



Dutch  
Metrology  
Institute

Yokogawa Europe B.V.



Erik Kroon

Supervisor Standards Laboratorium  
T&M center Europe

Euroweg 2, 3825 HD, Amersfoort  
P.O. Box 163, 3800 AD, Amersfoort, The Netherlands  
T +31 (0)88 4641000 D +31 (0)88 4641425

E erik.kroon@nl.yokogawa.com  
http://tmi.yokogawa.com/



CERTIFICATE

er 3351372  
of 5

Applicant

Submitted

Power meter  
Manufacturer : Yokogawa  
Type : WT3000T  
Serial number : 91K406547

Calibration  
method

The powermeter is compared to the VSL reference sampling Watt meter via a phantom technique. The settings used during calibration are noted on page 2 of this certificate. During the calibration the distortion of the applied voltage and current were below 0.1 %. Before calibration the device was powered on for at least 24 hours. The calibration was executed at an ambient temperature of  $(23.3 \pm 0.5) ^\circ\text{C}$  and a relative humidity of  $(44 \pm 5) \%$ .

Date of  
calibration

7 June 2010 until 8 June 2010

Result

The measurement results are given on page 2 to 5 of this certificate. The reported uncertainty of measurement is based on the standard uncertainty of measurement multiplied by a coverage factor  $k = 2$ , which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with the Guide to the Expression of Uncertainty in Measurement (GUM).

Traceability

The results of the calibration services are traceable to primary and/or (inter)nationally accepted measurement standards.



Delft, 9 June 2010  
VSL B.V.

  
J. Th. Dessens  
Allround metrologist

*This certificate is consistent with Calibration and Measurement Capabilities (CMCs) that are included in Appendix C of the Mutual Recognition Arrangement (MRA) drawn up by the International Committee for Weights and Measures (CIPM). Under the MRA, all participating institutes recognize the validity of each other's calibration and measurement certificates for the quantities, ranges and measurement uncertainties specified in Appendix C (for details see <http://lkcdb.bipm.fr>).*



VSL B.V.  
Thijsseweg 11, 2629 JA Delft (NL)  
P.O. Box 654, 2600 AR Delft (NL)  
T +31 15 269 15 00  
F +31 15 261 29 71  
I [www.vsl.nl](http://www.vsl.nl)

This certificate is issued under the provision that no liability is accepted and that the applicant gives warranty for each responsibility against third parties.

Reproduction of the complete certificate is permitted. Parts of this certificate may only be reproduced after written permission.



## Power function of element 1:

Measurement results were read from a user defined function programmed in the device under test. The function programmed was : "P(E1,ORT)".

Voltage Range 100 V, Current Range 1 A, int. Time 2 Sec, Filters Off, Current low connected to ground.

Relative deviation on the active power (related to the apparent power) of element 1

Applied values				Element 1	
Frequency	Voltage	Current	Cos $\varphi$ (i)	rel. Deviation	rel. Unc
[Hz]	[V]	[A]	[-]	[ $\mu$ WVA]	[ $\mu$ WVA]
53	100	1	1	4	23
53	100	1	0.5	15	20
53	100	1	0.05	16	20
53	100	1	0.02	15	20
53	100	1	0.01	16	20
53	100	1	0.001	14	20
53	40	0.8	1	69	20
53	40	0.8	0.5	49	20
53	40	0.8	0.05	20	20
53	40	0.8	0.02	18	20
53	40	0.8	0.01	17	20
53	40	0.8	0.001	16	20
53	40	0.4	1	88	21
53	40	0.4	0.5	59	20
53	40	0.4	0.05	21	20
53	40	0.4	0.02	17	20
53	40	0.4	0.01	17	20
53	40	0.4	0.001	10	20
53	40	0.2	1	145	22
53	40	0.2	0.5	86	20
53	40	0.2	0.05	24	20
53	40	0.2	0.02	20	20
53	40	0.2	0.01	18	20
53	40	0.2	0.001	8	20



## Power function of element 2:

Measurement results were read from a user defined function programmed in the device under test. The function programmed was : "P(E2,ORT)".

Voltage Range 100 V, Current Range 1 A, int. Time 2 Sec, Filters Off, Current low connected to ground.

