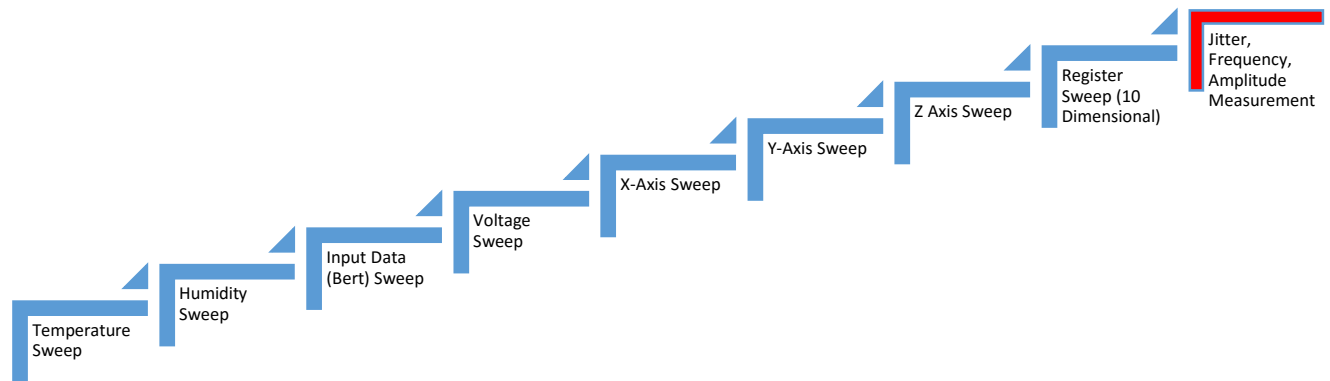


Figure 1: Indicating the Hierarchical Calling Structure of AnalysisProgram

AnalysisProgram is modular based, which depends on individual libraries for each instrument and operation, user has the option of executing only modules specific to their needs.

## Installation Requirement

In order to execute AnalysisProgram.py, needs to install the following or confirm the following python libraries have been installed.

1. python version 2.7 (Version 3.x is not compatible with some of the instrument drivers.
2. cython version 0.23..1 (Required for HID Calling objects MCP2210)
3. enum34 version 1.0.4
4. hid version 0.1.1 (Required for HID Calling objects MCP2210)
5. mcp2210 version 0.1.4
6. numpy version 1.9.2
7. pyserial version 2.7
8. PyVisa version 1.7 (Required for all Visa Drivers)

Addition to this the user will need to install required drivers for APT (Thorlabs) and National Instruments Visa. To assist people in finding some of these drivers required installation have been placed under

[\\Keyssa\\_NAS\Documents\Installation\\_Software\\_lab\InstallationRequirement](\\Keyssa_NAS\Documents\Installation_Software_lab\InstallationRequirement)

## Executing AnalysisProgram

AnalysisProgram.py can be executed from either command line or by double clicking, it is advised to execute using command line.

### Option 1 Execution (Default)

**python AnalysisProgram.py** this is the default execution method where the program will read from input.txt file and create Output **<current\_date>.csv**

### Option 2 Execution (Specify input and output file)

**python AnalysisProgram.py -i <input\_file> -o <output\_file>** This allows the user to specify any input file and output file of the choice, this option can be used to run multiple AnalysisProgram using a simple batch file.

### Option 3 Execution (Specify output file acronym)

**python AnalysisProgram.py -n <Acronym>** this allows the user to specify the output file acronym, i.e. the output file will be **<Acronym>\_<current\_date>.csv**

### Option 4 Confirm Version of Program

**python AnalysisProgram.py -v** this allows the user confirm the version of the program

### Option 5 Create Charts on Already run data files

**python AnalysisProgram.py -p** this allows the user to create plots on files automatically created.

## Input File Options

Input file is used by the program to setup and control the AnalysisProgram, if a variable is not needed either comment it out or delete it, anything that begins with the '#' is treated as a comment.

Refer to other Options for any needed instrument control as well

## Board Configuration

Board configuration is used to setup SLT Board and EV Board if using MCP2210/PIC Programming, if using Pin Strap mode this information not need to be specified.

