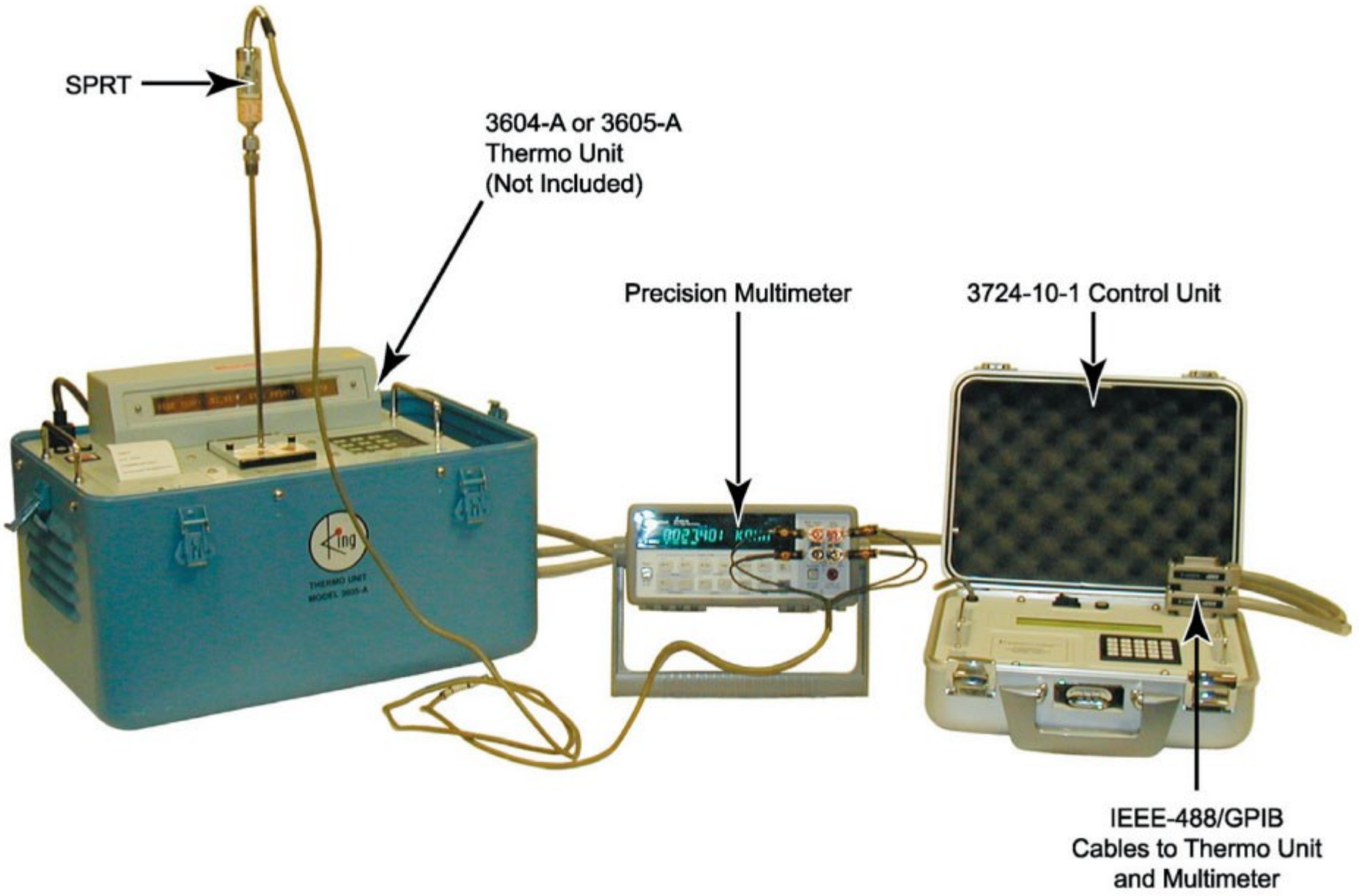
Introduction

By: Guy Soffer

LEGACY STATION CONFIGURATION



NEW STATION CONFIGURATION

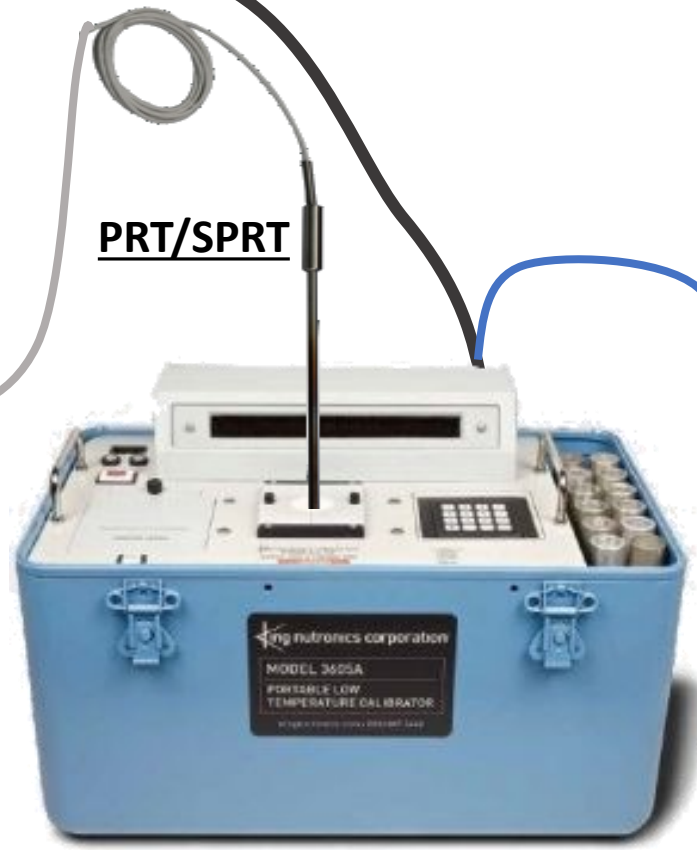
Optional

GPIB cable

DMM

Agilent 34401A

PRT/SPRT



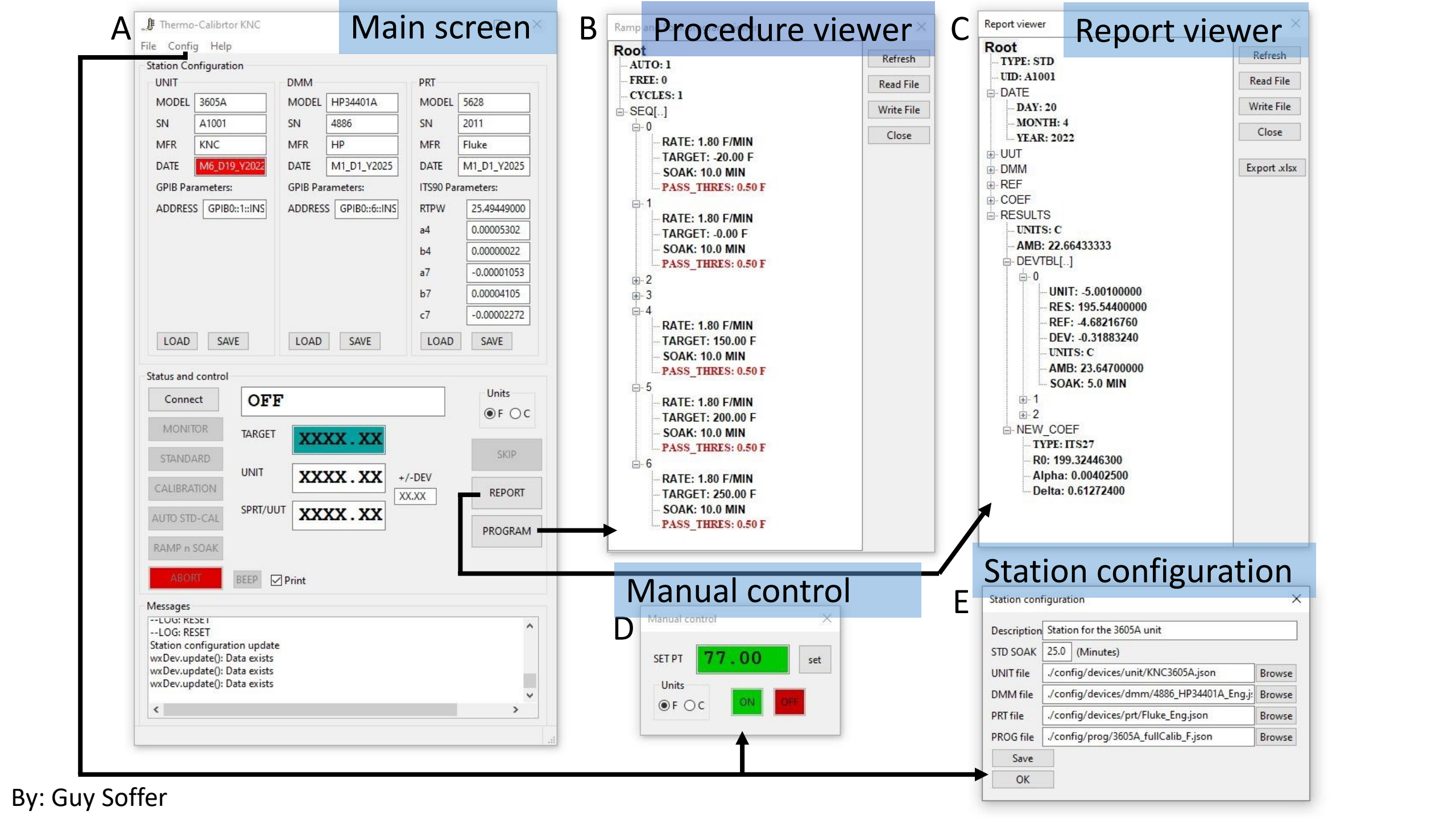
UNIT

Any computer with NI-GPIB-USB-HS

Replaces the legacy 3714

By: Guy Soffer

Thermal-Calibrator Application Overview



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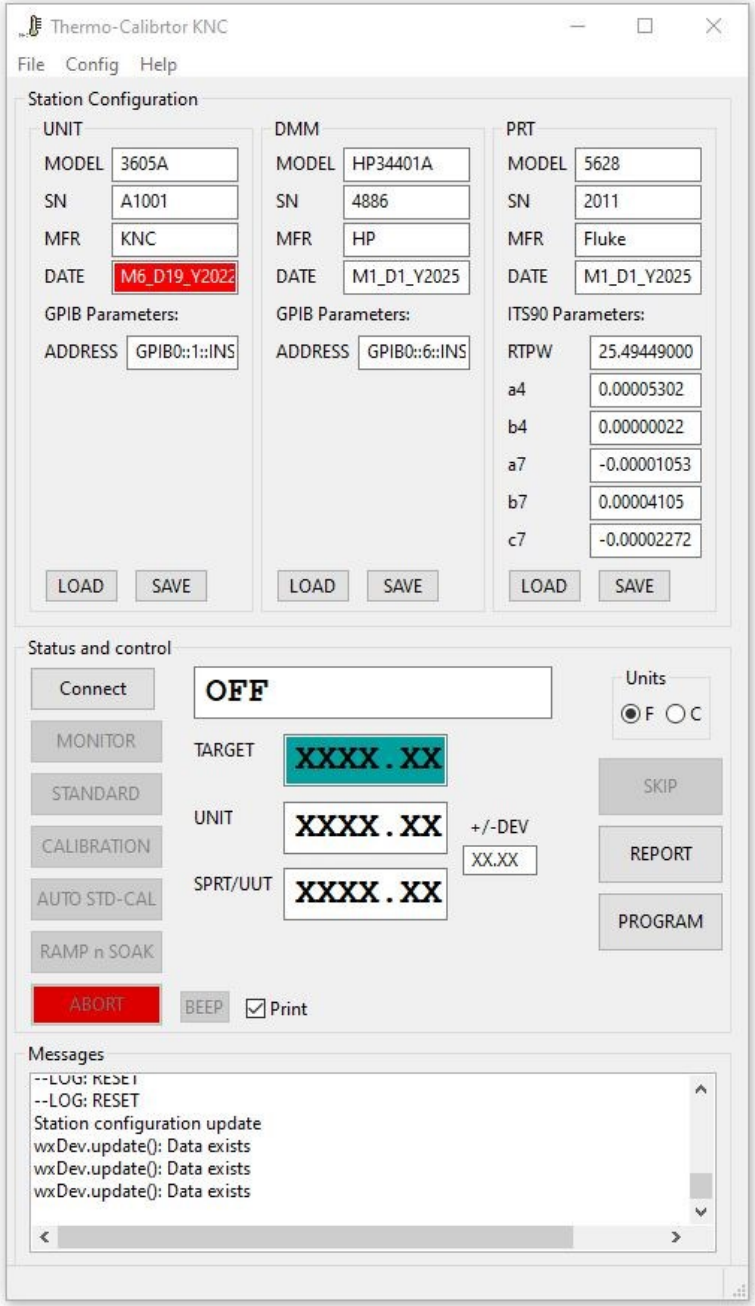
Menus to access files and tools

Station configuration

Real time status and control

Real time messages for debug



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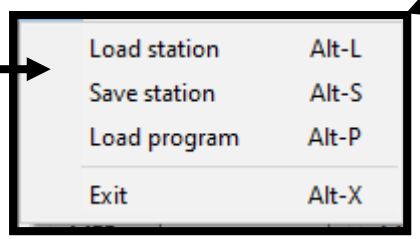
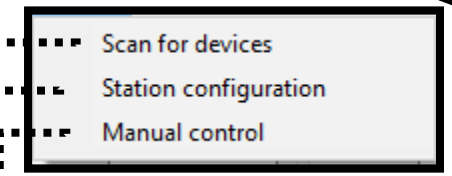
