



TracePQM – WP1

Validation and verification

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Installation issues – front panel and set-up issues

- Installation may require administrator level access
- OCTAVE packages, (incl. GOLPI), required a OCTAVE knowledge.
- Newest version of the driver for NI GPIB-USB-HS Interface did not operate correctly
- OS should have dot as a decimal separator to avoid issues with the transfer of measurement data.

- An overview of the front panel controls would be helpful to an inexperienced user (more than is in Users guide)

Digitizer config issues:

- When using two GP-IB interface adapters (for streaming mode), the DMMs VISA addresses must be edited.
- If over-range occur, the error will not be apparent to the user.
- If the aperture is set to “Manual” the user needs go to another window to set the aperture (Measurement Set-up\ New Measurement Configuration screen.)

Graphical users interface issues

HW correction window issues:

- The Transducers page serves multiple purposes: selecting transducers, assigning to channels, loading the correction files, editing the list of transducers, and editing the correction files. Operation is quite complex, instructions rather dense.

Digitizer correction window issues:

- Designations used in the Channel Identifier field must match the designations used in the Digitizer Configuration screen.
- By default, the only corrections shown in the Correction Item dropdown list are the Interchannel Timeshift and Timebase Correction. In order to display (and edit?) the individual digitizer corrections, the user must right click on the digitiser path in the Channel list.

Measurement Configuration window :

- With some practice, the operation of the New Measurement Configuration screen is straightforward.

TWM Operation issues:

- Interpretation of the displayed error message difficult, frequently required a detailed knowledge of the software
- Example: an run-time error condition (“Aperture Error”) was due to an entry in the correction file.

TWM measurement tests

Gain correction test (0.5 V, 50 Hz, Master/slave?, TWM-FPNLSF, $F_s = 1$ kHz, $N = 5000$, Measurements = 10)

Nominal Gain Correction	Measured Ratio	Expanded type A Uncertainty
Disabled	Reference	-
1.000 000	0.999 999 8	0.000 000 6
1.000 001	1.000 001 1	0.000 000 6
1.000 010	1.000 010 1	0.000 000 5
1.000 100	1.000 099 9	0.000 000 5

Gain correction test 2, with csv file, same conditions

Gain correction		
f/a	Gain	u(gain)
0	1.000 000	0.000 001
50	1.000 010	0.000 001
60	1.000 050	0.000 001
500	1.000 100	0.000 001

Input Frequency	Gain Transfer Correction Factor	Measured Ratio	Expanded type A Uncertainty
50 Hz	1.000 010	1.000 010 4	0.000 001 0
53 Hz	-	1.000 022 2	0.000 000 6
55 Hz	-	1.000 029 8	0.000 000 7
57 Hz	-	1.000 038 0	0.000 000 6
60 Hz	1.000 050	1.000 049 6	0.000 000 6

