

13. TECHNICAL SPECIFICATIONS

13.1. TECHNICAL FEATURES

Accuracy is indicated as [% of reading + number of digits]. It refers to the following atmospheric conditions: a temperature of $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$ with a relative humidity $< 60\%$.

Martindale Electric Ltd reserves the right to change specification without notice, and without incurring any obligation.

Safety Test functions

● LOWΩ: 200mA CONTINUITY TEST (AUTO, RT+, RT- MODE)

Range [Ω]	Resolution [Ω]	Accuracy(*)
0.01 - 9.99	0.01	±(2% Reading + 2 digits)
10.0 - 99.9	0.1	

(*) After Test leads calibration

Test Current > 200mA DC per $R \leq 5\Omega$ (Test leads included)
 Resolution for Test current: 1mA
 Open Circuit Voltage $V_0 \geq 4V \leq 24V$

● MΩ: INSULATION TEST

Test Voltage [V]	Range [MΩ]	Resolution [MΩ]	Accuracy
50	0.01 - 9.99	0.01	±(2% Reading + 2 digits) if $V/R > 1\mu\text{A}$
	10.0 - 49.9	0.1	
	50.0 - 99.9	0.1	±(5% Reading + 2 digits) if $V/R \leq 1\mu\text{A}$
100	0.01 - 9.99	0.01	±(2% Reading + 2 digits) if $V/R > 1\mu\text{A}$
	10.0 - 99.9	0.1	
	100.0 - 199.9	0.1	±(5% Reading + 2 digits) if $V/R \leq 1\mu\text{A}$
250	0.01 - 9.99	0.01	±(2% Reading + 2 digits) if $V/R > 1\mu\text{A}$
	10.0 - 199.9	0.1	
	200 - 249	1	±(5% Reading + 2 digits) if $V/R \leq 1\mu\text{A}$
250 - 499	1		
500	0.01 - 9.99	0.01	±(2% Reading + 2 digits) if $V/R > 1\mu\text{A}$
	10.0 - 199.9	0.1	
	200 - 499	1	±(5% Reading + 2 digits) if $V/R \leq 1\mu\text{A}$
500 - 999	1		
1000	0.01 - 9.99	0.01	±(2% Reading + 2 digits) if $V/R > 1\mu\text{A}$
	10.0 - 199.9	0.1	
	200 - 999	1	±(5% Reading + 2 digits) if $V/R \leq 1\mu\text{A}$
1000 - 1999	1		

Open circuit Test Voltage < $1.3 \times$ Nominal Test Voltage
 Short Circuit Current < 6.0mA with 500V Test Voltage
 Nominal Test Current 500V > 2.2mA with 230kΩ
 other > 1mA with $1\text{k}\Omega \cdot V_{\text{nom}}$

● RCD: TEST ON RCD DEVICES

Nominal Test Current ($I_{\Delta N}$) 10mA, 30mA, 100mA, 300mA, 500mA
 RCD type AC, A General and Selective
 Phase to Earth Test Voltage 100V - 250V 50 Hz
 Frequency 50Hz $\pm 0.5\text{Hz}$

- Tripping Time Measurement $t_{\Delta N}$

Range [ms]	Resolution [ms]	Accuracy
$\frac{1}{2} I_{\Delta N}, I_{\Delta N}$ 1 - 999	1	±(2% Reading + 2 digits)
2 $I_{\Delta N}$ 1 - 200 general		
1 - 250 selective		
5 $I_{\Delta N}$ RCD 1 - 50 general		
1 - 160 selective		

- Contact Voltage U_t

Range [V]	Resolution [V]	Accuracy
0 - $2U_{t\text{lim}}$	0.1	- 0%, +(5% Reading + 3 digits)

$U_{t\text{LIM}}$ (UL): 25V or 50V

- Global Earth Resistance Measurement (avoiding RCD tripping)

Range [Ω]	Resolution [Ω]	Accuracy $I_{\Delta N}$
1 - 1999	1	- 0%, +(5% Reading + 3 digits)

Test Current 0.5 $I_{\Delta N}$ set

- Tripping Current Measurement

$I_{\Delta N}$	RCD Type	Range $I_{\Delta N}$ [mA]	Resolution [mA]	Accuracy $I_{\Delta N}$
$I_{\Delta N} \leq 10\text{mA}$	AC	$(0.5 - 1.4) I_{\Delta N}$	0.1 $I_{\Delta N}$	- 0%, +5% $I_{\Delta N}$
	A	$(0.5 - 2.4) I_{\Delta N}$		
$I_{\Delta N} > 10\text{mA}$	AC	$(0.5 - 1.4) I_{\Delta N}$		
	A	$(0.5 - 2) I_{\Delta N}$		