Relative deviation on the active power (related to the apparent power) of element 2

Applied values				Element 2	
Frequency	Voltage	Current	Cos $\varphi$ (i)	rel. Deviation	rel. Unc
[Hz]	[V]	[A]	[-]	[ $\mu$ WVA]	[ $\mu$ WVA]
53	100	1	1	15	26
53	100	1	0.5	20	20
53	100	1	0.05	15	20
53	100	1	0.02	14	20
53	100	1	0.01	15	20
53	100	1	0.001	13	20
53	40	0.8	1	82	21
53	40	0.8	0.5	55	20
53	40	0.8	0.05	19	20
53	40	0.8	0.02	17	20
53	40	0.8	0.01	16	20
53	40	0.8	0.001	15	20
53	40	0.4	1	87	21
53	40	0.4	0.5	57	20
53	40	0.4	0.05	19	20
53	40	0.4	0.02	16	20
53	40	0.4	0.01	15	20
53	40	0.4	0.001	9	20
53	40	0.2	1	126	21
53	40	0.2	0.5	75	20
53	40	0.2	0.05	21	20
53	40	0.2	0.02	18	20
53	40	0.2	0.01	15	20
53	40	0.2	0.001	7	20





### Power function of element 3:

Measurement results were read from a user defined function programmed in the device under test. The function programmed was : "P(E3,ORT)".

Voltage Range 100 V, Current Range 1 A, int. Time 2 Sec, Filters Off, Current low connected to ground.

Relative deviation on the active power (related to the apparent power) of element 3

Applied values				Element 3	
Frequency	Voltage	Current	Cos $\varphi$ (i)	rel. Deviation	rel. Unc
[Hz]	[V]	[A]	[-]	[ $\mu$ WVA]	[ $\mu$ WVA]
53	100	1	1	5	24
53	100	1	0.5	18	20
53	100	1	0.05	19	20
53	100	1	0.02	18	20
53	100	1	0.01	19	20
53	100	1	0.001	16	20
53	40	0.8	1	-57	20
53	40	0.8	0.5	-12	20
53	40	0.8	0.05	16	20
53	40	0.8	0.02	18	20
53	40	0.8	0.01	18	20
53	40	0.8	0.001	19	20
53	40	0.4	1	-7	21
53	40	0.4	0.5	14	20
53	40	0.4	0.05	18	20
53	40	0.4	0.02	18	20
53	40	0.4	0.01	18	20
53	40	0.4	0.001	11	20
53	40	0.2	1	84	21
53	40	0.2	0.5	58	20
53	40	0.2	0.05	23	20
53	40	0.2	0.02	20	20
53	40	0.2	0.01	18	20
53	40	0.2	0.001	9	20

### Voltage measured:

Voltage Range 100 V, int. Time 2 Sec, Filters Off.

Measurement results were read from a user defined function programmed in the device under test. The function programmed was : "V(E(x),ORT)". Where (x) is the element number.

Applied value	Element 1		Element 2		Element 3	
Value	Value	Unc.	Value	Unc.	Value	Unc.
[V]	[V]	[V]	[V]	[V]	[V]	[V]
100.0000	100.0003	0.0026	100.0000	0.0026	100.0000	0.0026

### Current measured:

Current Range 1 A, int. Time 2 Sec, Filters Off.

Measurement results were read from a user defined function programmed in the device under test. The function programmed was : "I(E(x),ORT)". Where (x) is the element number.

Applied value	Element 1		Element 2		Element 3	
Value	Value	Unc.	Value	Unc.	Value	Unc.
[A]	[A]	[A]	[A]	[A]	[A]	[A]
1.000000	1.00001	0.00005	1.00001	0.00005	1.00001	0.00005

### Additional Remarks:

The relative deviation is defined as:

$$\frac{\Delta P}{S} = \frac{P_x - P_{ref}}{S_{ref}}$$

$$\frac{\Delta P}{S} = \text{relative deviation}$$

$P_x$  = active power DUT

$P_{ref}$  = active power (VSL standard)

$S_{ref}$  = apparent power (VSL standard)

Phase/Power factor:

" $\varphi = 60^\circ$ " is equal to " $\cos \varphi = 0.5i$ "

" $\varphi = -60^\circ$ " is equal to " $\cos \varphi = 0.5c$ "