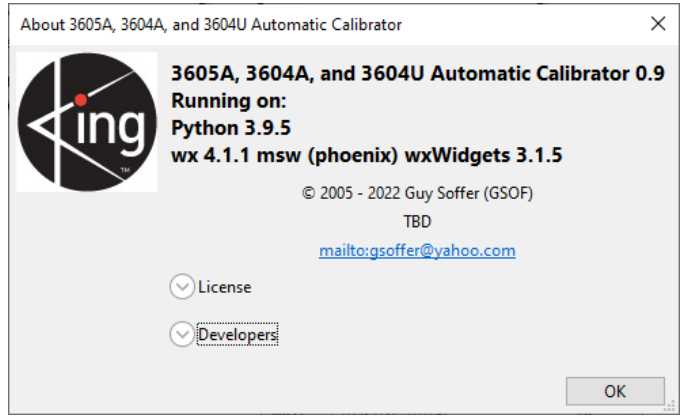
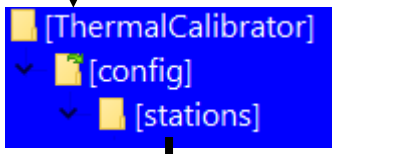
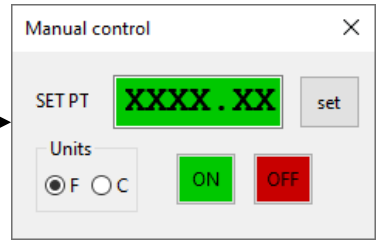
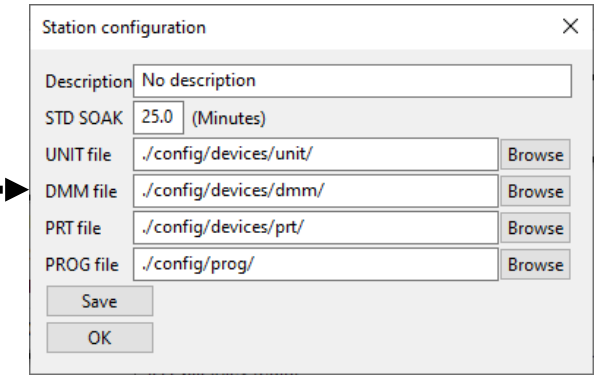


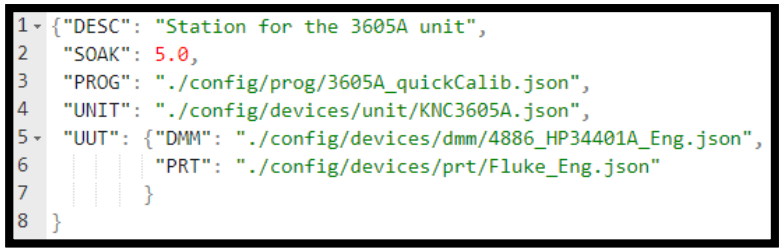




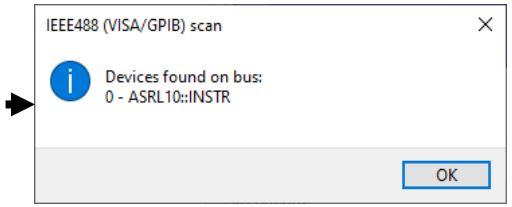








```
{"DESC": "Station for the 3605A unit",
 "SOAK": 5.0,
 "PROG": "./config/prog/3605A_quickCalib.json",
 "UNIT": "./config/devices/unit/KNC3605A.json",
 "UUT": {"DMM": "./config/devices/dmm/4886_HP34401A_Eng.json",
         "PRT": "./config/devices/prt/Fluke_Eng.json"
        }
}
```



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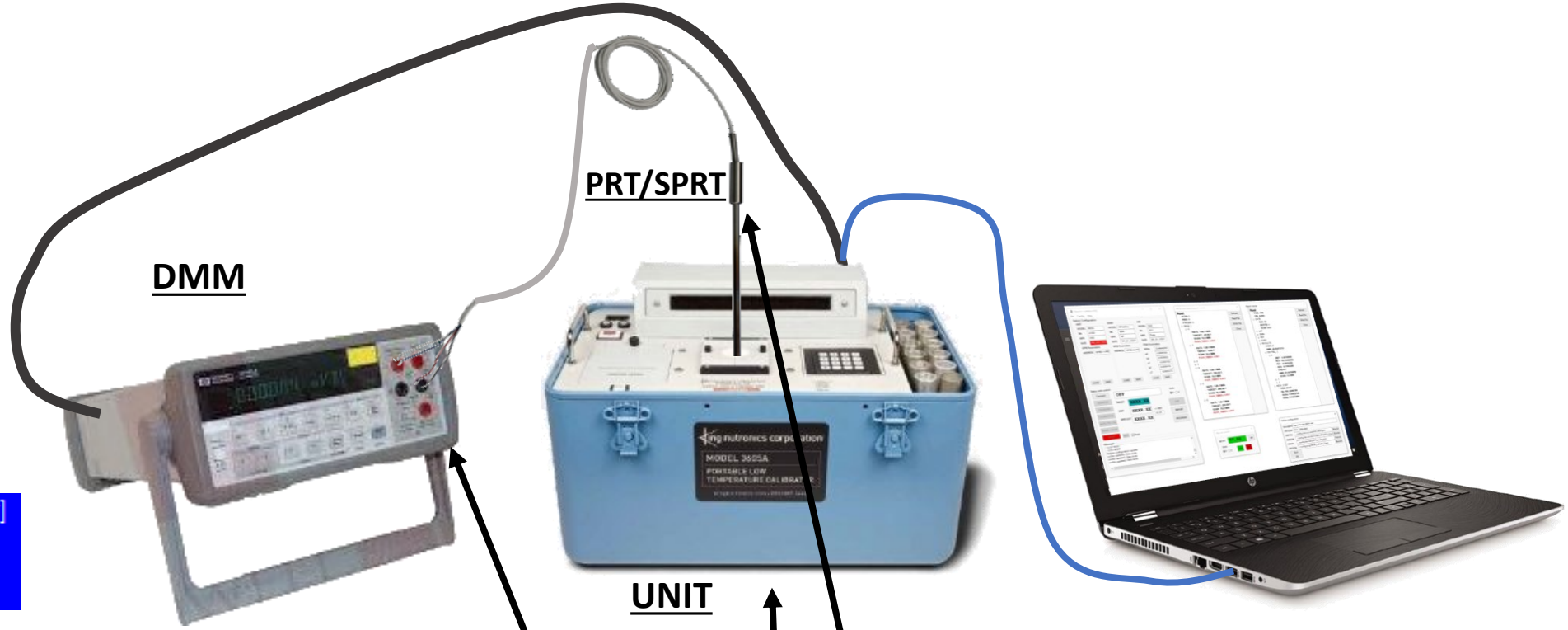
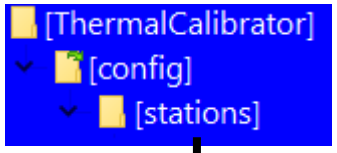
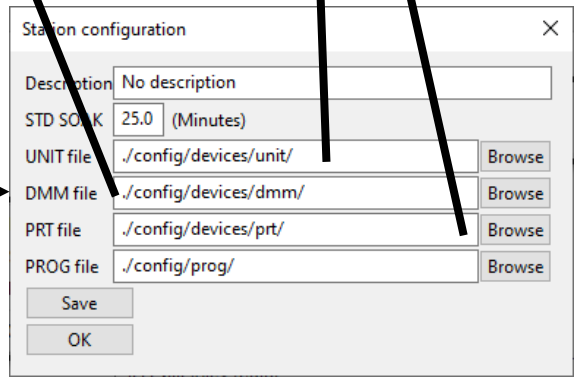
STATION CONFIGURATION





