

CERTIFICATE OF ACCREDITATION

This is to certify that:

CSIR NATIONAL METROLOGY LABORATORY

Laboratory Accreditation No. 1612

is a South African National Accreditation System Accredited Laboratory

for five years commencing **September 2005** provided that

all SANAS conditions and requirements are complied with

This certificate is valid for:

DC LOW FREQUENCY METROLOGY

as per scope on accompanying schedule of accreditation

THE LABORATORY COMPLIES WITH ISO/IEC 17025

While this certificate remains valid,
the Accredited Laboratory named above
is authorised to issue SANAS certificates.

Programme Manager

*"Recognised as the official national accreditation body by the
Department of Trade and Industry of the Republic of South Africa"*

This schedule is only valid when accompanied by its schedule of accreditation.

Accredited Laboratory Measuring Capabilities

SCHEDULE OF ACCREDITATION

DC LOW FREQUENCY METROLOGY

Laboratory Accreditation Number: 1612

<u>Permanent Address of Laboratory:</u> CSIR Building 5 Meiring Naude Road Brummeria Pretoria <u>Postal Address:</u> PO Box 395 Pretoria 0001 Tel: (012) 841 3193 Fax: (012) 841 2131 Email: dddejager@csir.co.za		<u>Technical Signatories</u> : Mr A.M. Matlejoane (Item 1,2 & 3) : Mr M.L. Temba (Item 4 & 5) : Mr B. van Oostrom (Item 3) <u>Nominated Representative</u> : Ms D de Jager Issue No : 02 Date of Issue : May 2006 Expiry Date: : September 2010			
ITEM	FUNCTION	NOMINAL RANGE	NOMINAL FREQUENCY	BEST MEASUREMENT CAPABILITIES EXPRESSED AS AN UNCERTAINTY (\pm)	NOTES
1	DC Voltage				
1.1	Specific values - Josephson Junction Array Voltage Standard				
		1 V 1,018 V 10 V	DC DC DC	$1 \cdot 10^{-7} \cdot U$ $1 \cdot 10^{-7} \cdot U$ $2 \cdot 10^{-8} \cdot U$	
1.2	Specific values - 8000A System, DC Reference Standards				
		1 V 1,018 V 10 V	DC DC DC	$4 \cdot 10^{-7} \cdot U$ $4 \cdot 10^{-7} \cdot U$ $2 \cdot 10^{-7} \cdot U$	
1.3	Specific values - Reference Divider, DC Reference Standard				
		0,1 V 1 V 10 V 100 V 1 000 V	DC DC DC DC DC	$6 \cdot 10^{-6} \cdot U$ $3 \cdot 10^{-6} \cdot U$ $6 \cdot 10^{-7} \cdot U$ $3 \cdot 10^{-6} \cdot U$ $6 \cdot 10^{-6} \cdot U$	

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The BMC, expressed as an expanded uncertainty of measurement, is stated as the standard uncertainty of measurement multiplied by a coverage factor $k = 2$, corresponding to a confidence level of approximately 95%

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ITEM	FUNCTION	NOMINAL RANGE	NOMINAL FREQUENCY	BEST MEASUREMENT CAPABILITIES EXPRESSED AS AN UNCERTAINTY (\pm)	NOTES
1.4	Range - Multifunction Calibrator				
		0 to 100 mV	DC	$1 \cdot 10^{-5} \cdot U + 1 \mu V$	
		0,1 to 1 V	DC	$2 \cdot 10^{-5} \cdot U$	
		1 to 10 V	DC	$7 \cdot 10^{-6} \cdot U$	
		10 to 100 V	DC	$5 \cdot 10^{-6} \cdot U$	
		100 to 1 000 V	DC	$8 \cdot 10^{-6} \cdot U$	
1.5	Range - Digital Multimeter				
		0,01 to 100 mV	DC	$1 \cdot 10^{-5} \cdot U + 1 \mu V$	
		0,1 to 1 V	DC	$2 \cdot 10^{-5} \cdot U$	
		1 to 10 V	DC	$2 \cdot 10^{-5} \cdot U$	
		10 to 100 V	DC	$2 \cdot 10^{-5} \cdot U$	
		100 to 1 000 V	DC	$2 \cdot 10^{-5} \cdot U$	
2	DC Current				
2.1	Range – Multifunction Calibrator, Transconductance Amplifier, Digital Multimeter, Standard Resistors				
		0,1 to 1 μA	DC	$6 \cdot 10^{-4} \cdot I$	
		1 to 10 μA	DC	$6 \cdot 10^{-5} \cdot I$	
		10 to 100 μA	DC	$9 \cdot 10^{-6} \cdot I$	
		0,1 to 1 mA	DC	$3 \cdot 10^{-6} \cdot I$	
		1 mA to 10 mA	DC	$3 \cdot 10^{-6} \cdot I$	
		10 to 100 mA	DC	$4 \cdot 10^{-6} \cdot I$	
		0,1 to 1 A	DC	$4 \cdot 10^{-6} \cdot I$	
		1 to 20 A	DC	$4 \cdot 10^{-6} \cdot I$	
		20 to 100 A	DC	$3 \cdot 10^{-5} \cdot I$	1

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Note 1: Measure only.