● **FREQUENCY MEASUREMENT**

Range [Hz]	Resolution [Hz]	Accuracy
47.0 - 63.6	0.1	±(0.1%Reading + 1 digit)

RCD and LOOP function are active only for 50Hz ± 0.5Hz frequency

● **VOLTAGE MEASUREMENT (RCD, LOOP, PHASE ROTATION)**

Range [V]	Resolution [V]	Accuracy
0 - 460V	1	±(3%Reading + 2 digits)

● **LOOP P-P, P-N: LINE IMPEDANCE MEASUREMENT (Phase - Phase, Phase - Neutral)**

Range [Ω]	Resolution [Ω]*	Accuracy
0.01 - 9.99	0.01	±(5% Reading + 3 digits)
10.0 - 199.9	0.1	

(*) 0.1 mΩ on range 0.0 - 199.9 mΩ (with IMP57)

Peak value of the Test current

127V	3.65A
230V	6.64A
400V	11.5A

Voltage Range (Phase - Phase, Phase - Neutral) 100 - 250/ 100 - 440V

Frequency 50Hz ± 0.5Hz

● **LOOP P-PE: FAULT LOOP IMPEDANCE MEASUREMENT (Phase - Earth)**

Range [Ω]	Resolution [Ω]*	Accuracy
0.01 - 19.99	0.01	±(5% Reading + 3 digits)
20.0 - 199.9	0.1	
200 - 1999	1	

(*) 0.1 mΩ on range 0.0 - 199.9 mΩ (with IMP57)

Peak value of the Test current:

127V	3.65A
230V	6.64A

Voltage Range (Phase - Earth)

100 - 250V

Frequency

50Hz ± 0.5Hz

● **LOOP R_a 15mA: FAULT LOOP IMPEDANCE MEASUREMENT without RCD Tripping (Phase - Earth)**

Range [Ω]	Resolution [Ω]	Accuracy
1 ÷ 1999	1	- 0%, +(5% Reading + 3 digits)

Test Current

15mA

Voltage Range (Phase - Earth)

100 - 250V 50Hz

● **EARTH: GROUND RESISTANCE MEASUREMENT WITH EARTH RODS**

Range RE [Ω]	Resolution [Ω]	Accuracy
0.01 - 19.99	0.01	±(5% Reading + 3 digits)
20.0 - 199.9	0.1	
200 - 1999	1	

Test Current

<10mA - 77.5Hz

Open circuit Test Voltage

<20V RMS

● **RESISTIVITY MEASUREMENT**

Range ρ	Resolution	Accuracy
0.60 - 19.99 Ωm	0.01 Ωm	±(5% Reading + 3 digits)
20.0 - 199.9 Ωm	0.1 Ωm	
200 - 1999 Ωm	1 Ωm	
2.00 - 99.99 kΩm	0.01 kΩm	
100.0 - 125.6 kΩm(*)	0.1 kΩm	

(*) setting distance = 10m

Test Current

<10mA - 77.5Hz

Open circuit Test Voltage

<20V RMS

13.1.1. ANALYZER and AUX functions

● VOLTAGE MEASUREMENT – SINGLE PHASE SYSTEM (AUTORANGE)

Range [V]	Resolution [V]	Accuracy	Input Impedance
15 - 310V	0.2V	±(0.5% Reading+2digits)	300kΩ (Phase - Neutral)
310 - 600V	0.4V		300kΩ (Phase - Phase)

● VOLTAGE SAG AND SURGE DETECTION – SINGLE PHASE SYSTEM (MANUAL RANGE)

Range [V]	Resolution (Voltage)	Resolution (Time)	Accuracy (Voltage)	Accuracy (rif. 50Hz) (Time)	Input Impedance
15 - 310V	0.2V	10ms (½ period)	±(1.0% Reading+2digits)	± 10ms (½ period)	300kΩ (Phase - Neutral)
310 - 600V	0.4V				300kΩ (Phase - Phase)

● CURRENT MEASUREMENT – SINGLE PHASE SYSTEM (AUTORANGE)

Range [V]	Resolution [mV]	Accuracy	Input Impedance	Overload Protection
0.005 - 0.26V	0.1	±(0.5% Reading+2digits)	200kΩ	5V
0.26 - 1V	0.4			

(*): Example: with a 1000A/1V full scale clamp , the instrument detect only current higher than 5A

● POWER MEASUREMENT – SINGLE PHASE SYSTEM (AUTORANGE)

