# Sequence File Syntax

- File extension - **.lseq**
- Preferred text editor – Sublime Text

## General Format

- Lines starting with **#** are considered as comments. No action will be taken on these.
- Leaving blank lines is allowed.
- Avoid any tabs or indentation in the scripts.
- All keywords must be in FULL CAPS.

- All actionable commands have the following syntax –
  `<action> <variable> <param1, param2, …>`

- Only spaces must be used to separate words (and numbers) in actionable commands. No other punctuation should be used.

## Commands Description

- Each *action* accepts certain *variables*. *Params* list depends on the *action* and *variable* chosen.
- Each *action* is described in the following subsections.

### SET

- Drives a *variable* to a setpoint.
- Variables – `TEMP, FIELD, THETA, CURRENT, AC-SINGLE, DC-SINGLE`
- Params - `<setpoint> RATE <rate>`
- Examples –
  - `SET TEMP 300 RATE 6`
    - Set temperature to 300 **K** at a rate of 6 **K/min**
    - Do not exceed a rate of 10 K/min
  - `SET FIELD 1000 RATE 100`
    - Set field to 1000 **Oe** at a rate of 100 **Oe/s**
    - Never exceed a rate of 200 Oe/s
  - `SET THETA 90 RATE 1`
    - Set theta to 90 **degrees** at a rate of 1 **degree/s**
    - Never exceed a rate of 1 degree/s
  - `SET CURRENT 1.5e-6`
    - Set the current to $1.5\times10^{-6}$ **A**
    - Note that decimal as well as exponent representation is allowed for current setpoint.
  - `SET AC-SINGLE`

        - Configures instruments to perform single-shot measurements using the lock-in amplifier(s) (AC Setup settings).
        - Single measurement is performed every time the `START MEASURE SINGLE` line appears in the code.
    - `SET DC-SINGLE`
        - Configures instruments to perform single-shot measurements using the voltmeter(s) (DC Setup settings).
        - Single measurement is performed every time the `START MEASURE SINGLE` line appears in the code.

**WAIT**

- Halts the sequence execution until setpoint of the variable is reached. Additionally delays proceeding of the sequence by specified time.
- Variables - `TEMP, FIELD, THETA, MEASURE`
- Params - *<delay time>*
- Examples –
    - `WAIT TEMP 600`
        - Waits until the temperature setpoint is reached. Then waits additional 600 **seconds** before proceeding to next lines.
        - Similar operation for FIELD and THETA
    - `WAIT MEASURE 600`
        - There is not setpoint to be reached here. This is just a provision to ensure that the sequence halts for a while until all instruments are properly initialized and ready to start meaningful measurements.
        - Halting at least 20 seconds after starting any measurement is recommended.

**SCAN – END SCAN**

- Starts a loop (something like a for loop) over a variable.
- Variables - `TEMP, FIELD, THETA, CURRENT`
- Params - *<start point> <stop point> <number of points>* RATE *<rate>*
- Examples –
    - ```
      SCAN FIELD 0 90000 10 RATE 100
      WAIT FIELD 10
      # Additional steps to be executed in the loop
      END SCAN
      ```
        - Start a scan over field. Fields setpoints loop over 0, 10000 Oe, ..., 90000 Oe (10 points, linearly spaced, from 0 to 90000).
        - WAIT command right after the SCAN command is recommended, to allow reaching the setpoint of the current loop.
        - Do not forget the END SCAN command at the end of the loop.
- Note – Nested loops are NOT supported.
      ```

## START

- Start a measurement.
- Variables – `MEASURE, MEASURE SINGLE, IV`
- Params – Not applicable
- Examples –
    - `START MEASURE`
        - Starts continuous measurements based on the hardware settings (AC/DC system). Sequence execution proceeds to the next lines immediately. Measurements continue right until a STOP MEASURE command appears.
    - `START MEASURE SINGLE`
        - Single-shot measurement taken based on the hardware settings (AC/DC system) defined through the `SET AC-SINGLE` or `SET DC-SINGLE` commands.
    - `START IV`
        - Start an IV measurement, based on settings specified in the program. The IV plotting sub-VI pops up and closes after the IV measurement is complete. Sequence proceeds only after the IV measurement is complete.

## STOP

- Stop the measurements started with the START MEASURE command.
- Variables – `MEASURE`
- Params – Not applicable
- Example –
    - `STOP MEASURE`

## NEWFILE

- Create a new file for data accumulation. All data is appended in this file, over multiple START MEASURE – STOP MEASURE instances, until another file is created. File created has the chosen extension (default is .csv). A timestamp is also appended in the filename before the extension, in the format _MMDD_hhmm.
- Variables – Not applicable
- Params – *<filename without extension>*
- Examples –
    - `NEWFILE test_datafile`
        - Creates a new datafile with the name test_datafile_1231_2359.csv assuming .csv extension is chosen, and file was created on December 31 at 11:59 PM.