Station configuration file

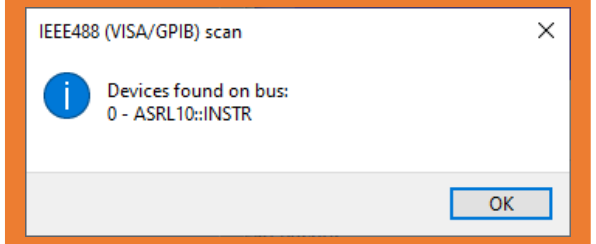
```
{"DESC": "Station for the 3605A unit",
 "SOAK": 5.0,
 "PROG": "./config/prog/3605A_quickCalib.json",
 "UNIT": "./config/devices/unit/KNC3605A.json",
 "UUT": {"DMM": "./config/devices/dmm/4886_HP34401A_Eng.json",
         "PRT": "./config/devices/prt/Fluke_Eng.json"
         }
}
```



Station configuration editor / display

Note:

Device detection tool



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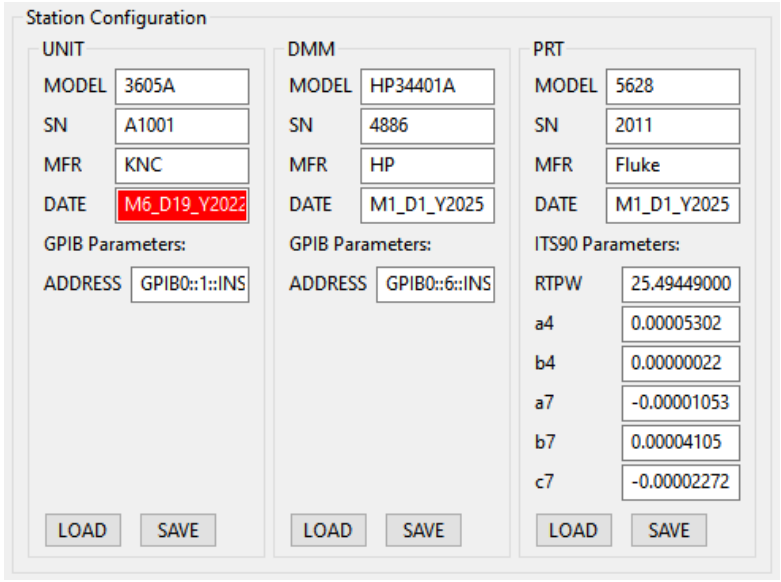

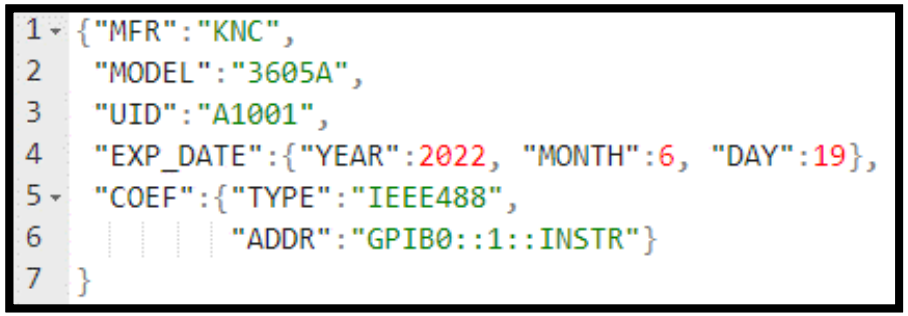

```
{"MFR":"KNC",
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 "UID":"A1001",
 "EXP_DATE":{"YEAR":2022, "MONTH":6, "DAY":19},
 "COEF":{"TYPE":"IEEE488",
         "ADDR":"GPIB0::1::INSTR"}
}
```
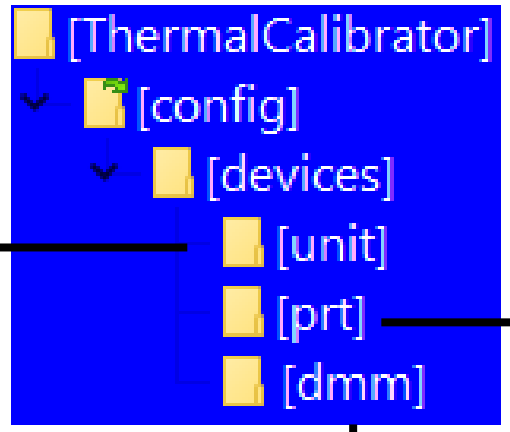
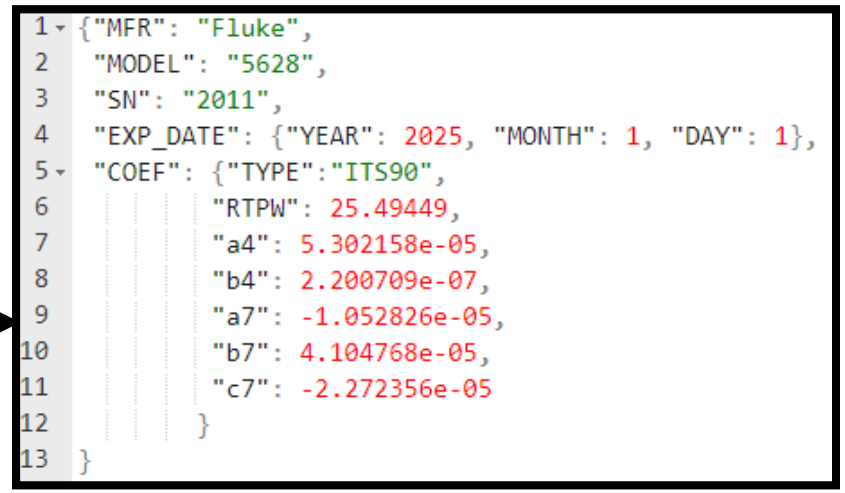
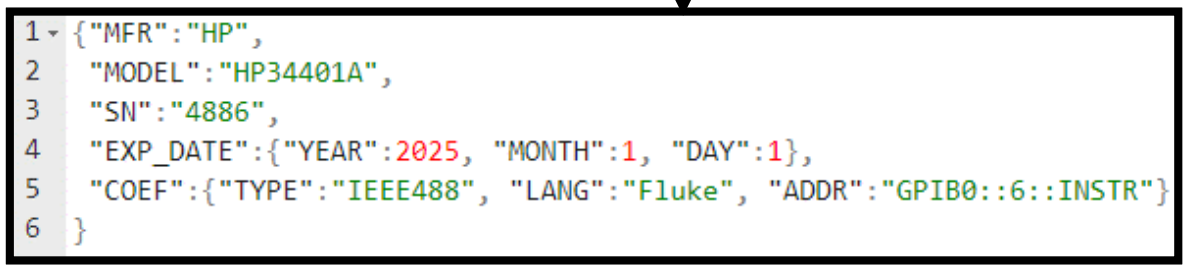





```
{"MFR": "Fluke",
 "MODEL": "5628",
 "SN": "2011",
 "EXP_DATE": {"YEAR": 2025, "MONTH": 1, "DAY": 1},
 "COEF": {"TYPE":"ITS90",
          "RTPW": 25.49449,
          "a4": 5.302158e-05,
          "b4": 2.200709e-07,
          "a7": -1.052826e-05,
          "b7": 4.104768e-05,
          "c7": -2.272356e-05
         }
}
```



```
{"MFR":"HP",
 "MODEL":"HP34401A",
 "SN":"4886",
 "EXP_DATE":{"YEAR":2025, "MONTH":1, "DAY":1},
 "COEF":{"TYPE":"IEEE488", "LANG":"Fluke", "ADDR":"GPIB0::6::INSTR"}
}
```

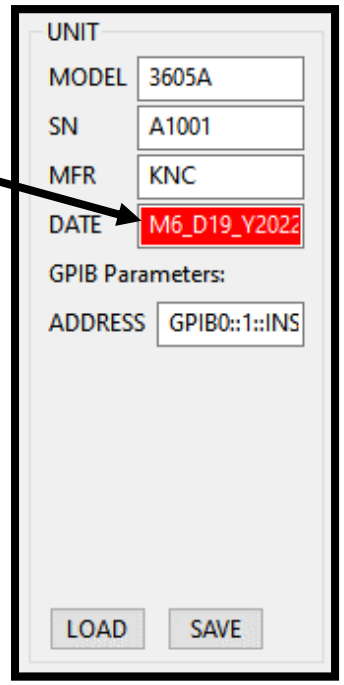
By: Guy Soffer

UNIT information

UNIT configuration source file (JSON)

UNIT data structure

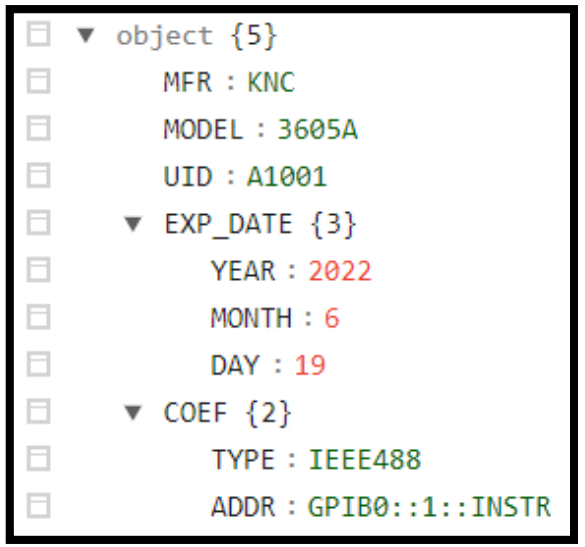
Red background indicates that the date expired




```
1 {"MFR":"KNC",
2  "MODEL":"3605A",
3  "UID":"A1001",
4  "EXP_DATE":{"YEAR":2022, "MONTH":6, "DAY":19},
5  "COEF":{"TYPE":"IEEE488",
6          "ADDR":"GPIB0::1::INSTR"}
7 }
```