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ITEM	FUNCTION	NOMINAL RANGE	NOMINAL FREQUENCY	BEST MEASUREMENT CAPABILITIES EXPRESSED AS AN UNCERTAINTY (\pm)	NOTES
3	Resistance				
3.1	Range – Resistance bridges, Standard Resistors, Teraohmmeter				
		1 to 10 $\mu\Omega$	DC	$70 \cdot 10^{-6} \cdot R$	
		10 to 100 $\mu\Omega$	DC	$7 \cdot 10^{-6} \cdot R$	
		0,1 to 1 m Ω	DC	$0,8 \cdot 10^{-6} \cdot R$	
		1 to 10 m Ω	DC	$0,8 \cdot 10^{-6} \cdot R$	
		10 to 100 m Ω	DC	$0,7 \cdot 10^{-6} \cdot R$	
		0,1 to 1 Ω	DC	$0,7 \cdot 10^{-6} \cdot R$	
		1 Ω	DC	$0,6 \cdot 10^{-6} \cdot R$	
		1 to 10 Ω	DC	$0,6 \cdot 10^{-6} \cdot R$	
		10 to 100 Ω	DC	$0,7 \cdot 10^{-6} \cdot R$	
		0,1 to 1 k Ω	DC	$0,7 \cdot 10^{-6} \cdot R$	
		1 to 10 k Ω	DC	$0,8 \cdot 10^{-6} \cdot R$	
		10 to 100 k Ω	DC	$3 \cdot 10^{-6} \cdot R$	
		0,1 to 1 M Ω	DC	$4 \cdot 10^{-6} \cdot R$	
		1 to 10 M Ω	DC	$6 \cdot 10^{-6} \cdot R$	
		10 to 100 M Ω	DC	$6 \cdot 10^{-6} \cdot R$	
		0,1 to 1 G Ω	DC	$9 \cdot 10^{-6} \cdot R$	
		1 to 10 G Ω	DC	$7 \cdot 10^{-4} \cdot R$	
		10 to 100 G Ω	DC	$9 \cdot 10^{-4} \cdot R$	
		0,1 to 1 T Ω	DC	$12 \cdot 10^{-4} \cdot R$	
		1 to 10 T Ω	DC	$25 \cdot 10^{-4} \cdot R$	
		10 to 100 T Ω	DC	$35 \cdot 10^{-4} \cdot R$	
		100 to 1 000 T Ω	DC	$60 \cdot 10^{-4} \cdot R$	

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ITEM	NOMINAL RANGE			NOMINAL FREQUENCY	BEST MEASUREMENT CAPABILITIES EXPRESSED AS AN UNCERTAINTY (\pm)			NOTES
4	AC Voltage							
4.1	Range – AC-DC Transfer standards				BMC specified in μ V/V			
	FREQUENCY							
Voltage	0,01 kHz	0,02 kHz	0,03 kHz	0,04 kHz	0,5 kHz	1 kHz	10 kHz	
0,1 V	40	40	40	40	40	40	40	
0,7 V	10	10	10	10	10	10	10	
1 V	10	10	10	10	10	10	10	
2 V	12	12	12	12	12	12	12	
3 V	15	15	15	15	25	15	15	
5 V	20	20	20	20	20	20	20	
10 V	12	12	12	12	12	12	12	
20 V	14	14	14	14	14	14	14	
30 V	15	15	15	15	15	15	15	
50 V	X	X	X	20	20	20	20	
100 V	X	X	X	30	30	30	30	
200 V	X	X	X	35	35	35	35	
300 V	X	X	X	45	45	45	45	
500 V	X	X	X	50	55	55	55	
700 V	X	X	X	60	65	70	75	
1000 V	X	X	X	70	75	75	80	