Syntax for specifying board configuration in the input file.

```
__BOARD_CONFIG_BEGIN__  
##Required Selections go under here  
__BOARD_CONFIG_END__
```

### SLT Board

If using SLT board in a pair, maximum two separate boards can be specified.

```
#<Board_Name>,<Type>,<Comport>,<ChipAssignment:Lane:A1>,<ChipAssignment:Lane:A2>  
<Board_Name> -- Can be any alphanumeric string to indicate the name
```

<Type> -- If using SLT board specify SLTBoard as type  
 <Comport> -- Find the correct mapping in the Device Manager to confirm comport that is enumerated.  
 <ChipAssignment:Lane:A1> --Specify what type of connection it is either RX or TX and the corresponding lane in USB configuration there is 2 bidirectional lanes for A1 chip on the SLT Board  
 <ChipAssignment:Lane:A2> --Specify what type of connection it is either RX or TX and the corresponding lane in USB configuration there is 2 bidirectional lanes for A2 chip on the SLT Board

#### Sample Board Implementation

Board\_A,SLTBoard,COM60,TX:1,RX:2

Board\_B,SLTBoard,COM12,TX:2,RX:1

### EV Board

If using EV Board in a pair only specify per MCP2210 (i.e. two EV boards in single MCP2210)

#<Board\_Name>,<Type>,<Comport>,<ChipAssignment:Lane:A1>,<ChipAssignment:Lane:A2>

<Board\_Name> -- Can be any alphanumeric string to indicate the name

<Type> -- If using HID Board i.e. EV boards specify it as HIDBoard

<Comport> -- N/A

<ChipAssignment:Lane:A1> --Specify what type of connection it is either RX or TX and specify 1 for the lane since there is only one lane.

<ChipAssignment:Lane:A2> -- Specify what type of connection it is either RX or TX and specify 1 for the lane since there is only one lane.

#### Sample Board Implementation

HIDBoardSet,HIDBoard,N/A,RX:1,TX:1

## Optical Bench Configuration

Optical Bench configuration is used to control the Thorlabs Optical Bench Motors, if X/Y/Z Alignment is not desired either comment it or delete it.

Syntax for specifying Optical Bench in the input file.

\_\_OPTICAL\_BENCH\_BEGIN\_\_

##Required Selections go under here

\_\_OPTICAL\_BENCH\_END\_\_

#<MotorType>,<MotorIdentification>,<StartPoint>,<EndPoint>,<StepSize>

<MotorType> -- Name of the Motor specify either XAxis, YAxis or ZAxis

<MotorIdentification> -- Unique Identification for each Thorlabs Motor

<StartPoint> -- Relative Start point

<EndPoint> -- Relative End point

<StepSize> -- Step Size for each increment

#### Sample Optical Bench Implementation

XAxis,83860486,-0.5,0.5,0.5

YAxis,83860484,-0.5,0.5,0.5

ZAxis,83860488,0,1.00,0.5

Optical Bench can be set to predefined set point in the beginning of the program by specifying the following syntax as well.

\_\_OPTICAL\_BENCH\_START\_POSITIONS\_BEGIN\_\_

X\_START\_POS,14.0

Y\_START\_POS,7.0

Z\_START\_POS,5.0

\_\_OPTICAL\_BENCH\_START\_POSITIONS\_END\_\_

This above will set the XAxis/YAxis and ZAxis to preset 14.0/7.0 and 5.0 mm coordinate prior to the sweep.

## Temperature Sweep

Temperature sweep is supported currently for TestEquity 107 and 205H models.

Syntax for specifying Temperature Sweep in the input file.

```
__TEMPERATURE_BEGIN__
```

##Required Selections go under here

```
__TEMPERATURE_BEGIN__
```

#<Value>

<Value> -- Value is in Celsius and can specify -10 degrees to 105 degrees

*Sample Implementation*

```
__TEMPERATURE_BEGIN__
```

25

75

```
__TEMPERATURE_END__
```

## Humidity Sweep

Humidity sweep is supported only at 205H Test Equity Model due to hardware functionality.

```
__HUMIDITY_BEGIN__
```

##Required Selections go under here

```
__HUMIDITY_END__
```

#<Value>

<Value> -- Value is in Percentage to indicate the humidity, Humidity can only be performed at temperatures 10 Degrees to 85 Degrees

*Sample Implementation*

```
__HUMIDITY_BEGIN__
```

10

20

```
__HUMIDITY_END__
```

## Voltage Sweep

Voltage sweep is supported by at Korad family products

```
__VOLTAGE_BEGIN__
```

##Required Selections go under here

```
__VOLTAGE_END__
```

#<Value>

<Value> -- Value is in to indicate the voltage beware to connect the voltage to the board correctly

*Sample Implementation*

```
__VOLTAGE_BEGIN__
```

1.2

```
__VOLTAGE_END
```

## Input Data Sweep (Bert)

Input Data Sweep is currently supported in Agilent J-Bert N49xxx Product Families

```
__INPUT_DATA_BEGIN__
```