GPIB bus#
0 if a single GPIB-USB-HS is used

Device#
KNC units are 1 by default



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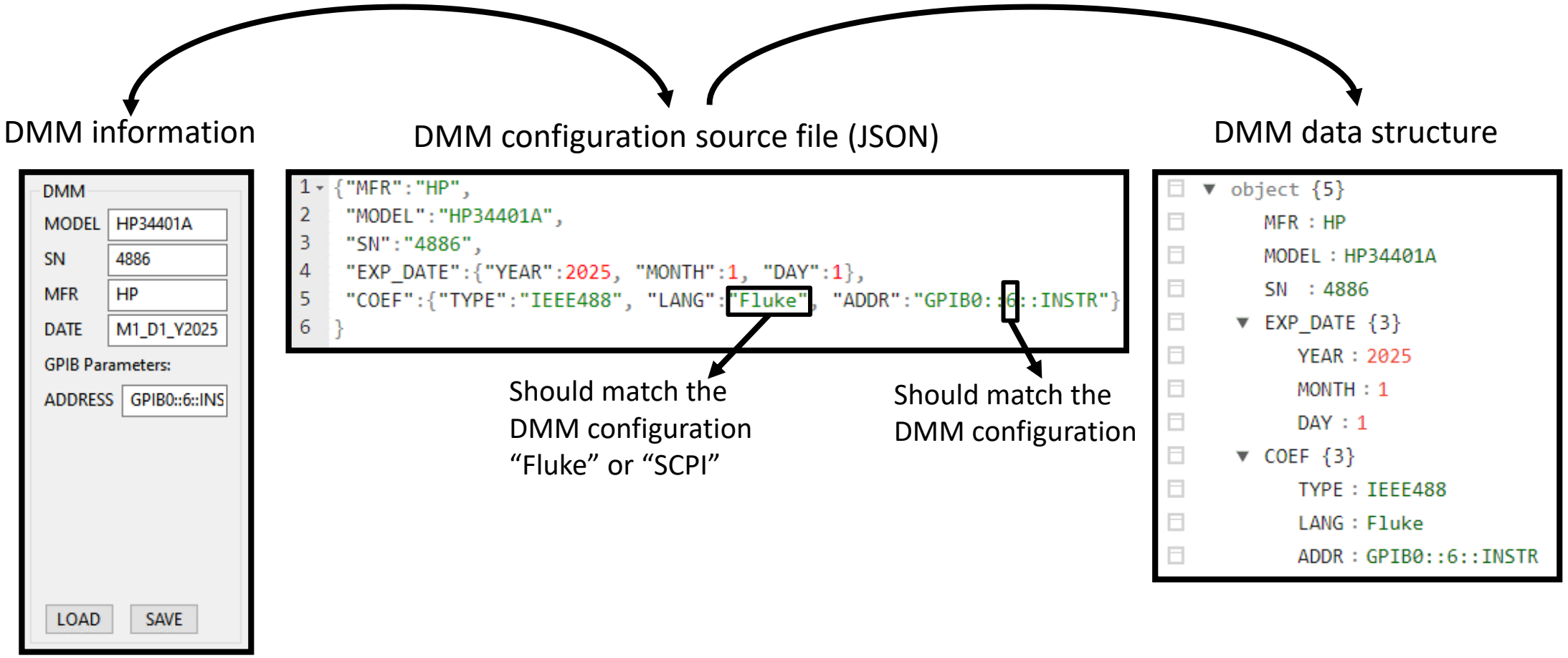
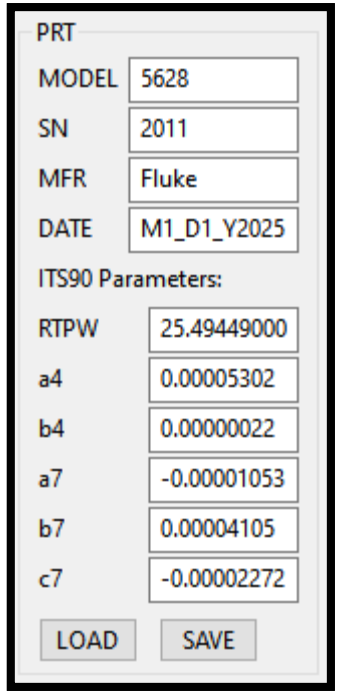
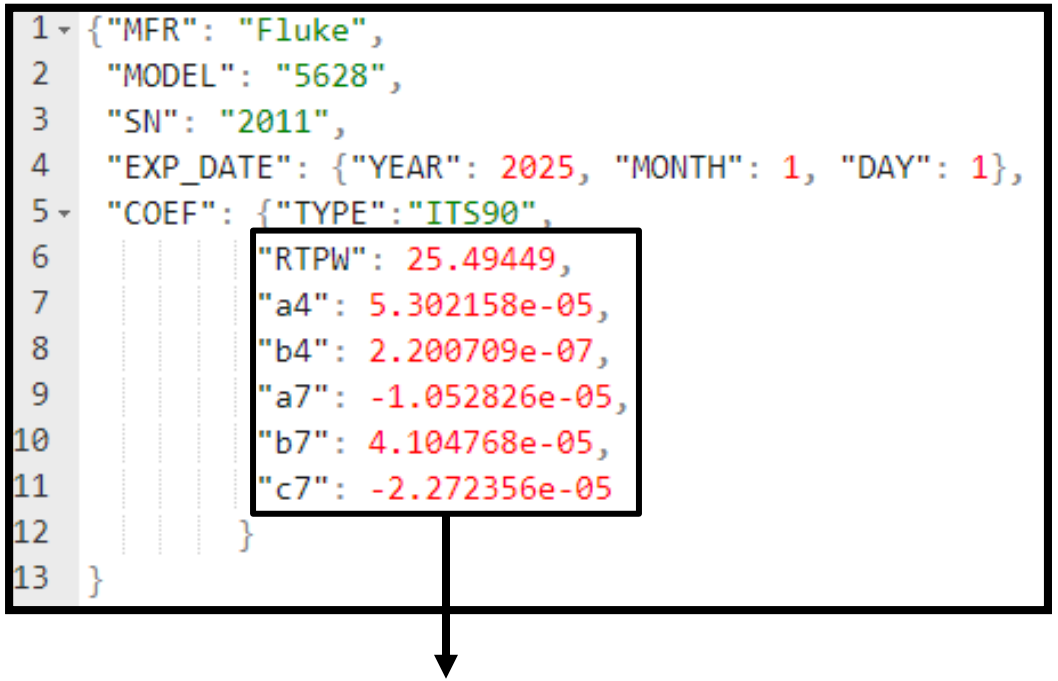


By: Guy Soffer

PRT information

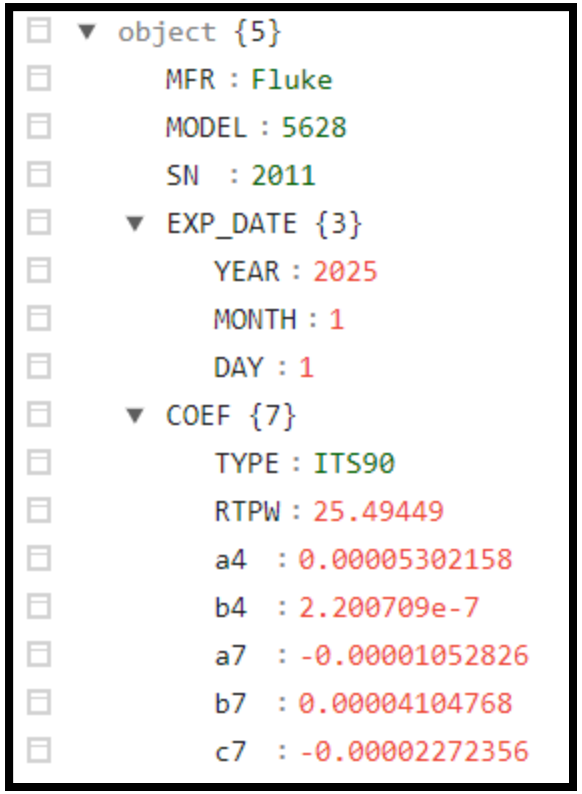


PRT configuration source file (JSON)