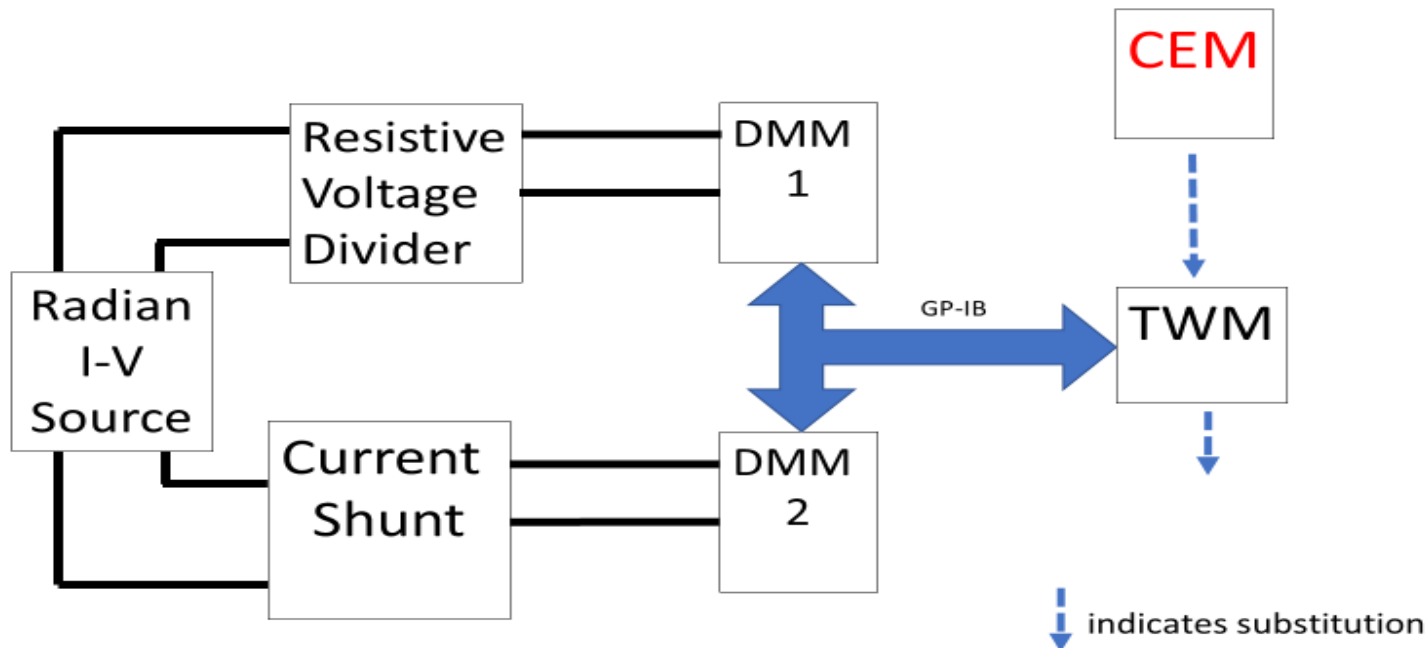
TWM measurement tests

Buffer/Streaming mode test: 240 V (RD ratio 300) , 1A (shunt ratio 1.25 V/A)
corrections off, 50 Hz, Master/slave,
TWM-FPNLSF ?, $F_s = 1$ kHz, $N = 5000$,
Repetitions = 5, phase = 0, $\pi/6$, $\pi/3$, $\pi/2$.

Result: Less than 1 ppm/ 2 μ rad difference

TWM/CEM SMMD comparison: 0,8 V, 50 Hz,
TWM: corrections off, Master/slave, TWM-FPNLSF
?, $F_s = 1$ kHz, $N = 5000$, Repetitions = 5, phase = 0,
 $\pi/6$, $\pi/3$, $\pi/2$

Result: Less than 2 μ V/V/ app. 10 μ rad difference



Flicker test: 240 V (RD ratio 300) ?, 1A (shunt ratio 1.25 V/A)?, corrections off, 50 Hz, Master/slave, TWM-Flicker, $F_s = ?$ kHz, Repetitions= 5, Modulation = ?

Result: ?

(Also tested in A 2.3.4)

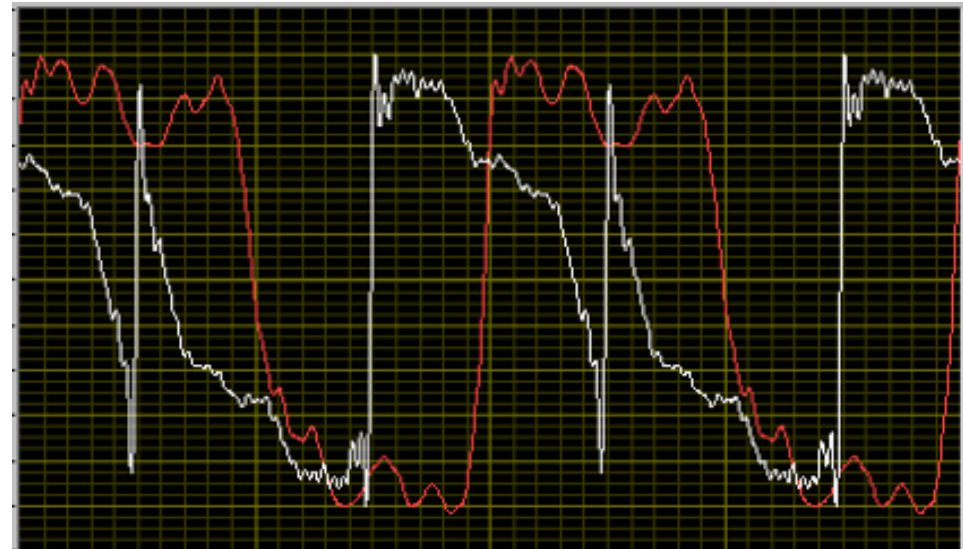
Harmonics test: test:120 V, 50 Hz, plus 12 V 250 Hz, 0.6 A, 50 Hz plus 0,24 A, 250 Hz, corrections off, Master/slave, TWM-MFSF?, $F_s = 1$ kHz, Repetitions= 5