##Required Selections go under here

```
__INPUT_DATA_END__
```

#<Type><SubType><DataRate>

<Type> -- Can either be Default if using PRBS type, or can specify File if loading any pattern in the JBERT

<SubType> -- Either specify PRBS7, or specify the file name

<DataRate> -- Specify the Data rate i.e. 5000000000 for 5Gbps

*Sample Implementation*

\_\_INPUT\_DATA\_BEGIN\_\_

Default,PRBS7,5000000000

\_\_INPUT\_DATA\_END\_\_

## Register Sweep

Register Sweep allows to sweep across any writeable register in KSS Product chip, maximum allowed number of registers to be swept at same time is 10

\_\_REGISTER\_SWEEP\_BEGIN\_\_

##Required Selections go under here

\_\_REGISTER\_SWEEP\_END\_\_

#<ID>,<Name>,<ChipIdentification>,<StartPointWithMask>,<EndPointWithMask>,<StepSize>

<ID> -- Just an ID can be 0 to n number

<Name> -- Name of the Register primary purpose of this is for data logging

<ChipIdentification> -- Specify which chip Lane 1 TX Lane 1 RX

<StartPointWithMask> -- Specify the starting bit with masked for untyped register i.e. if starting four MSB bits from zero it would be 0000XXXX, but must be 8 bits

<EndPointWithMask> -- Specify the Ending bit with masked for untyped register i.e. if ending four MSB bits from zero it would be 0000XXXX, but must be 8 bits

<StepSize> -- Step size is an integer to indicate the size of the steps.

*Sample Implementation*

\_\_REGISTER\_SWEEP\_BEGIN\_\_

0,PATrim,TX:1,0x01,0000XXXX,1111XXXX,5

1,PATrim,TX:2,0x01,0000XXXX,1111XXXX,5

2,VCOTrim,RX,0x43,110000XX,110000XX,1

\_\_REGISTER\_SWEEP\_END\_\_

## Execution

Execution is where the actual measurements take place and needs to be specified, below is some of the available options for now.

\_\_EXECUTION\_ORDER\_BEGIN\_\_

##Required Selections go under here

\_\_EXECUTION\_ORDER\_END\_\_

##<Task>,<SubTask>

<Task> -- Task can be either Measuring DSA/Measuring on Multimeter...

<SubTask> -- SubTask is either Channel 1 dual (with crosstalk) or Channel 1 single

### Available Tasks and SubTasks

| Task               | SubTask    | Description   |
|--------------------|------------|---|
| Meas_DSA_Jitter    | CH1_DUAL   | Measure Jitter on Lane 1 while Aggressor Lane 2 is running (with Cross Talk)    |
|                    | CH2_DUAL   | Measure Jitter on Lane 2 while Aggressor Lane 1 is running (with Cross Talk)    |
|                    | CH1_SINGLE | Measure Jitter on Lane 1 with no aggressor                                      |
|                    | CH2_SINGLE | Measure Jitter on Lane 2 with no aggressor                                      |
| Meas_DSA_Frequency | CH1_DUAL   | Measure Frequency on Lane 1 while Aggressor Lane 2 is running (with Cross Talk) |
|                    | CH2_DUAL   | Measure Frequency on Lane 2 while Aggressor Lane 1 is running (with Cross Talk) |



|                           |             |   |
|---------------------------|-------------|---|
| <b>Meas_DSA_Amplitude</b> | CH1_SINGLE  | Measure Frequency on Lane 1 with no aggressor                                   |
|                           | CH2_SINGLE  | Measure Frequency on Lane 2 with no aggressor                                   |
|                           | CH1_DUAL    | Measure Amplitude on Lane 1 while Aggressor Lane 2 is running (with Cross Talk) |
|                           | CH2_DUAL    | Measure Amplitude on Lane 2 while Aggressor Lane 1 is running (with Cross Talk) |
|                           | CH1_SINGLE  | Measure Amplitude on Lane 1 with no aggressor                                   |
|                           | CH2_SINGLE  | Measure Amplitude on Lane 2 with no aggressor                                   |
| <b>Meas_Multimeter</b>    | Voltage     | Measure Voltage on the Keithley Multimeter                                      |
|                           | Temperature | Measure Temperature on the Keithley Multimeter                                  |

## Other Options

Other options are required for specific instrument control, some of these can be deleted or commented out for usage model