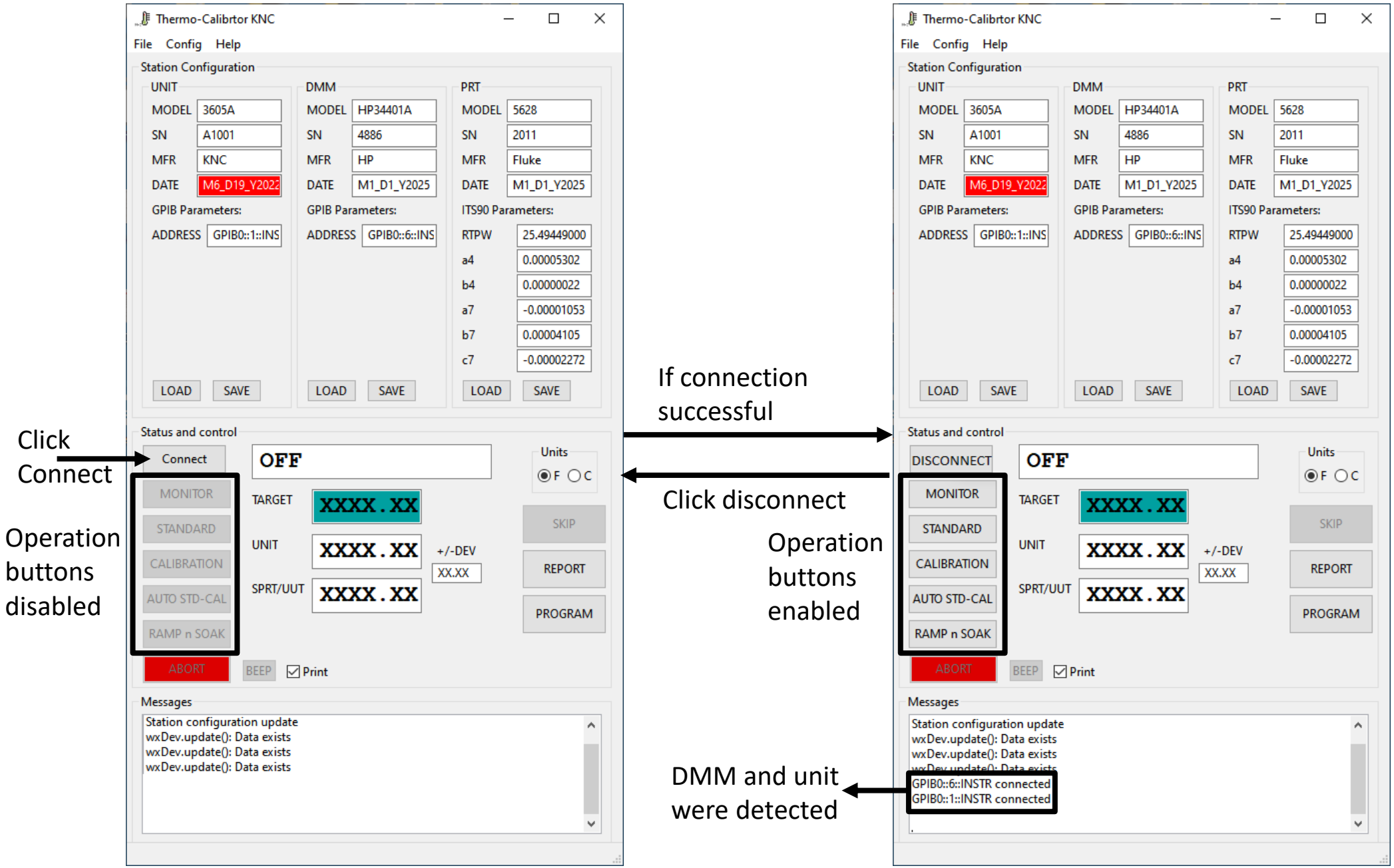
Should match the SPRT calibration report

PRT data structure

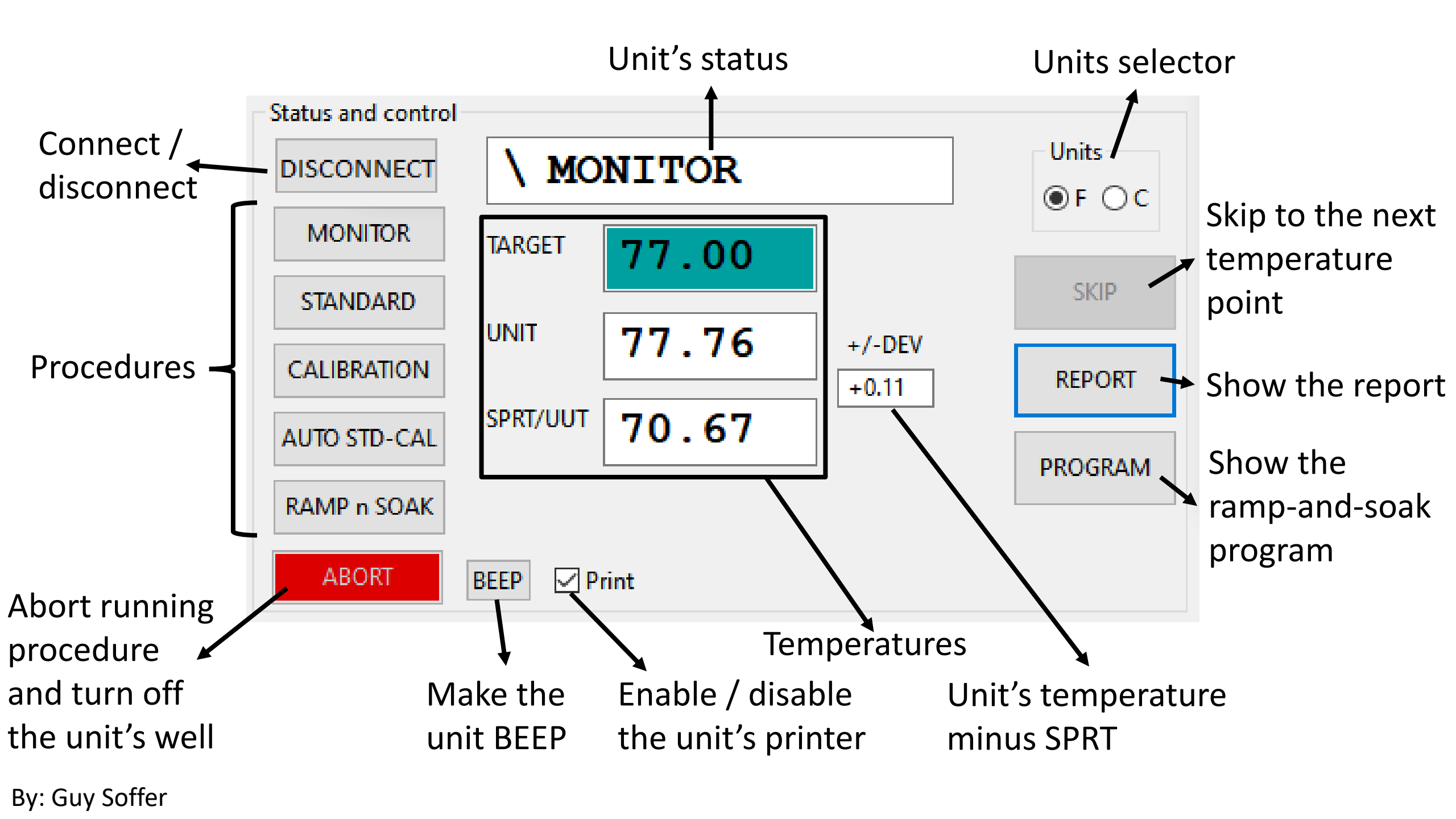


By: Guy Soffer

STATION OPERATION



By: Guy Soffer



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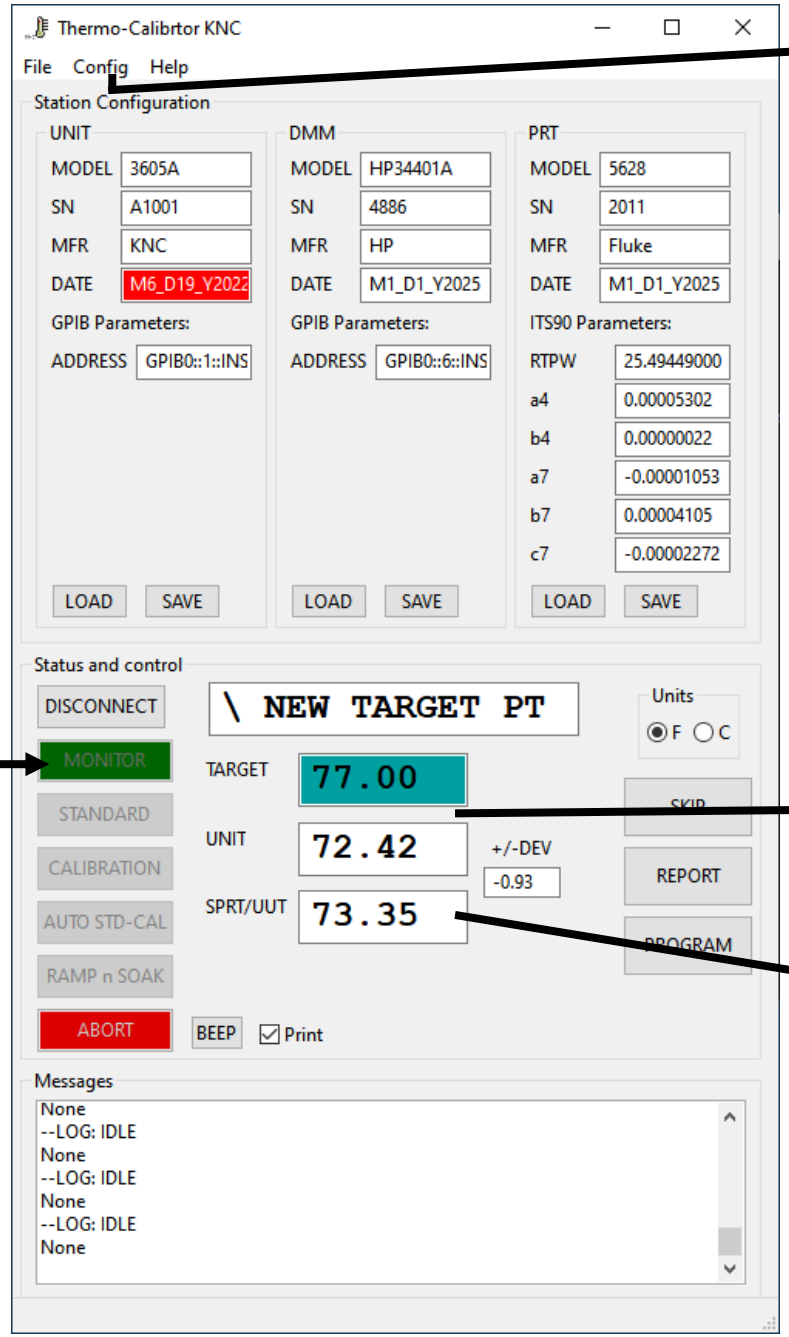
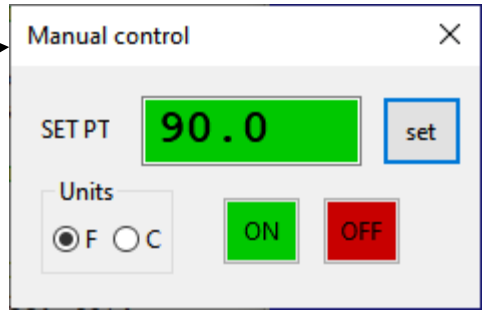
MONITOR or MANUAL CONTROL





If the unit is present on the GPIB bus, it can be manually controlled via the "***Manual control***" dialog box (under the "***Config***" menu.