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ITEM	NOMINAL RANGE			NOMINAL FREQUENCY	BEST MEASUREMENT CAPABILITIES EXPRESSED AS AN UNCERTAINTY (\pm)				NOTES
4.1	Range – AC-DC Transfer standards (Continued)			BMC specified in $\mu\text{V/V}$					
	FREQUENCY								
Voltage	20 kHz	50 kHz	70 kHz	100 kHz	200 kHz	500 kHz	700 kHz	1 MHz	
0,1 V	40	45	60	60	90	105	110	120	
0,7 V	10	15	15	15	20	25	40	60	
1 V	10	15	15	15	20	25	35	25	
2 V	12	17	17	17	20	20	40	30	
3 V	15	20	20	20	25	35	45	40	
5 V	20	30	30	30	35	35	50	55	
10 V	12	15	15	15	18	18	50	60	
20 V	14	20	20	30	35	40	55	65	
30 V	15	25	35	40	45	55	65	70	
50 V	20	25	25	25	X	X	X	X	
100 V	30	40	40	50	X	X	X	X	
200 V	35	45	45	65	X	X	X	X	
300 V	45	50	55	85	X	X	X	X	
500 V	55	65	80	90	X	X	X	X	
700 V	80	100	100	120	X	X	X	X	
1000 V	85	90	110	120	X	X	X	X	

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ITEM	NOMINAL RANGE	NOMINAL FREQUENCY	BEST MEASUREMENT CAPABILITIES EXPRESSED AS AN UNCERTAINTY (\pm)					NOTES
4.2	Range - AC Voltage, Multimeters		BMC Specified in $\mu\text{V/V}$					
	FREQUENCY							
Voltage	0,01 kHz	0,02 kHz	0,03 kHz	0,04 kHz	0,5 kHz	1 kHz	10 kHz	
0,1 V	90	90	90	80	80	85	90	
0,2 V	195	80	80	60	60	60	70	
0,6 V	60	60	50	50	50	50	50	
1 V	60	60	50	50	50	50	50	
2 V	60	60	60	60	60	60	60	
3 V	60	60	60	60	60	60	60	
5 V	70	60	60	60	60	60	60	
10 V	70	60	60	60	60	60	60	
20 V	75	70	70	70	70	70	70	
30 V	75	70	70	70	70	70	70	
50 V	75	70	70	70	70	70	70	
100 V	75	70	70	70	70	70	70	
200 V	80	80	80	80	80	80	80	
300 V	90	90	90	90	90	90	90	
500 V	100	100	100	100	100	100	100	
700 V	100	100	100	100	100	100	100	
800 V	100	100	100	100	100	100	100	
1000 V	100	100	100	100	100	100	100	

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4.2	Range - AC Voltage Multimeters (Continued),							BMC Specified in $\mu\text{V/V}$		
FREQUENCY										
Voltage	20 kHz	50 kHz	70 kHz	100 kHz	200 kHz	500 kHz	700 kHz	1 MHz		
0,1 V	90	95	95	100	100	105	140	195		
0,2 V	70	75	75	75	85	105	120	160		
0,6 V	50	70	70	70	70	50	50	50		
1 V	50	55	55	60	65	70	80	90		
2 V	60	70	70	75	75	80	80	90		
3 V	60	70	70	75	75	80	80	90		
5 V	60	60	70	70	80	80	85	90		
10 V	60	60	70	70	80	80	85	90		
20 V	70	70	70	80	80	95	95	100		
30 V	70	70	70	80	80	95	95	100		
50 V	70	70	70	80	X	X	X	X		
100 V	70	70	70	80	X	X	X	X		
200 V	80	80	90	90	X	X	X	X		
300 V	95	95	100	100	X	X	X	X		
500 V	100	105	105	105	X	X	X	X		
700 V	100	105	105	105	X	X	X	X		
800 V	100	105	105	105	X	X	X	X		
1000 V	100	105	105	105	X	X	X	X		

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5	AC Current				
5.1	Range - AC-DC Transfer standards, Current		BMC Specified in $\mu\text{A}/\text{A}$		
	Frequency				
Current	30 Hz	1 kHz	5 kHz		
0,01 A	70	70	70		
0,02 A	70	70	70		
0.03 A	70	70	70		
0,5 A	75	75	75		
0,1 A	70	70	70		
0,2 A	70	70	70		
0,3 A	70	70	70		
0,5 A	70	70	70		
1,0 A	70	70	70		
2,0 A	70	70	70		
3,0 A	70	70	70		
5,0 A	100	100	100		
10,0 A	200	200	200		
20,0 A	200	200	200		

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ISSUED BY THE SOUTH AFRICAN NATIONAL ACCREDITATION SYSTEM

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