Result: ??

THD test TWM/Metrosert SWM3458: 100 V, 50 Hz, plus harmonics, 1 A, 50 Hz plus harmonics, corrections off, Master/slave, TWM-THDWFFT? , $F_s = 25$ kHz?, $N=2000$?

THDI=76,2 %, THDU=42,9 %

Result: difference less than 0,0002 %



Verification tests on WB set-up

Data missing from activity A1.4.2 (**Tubitak**, IMBIH)

Validation summary of a very modular LF system

Both LF and WB systems can be configured i many ways.

Not all combinations could be tested, highlighted configurations were tested in one or more combination

Voltage divider

Resistive

Inductive

Current sensor

Shunts

Transformer plus shunt

GUI software

LabVIEW_TWM

Labwindows/CVI_TPQA

DigitizeCrs

3458A

NI5922

WB synch./clock

Internal clock

External clock

LF synch.

Master/slave and
TIMER

AWG, Ext Trig*

Computing software

Mathlab

GNU Octave

Computing algorithms

PSFE

MODTDP

FPNLSF

HCRMS

InDiSwell

THDWFFT

PWRTDI

Flicker

MFSF

WFFT*

* Not reported in D3 but tested in activity A2.3.4

Summary of software validation

Capability	TWM support	TPQA support
Power & PQ algorithms	(TWM and TPQA use the same algorithms)	
Single tone frequency; P, U, I, Φ , S, PF	Yes	
Harmonics amplitude and phase	Yes	
Arbitrary waveform P, U, I, Φ , S, PF	Yes	
Flicker	Yes	
Three-phase power analysis	Partial support ¹⁾	
Hardware support		
Digitizers	Keysight 3458A, NI 5922 ²⁾	Keysight 3458A, NI 5922 ²⁾
Voltage transducers	Resistive voltage dividers ³⁾	Resistive voltage dividers ³⁾
Current transducers	Current shunts ³⁾	Current shunts ³⁾
Transducer loading correction	Yes	Yes
Differential measurement (two channels)	Yes	Yes
Digitizer synchronisation	Ext. and int. sample clock	Ext. and int. sample clock
Signal sources	No ⁴⁾	No ⁴⁾
Software design		
Modular components	Voltage/Current transducers Algorithms, Digitizers	Voltage/Current transducers Algorithms, Digitizers
User integration	API for external control by user application	No API support
Open source license	MIT License ⁵⁾	MIT License ⁵⁾

LF and WB hardware validation

Capability	Keysight 3458A setup	NI 5922 setup
Power & PQ parameters		
Power @ single frequency (at any power factor)	Yes	Yes
Harmonics (amplitude and phase)	Yes	Yes
Flicker	Yes	Yes
Multiple phase measurements	Yes	Yes
Digitizer performance		
Bandwidth	DC – 10 kHz	DC – 1 MHz
Gain stability	2 $\mu\text{V/V}$	20 $\mu\text{V/V}$ ¹⁾
Synchronisation with signal		
Synchronisation by external sample clock	Yes	Yes
Indirect synchronisation by common reference clock	No	Yes
Asynchronous sampling	Yes	Yes
Connection scheme		
Single ended sampling	Yes	Yes
Differential sampling	Yes	Yes ²⁾

Validation summary

- Some issues were identified with the installation, set-up and running of the software. However, no critically problems were found.
- A number of functionalities were tested without finding any large problems.
- The validation is therefore considered successful



THANK YOU!

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