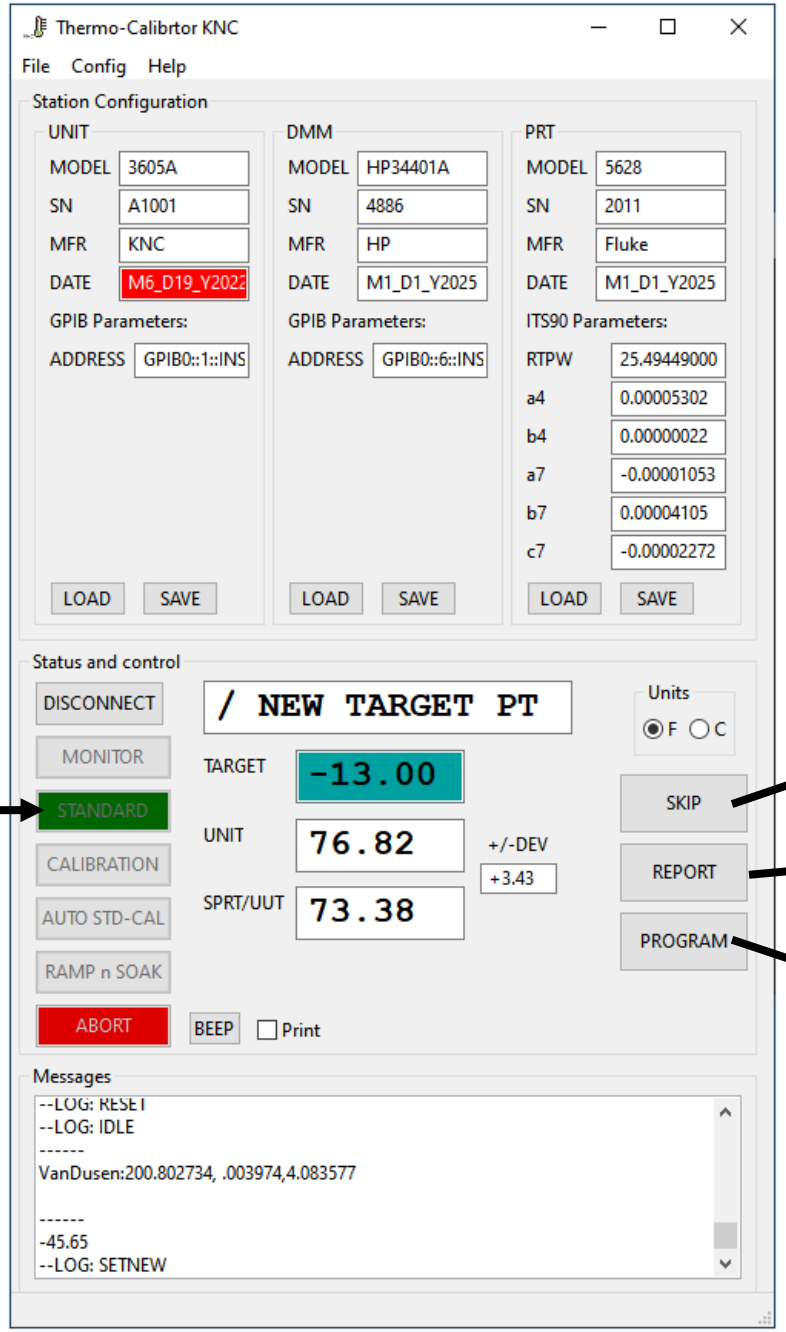
The "***MONITOR***" mode supports stations with unit only, SPRT only, or both connected configurations.

The TARGET and UNIT fields will be updated if the unit is present on the GPIB bus.

The SPRT/UUT field will be updated if the DMM is present on the GPIB bus.

By: Guy Soffer

STANDARDIZATION



Both the unit and DMM must be present on the GPIB bus.

The SPRT/UUT field will be updated if the DMM is present on the GPIB bus.

Advance to the next standardization point.

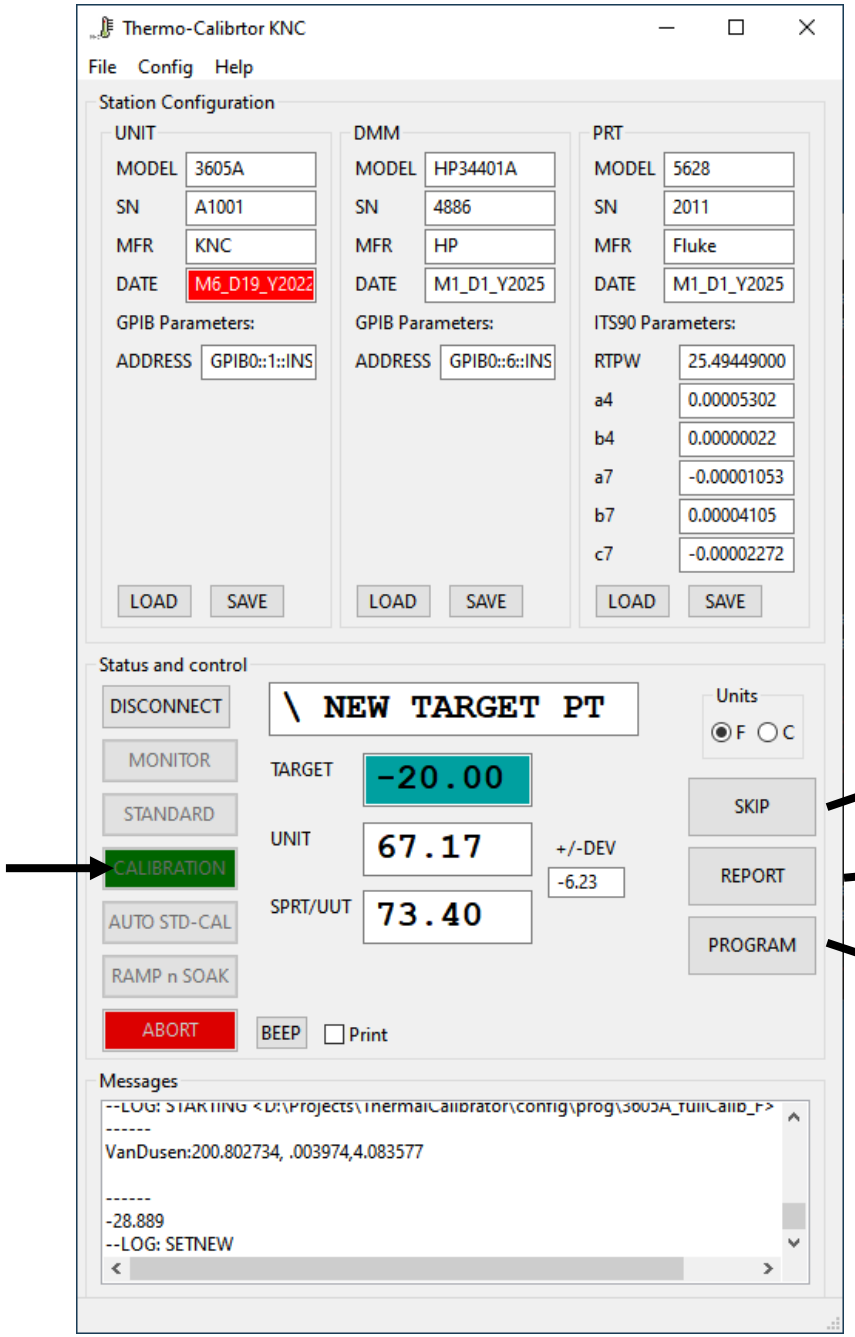
Show the standardization report.

Not applicable in standardization mode.

Note: The unit must be place an CAL mode with activated IEEE mode. Refer to unit's user manual to further instructions.

By: Guy Soffer

CALIBRATION



Both the unit and DMM must be present on the GPIB bus.

The SPRT/UUT field will be updated if the DMM is present on the GPIB bus.

The calibration protocol (target points, dwell times, and pass/fail criteria) is in a standard “Ramp-and-Soak” program ***<3605A_fullCalib_F.json>***.
A **quick calibration** procedure can be run by loading the program ***<3605A_quickCalib.json>*** *before starting the procedure. Different calibration procedures can added as well.*

Advance to the next calibration point.

Show the calibration report.

Show the calibration procedure steps.

By: Guy Soffer

AUTOMATIC STANDARDIZATION AND CALIBRATION

Both the unit and DMM must be present on the GPIB bus.
First the standardization procedure will run.
Than, the calibration procedure will begin.
The natural cooling time of 5 min is inserted between the end of the STD to the beginning of the CAL.

Advance to the next standardization / calibration point.

Show the current procedure report.

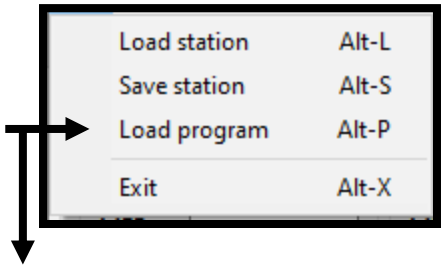
Show the calibration procedure steps.

By: Guy Soffer

RAMP AND SOAK PROGRAM

User defined test protocols (Ramp-and-Soak)

Load a program and start a “Ramp And Soak” process



Example of a quick calibration test program

<3605A_quickCalib.json>

Automatically transition between test points

Soak time after unit’s temperature is stable

How many times to repeat the sequence

The test sequence

```
{"AUTO": 1,
"FREE": 0,
"CYCLES": 1,
"SEQ": [
        {"RATE": 1.0, "TARGET": -5.0, "SOAK": 5.0, "PASS_THRES":0.3},
        {"RATE": 1.0, "TARGET": 35.0, "SOAK": 5.0, "PASS_THRES":0.3},
        {"RATE": 1.0, "TARGET": 75.0, "SOAK": 5.0, "PASS_THRES":0.3}
       ]
}
```

Not implemented (°C/minute)