\_\_OTHER\_BEGIN\_\_

##Required Selections go under here

\_\_OTHER\_END\_\_

| Field Name                   | Required                                 | Options                                    | Description  |
|------------------------------|--|--|--|
| <b>DEVICE_FAMILY</b>         | Optional                                 | Any String name                            | Device family name for any future enhancement or data logging purposes not used currently  |
| <b>DATA_OUTPUT_DIRECTORY</b> | Mandatory                                | Directory Name                             | Specify where the output data will be stored   |
| <b>POWERSUPPLY_COMPORT</b>   | Voltage/<br>Power Cycling                | Comport of Power Supply i.e COM2           | Required if using external programmable power supply                                       |
| <b>POWER_CYCLE_DEVICE</b>    | Power Cycling                            | True/False                                 | Required if using Power Cycling between runs, also need to specify POWERSUPPLY_COMPORT     |
| <b>TEMPCHAMBER_COMPORT</b>   | Temperature / Humidity                   | Comport of Test Equity Temperature Chamber | Required if using Temperature / Humidity sweep   |
| <b>TEMPCHAMBER_SOAKTIME</b>  | Temperature / Humidity                   | Soak Time for temperature and humidity     | Soak Time if required for Temperature and Humidity suggestion is at least 10-15 minutes    |
| <b>DSA_IPADDRESS</b>         | Meas_DSA****                             | IP Address of DSA Scope                    | IP Address of the DSA required if performing any Jitter or Frequency measurement using DSA |
| <b>DSA_SETUP_FILE_1</b>      | Meas_DSA_Jitter                          | Setup File name in Scope                   | Setup file needs to be created for Lane 1 and store in scope this name needs to be defined |
| <b>DSA_SETUP_FILE_2</b>      | Meas_DSA_Jitter                          | Setup File name in Scope                   | Setup file needs to be created for Lane 2 and store in scope this name needs to be defined |
| <b>DSA_AVERAGE_COUNT</b>     | Meas_DSA_Frequency<br>Meas_DSA_Amplitude | 1-4096                                     | Average count for sampling Frequency and Amplitude Measurement                             |
| <b>DSA_RETRY</b>             | Meas_DSA_Jitter                          | 1-n  | Number of times to retry when unable to capture a jitter due to delay or high jitter       |
| <b>MULTI_ADDRESS</b>         | Meas_Multimeter                          | USB Address of Keithley Multimeter         | Required for making measurements using Multimeter either voltage or temperature            |
| <b>READ_REPLICA_OFFSET</b>   | Optional                                 | True/False                                 | Read Replica offset status information for every run from the KSS chip                     |
| <b>READ_EYE_HEIGHT</b>       | Optional                                 | True/False                                 | Read Eye height status information for every run from the KSS chip                         |
| <b>READ_UPPER_SET</b>        | Optional                                 | True/False                                 | Read UpperSet Register status information for every run from the KSS chip                  |

|                           |          |            |  |
|---------------------------|----------|------------|--|
| <b>READ_SUMM_OFFSET</b>   | Optional | True/False | Read Summary Offset status information for every run from the KSS chip         |
| <b>READ_REFERENCE_SET</b> | Optional | True/False | Read Reference Set Register status information for every run from the KSS chip |
| <b>READ_GAIN_SET</b>      | Optional | True/False | Read GainSet status information for every run from the KSS chip                |
| <b>PLOT_DATA</b>          | Optional | True/False | Create Plots for executed X/Y/Z Measurements                                   |

## Potential Debug Issues/Solutions

Insure all devices under usage are powered up and connected

1. Scope is not responding:  
Check the IP Address of the scope from command prompt and try to ping it from a system, and confirm there is network connection  
Check to see if the Windows in the Scope is hung up, if so please restart the scope
2. Unable to communicate with Motor or APT Failure  
Close the program and invoke APT User in the PC, confirm all three motors are seen and make sure they are calibrated (this needs to be done where there is a power reset to the motor), remove the fixed axis SLT 3 board to avoid any premature collision
3. Unable to read register or set register  
Make sure the boards have been programmed with the PIC Firmware, and if needed do reprogram them using MPLAB IDE, in order to use PIC there must be "No" Strap present in the board.
4. No Jitter on Single Lane but present on dual  
Confirm that RX:1 is connected to Channel 1-3 and RX:2 is connected to Channel 2-4
5. Scope setup file is corrupted or reading same result on both lanes  
There could be a corruption due to saving file name over, if so just recreate the setup file.
6. Program shows -1 while scope shows an eye.  
This problem can occur due to unable to capture jitter or because of timing in visa driver, if the issue is due to visa driver the program has been updated to retry, otherwise confirm there is a reading on the TJ and not just an eye.