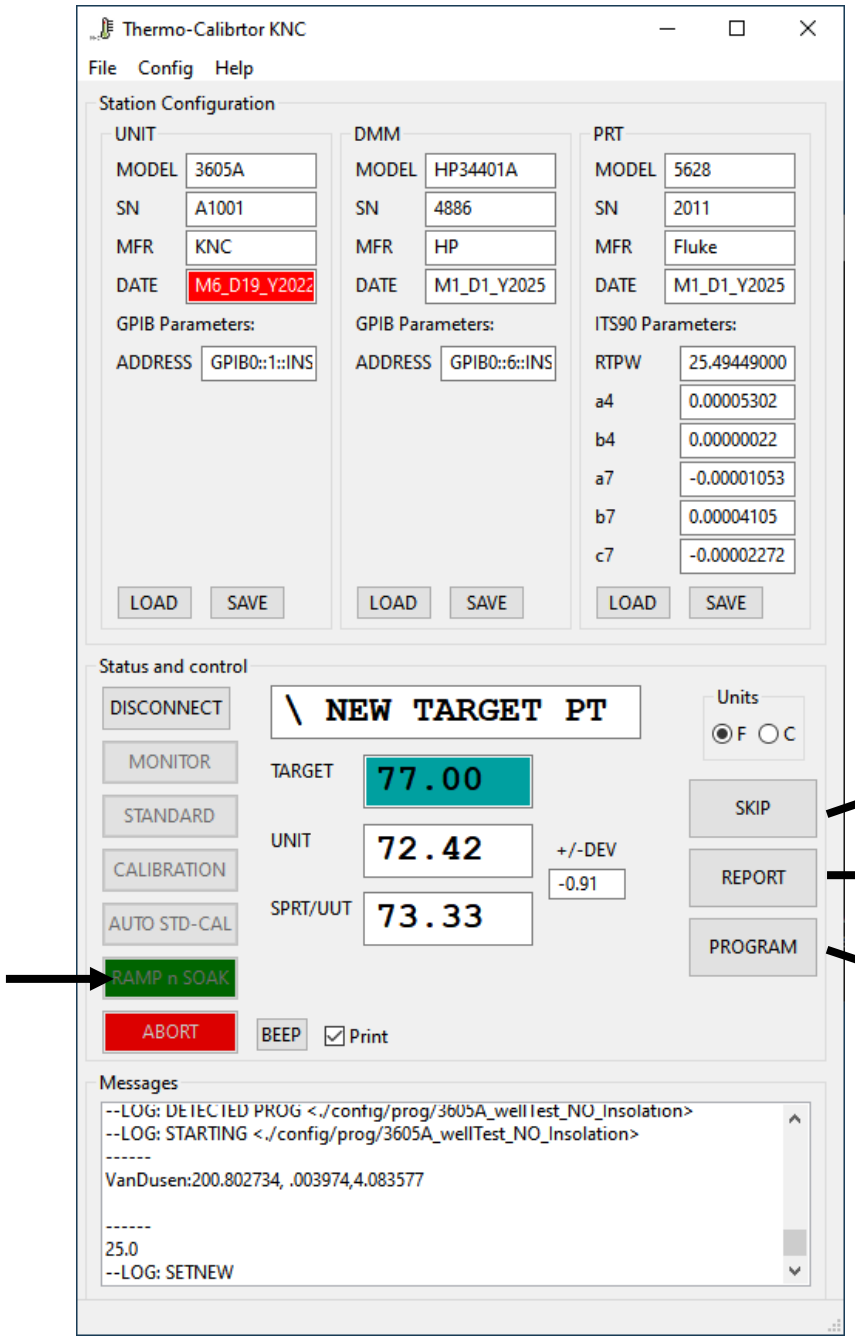
Target temperature (°C)

Soak / dwell time (minutes)

Pass / fail criteria (°C)

Note: All temperature values must be entered in °C units.

By: Guy Soffer



Depend on Ramp-and-Soak program configuration, only the unit or both the unit and DMM must be present on the GPIB bus.

Advance to the next target point.

Show the test report.

Show the test procedure steps.

By: Guy Soffer

WELL PERFORMANCE TESTING

WELL TESTING
STATION CONFIGURATION

Any computer with NI-GPIB-USB-HS

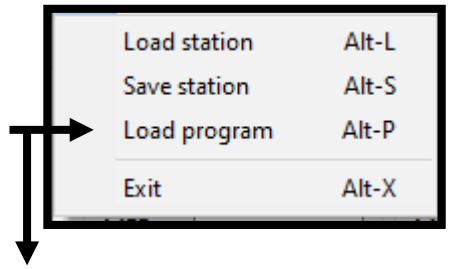
UNIT

Note: DMM and SPRT are optional and no being used during the well testing procedure.

By: Guy Soffer

Protocol for testing the thermal performance

Load a program and start a “Ramp And Soak” process



<3605A_wellTest_NO_Insolation.json>

FREE = 1: Dwell timer starts immediately after setpoint is set

Deviation is calculated between unit and set-point

```
{"AUTO": 1,
"FREE": 1,
"DEV":["UNIT","TARGET"],
"CYCLES": 1,
"SEQ": [
        {"RATE": 1.0, "TARGET": 25, "SOAK": 2.5, "PASS_THRES":0.1},

        {"RATE": 1.0, "TARGET": 30, "SOAK": 0.5, "PASS_THRES":1.2},
        {"RATE": 1.0, "TARGET": 40, "SOAK": 1.1, "PASS_THRES":3.0},
        {"RATE": 1.0, "TARGET": 50, "SOAK": 1.5, "PASS_THRES":4.2},
        {"RATE": 1.0, "TARGET": 60, "SOAK": 1.5, "PASS_THRES":6.4},
        {"RATE": 1.0, "TARGET": 70, "SOAK": 2.0, "PASS_THRES":6.6},
        {"RATE": 1.0, "TARGET": 80, "SOAK": 2.0, "PASS_THRES":8.3},
        {"RATE": 1.0, "TARGET": 90, "SOAK": 3.0, "PASS_THRES":8.4},
        {"RATE": 1.0, "TARGET":100, "SOAK": 3.0, "PASS_THRES":9.0},

        {"RATE": 1.0, "TARGET":100, "SOAK": 4.0, "PASS_THRES":0.1},
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        {"RATE": 1.0, "TARGET": 80, "SOAK": 1.5, "PASS_THRES":1.5},
        {"RATE": 1.0, "TARGET": 70, "SOAK": 1.5, "PASS_THRES":1.8},
        {"RATE": 1.0, "TARGET": 60, "SOAK": 1.5, "PASS_THRES":2.4},
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        {"RATE": 1.0, "TARGET": 40, "SOAK": 2.0, "PASS_THRES":3.2},
        {"RATE": 1.0, "TARGET": 30, "SOAK": 2.0, "PASS_THRES":3.9},

        {"RATE": 1.0, "TARGET": 25, "SOAK": 4.0, "PASS_THRES":0.1},
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        {"RATE": 1.0, "TARGET": 10, "SOAK": 3.0, "PASS_THRES":1.2},
        {"RATE": 1.0, "TARGET":  0, "SOAK": 4.0, "PASS_THRES":1.6},
        {"RATE": 1.0, "TARGET":-10, "SOAK": 5.5, "PASS_THRES":1.8},

        {"RATE": 1.0, "TARGET": 60, "SOAK": 10, "PASS_THRES":2.4}
       ]
}
```
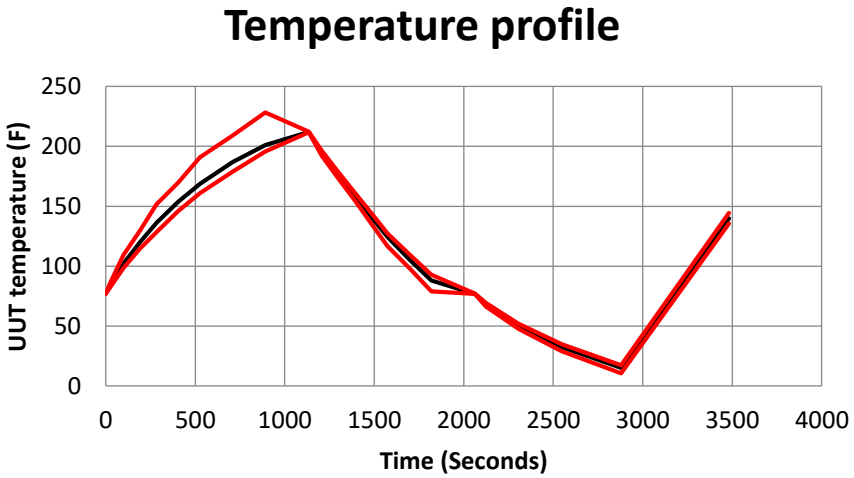
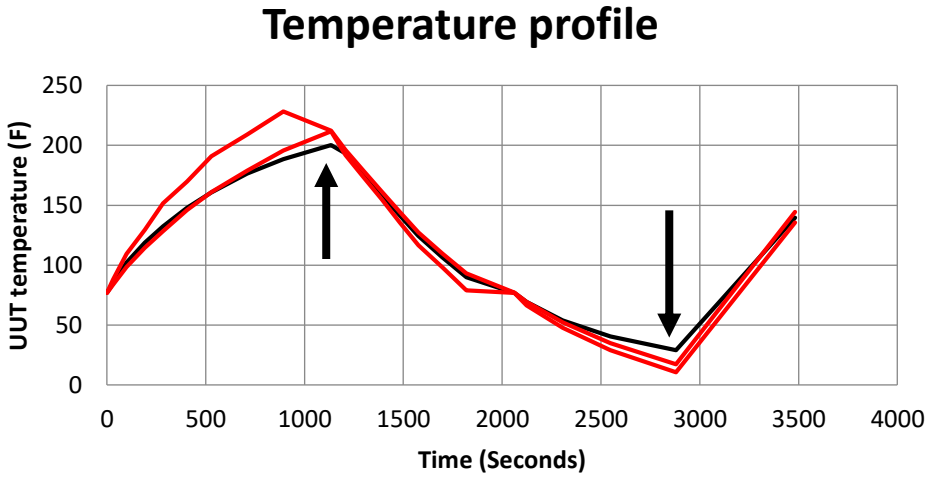

By: Guy Soffer

Results of good well

Red lines indicate minimum and maximum acceptance criteria
Black line indicates the measured well’s temperature



Results of defective well



Test Report

Double click “***Root***” to expand

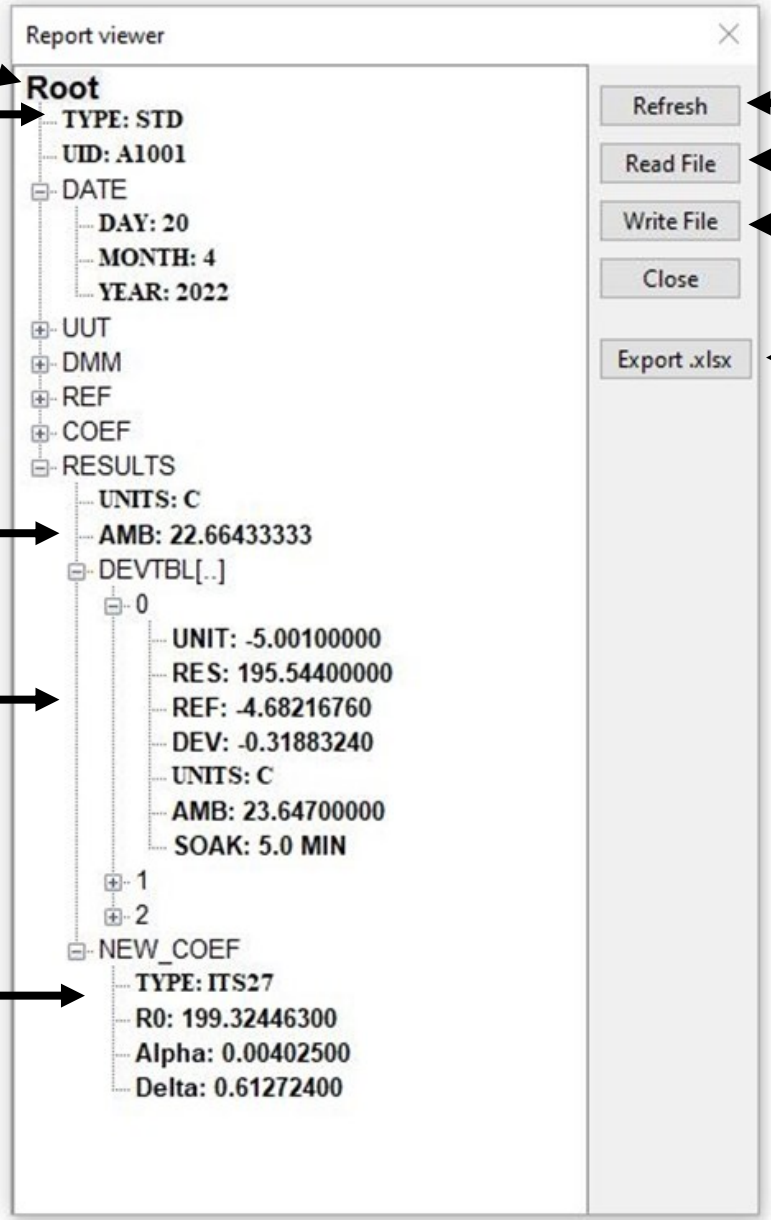
Type of test
STD, CAL, MEAS

Station configuration during the test

Average ambient temperature during the test

Measurements at each temperature point

In case of standardization, the new calculated coefficients



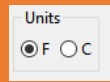
Refresh the report of a running test

Read a saved report

Save the report to a JSON file

Generate an excel report file

Note: The reports can displayed in °C or °F units. Select the desired units in the application’s main screen before opening the report viewer windows.



By: Guy Soffer

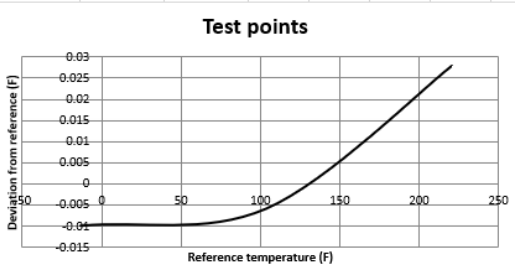
Standardization report in excel format

Station setup

The new coefficients

Results

TYPE	STD									
UID	30983									
DATE	11/10/2022									
REF	MFR	Fluke								
	MODEL	162N100A								
	SN	2140/1403								
	EXP_DATE	11/11/2024								
DMM	MFR	HP								
	MODEL	HP34401A								
	SN	8558/1398								
	EXP_DATE	2/18/2024								
START COEF	TYPE	ITS27								
	R0	199.341644								
	alpha	0.003952								
	delta	1.5341								
RESULTS	UNITS	F								
	Ambient	88.1792								
	NEW COEF	TYPE	ITS27							
		R0	199.335							
		alpha	0.00395							
		delta	1.54594							
DEVTBL	TIME	UNIT	RES	REF	DEV	UNITS	AMB	SOAK	THRS	
	0	-13	179.26	-12.99	-0.01	F	90.167	25	0	
	2044	104	231.15	104.01	-0.006	F	85.554	25	0	
	4415	221.0018	282	220.97	0.0278	F	88.817	25	0	



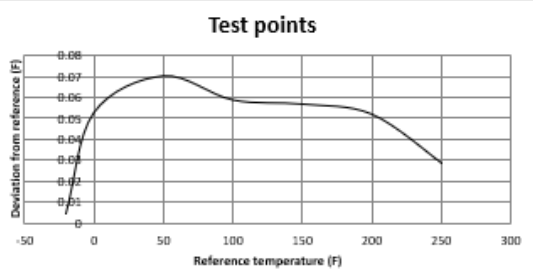
Note: The reports can be generated in °C or °F units, depends on the Report viewer window.

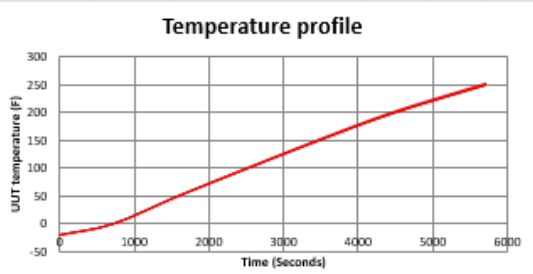
Calibration report in excel format

Station setup

Results

TYPE	CAL												
UID	30983												
DATE	11/10/2022												
REF	MFR	Fluke											
	MODEL	162N100A											
	SN	2140/1403											
	EXP_DATE	11/11/2024											
DMM	MFR	HP											
	MODEL	HP34401A											
	SN	8558/1398											
	EXP_DATE	2/18/2024											
START COEF	TYPE	ITS27											
	R0	199.335114											
	alpha	0.003953											
	delta	1.545939											
RESULTS	UNITS	F											
	Ambient	32											
DEVTBL	TIME	UNIT	REF	UUT	UNITS	DEV	AMB	SOAK	MARK	THRS	THRS_MIN	THRS_MAX	
	0	-19.9984	-20	-20	F	0.0044	92.727	10	PASS	0.49986	-20.50265211	-19.50293	
	720	-0.0004	-0.053	-4E-04	F	0.0525	89.762	10	PASS	0.49986	-0.552776848	0.4469432	
	1593	50	49.93	50	F	0.0701	86.446	10	PASS	0.49986	49.43001479	50.429735	
	2523	100.0022	99.944	100	F	0.0587	86.014	10	PASS	0.49986	99.44367754	100.4434	
	3473	150.0026	149.95	150	F	0.0567	86.886	10	PASS	0.49986	149.4460499	150.44577	
	4487	200.0012	199.95	200	F	0.0519	87.843	10	PASS	0.49986	199.4494889	200.44921	
	5713	250.0034	249.97	250	F	0.0285	89.159	10	PASS	0.49986	249.4750346	250.47475	





INSTALATION

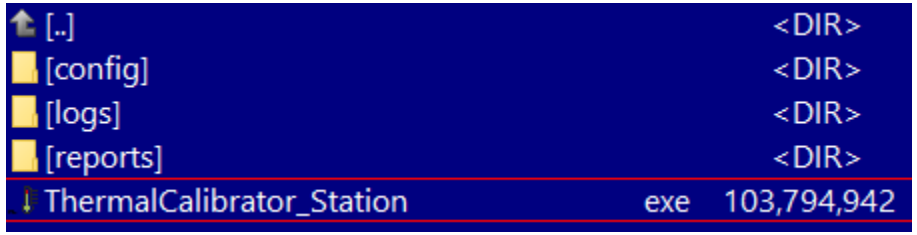
1. Download and install the NI IEEE488.2 drivers for windows

https://www.ni.com/en-us/support/downloads/drivers/download.ni-488-2.html#467646

2. Download the ThermoCalibrator application

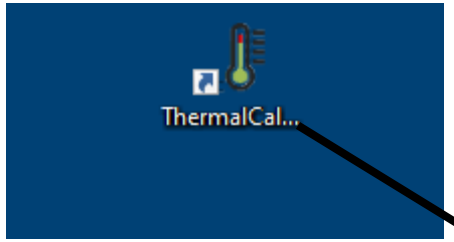
https://drive.google.com/file/d/1KcgN22rnByD-dbM9KaY9K4KyVqcFsqsT/view?usp=share_link

3. Unzip the ThermoCalibrator files into the desired folder

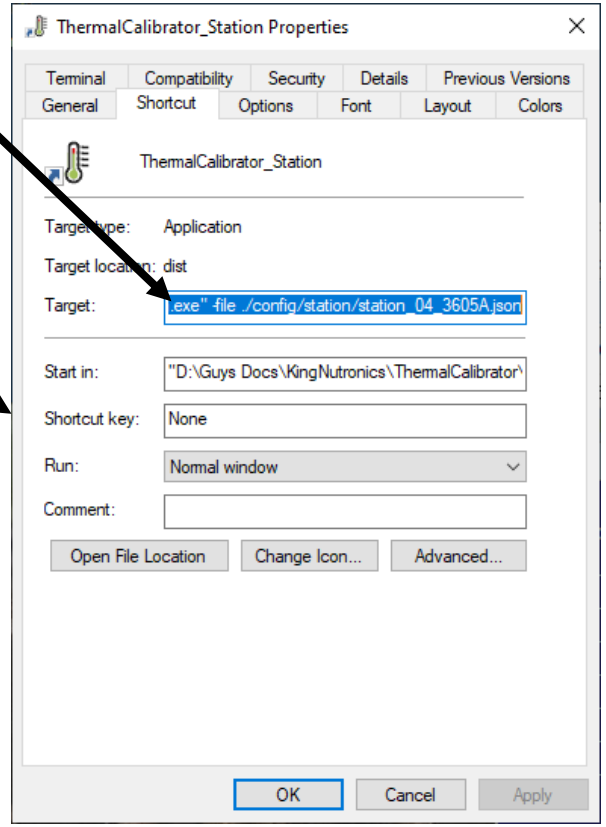


4. Make a shortcut on the desktop. The link can include the station configuration file to load on start.

```
"D:\KNC\ThermalCalibrator\ThermalCalibrator_Station.exe" -file ./config/station/station_04_3605A.json
```



Right click and select “***Properties***”



The path and file name of the station configuration file to load on start