Quantity	Range	Resolution	Accuracy
ACTIVE POWER	0 - 999.9W	0.1W	±(1.0% Reading + 2 digits)
	1 - 999.9kW	0.1kW	
	1 - 999.9MW	0.1MW	
	1000 - 9999MW	1MW	
REACTIVE POWER	0 - 999.9VAR	0.1VAR	±(1.0% Reading + 2 digits)
	1 - 999.9kVAR	0.1kVAR	
	1 - 999.9MVAR	0.1MVAR	
	1000 - 9999MVAR	1MVAR	
APPARENT POWER	0 - 999.9VA,	0.1VA	±(1.0% Reading + 2 digits)
	1 - 999.9kVA,	0.1kVA	
	1 - 999.9MVA	0.1MVA	
	1000 - 9999MVA	1MVA	
ACTIVE ENERGY (Class 2 EN61036)	0 - 999.9Wh,	0.1Wh	±(1.0% Reading + 2 digits)
	1 - 999.9kWh,	0.1kWh	
	1 - 999.9MWh	0.1MWh	
	1000 - 9999MWh	1MWh	
REACTIVE ENERGY (Class 3 IEC1268)	0 - 999.9VARh,	0.1VARh	±(1.0% Reading + 2 digits)
	1 - 999.9kVARh,	0.1kVARh	
	1 - 999.9MVARh	0.1MVARh	
	1000 - 9999MVARh	1MVARh	

● Cos φ MEASUREMENT – SINGLE PHASE SYSTEM

Cos φ	Resolution	Accuracy [°]
0.20	0.01	0.6
0.50		0.7
0.80		1.0

● VOLTAGE AND CURRENT HARMONICS MEASUREMENT – SINGLE PHASE SYSTEM

Range	Resolution	Accuracy
DC – 25H	0.1V / 0.1A	±(5% + 2 digits)
26H – 33H		±(10% + 2 digits)
34H – 49H		±(15% + 2 digits)

Harmonics values are null under fixed threshold:

- DC: its values are null if it is < 2%of Fundamental or is <2% of Full Scale clamp

- 1st Current Harmonic: its values are null if it is < 0.2% Full Scale clamp

- 2nd - 49th : its values are null if it is < 2% of fundamental or is <2% of Full Scale clamp

● LEAKAGE CURRENT MEASUREMENT

Range (*)	Resolution [mA]	Accuracy	Input Impedance	Overload Protection
0.5 - 999.9mA	0.1mA	±(5% Reading + 2digits)	200kΩ	5V

(*): During a recording the instrument will detect only Current > 5mA with Resolution 1mA

13.2. STANDARDS

13.2.1. General

Safety	EN 61010-1 + A2 (1997)
Protection classification	Class 2 - Double Insulation
Pollution degree	2
Degree of Protection:	IP50
Over-Voltage Category	CAT II 600V~ / 350V~ (phase –earth) CAT III 600V~ / 300V~ (phase –earth)
Usage:	Indoor; max height 2000m
EMC	EN61326-1 (1997) + A1 (1998)

The instrument complies with European Guidelines for CE mark

13.2.2. Safety Test

LOW Ω (200mA):	IEC 61557-4
M Ω :	IEC 61557-2
RCD:	IEC 61557-6
LOOP P-P, P-N, P-PE:	IEC 61557-3
PHASE SEQUENCE:	IEC 61557-7
EARTH:	IEC 61557-5

13.2.3. ANALYZER

Voltage Sag and Surge	EN50160
Alternating Current Static Watt-hour meters for Active Energy	EN61036 (CLASS 2)
Alternating Current Static VAR-hour meters for Reactive Energy	IEC1268 (CLASS 3)

13.3. GENERAL SPECIFICATIONS

13.3.1. Mechanical Data

Dimensions	225 (L) x165 (W) x 105 (H) mm
Weight	1295g approx (including batteries) 1150g approx (excluding batteries)

13.3.2. Power supply

Batteries	6 x 1.5-LR6-AA-AM3-MN 1500
Battery Life:	LOW Ω : approx: 800 tests M Ω : approx: 500 tests RCD AC and A Type: approx: 1000 tests LOOP P-P, P-N, P-PE: approx: 1000 tests Ra \perp : approx: 1000 tests EARTH: approx: 1000 tests PHASE SEQUENCE: approx: 1000 tests AUX (recording): approx: 20 Hours ANALYZER (recording): approx: 20 Hours
External Power Supply Adapter (optional)	Code MARVR2250PSU (for ANALYZER and AUX) functions

13.3.3. Display

Display Type	Graphic with backlight
Resolution	128 x128
Visible Area	73mm x 73mm

13.3.4. Memory

Safety Test Memory	999 measurements
ANALYZER:	2MByte (with 63 channels selected and Integration Period = 15min), more than 30 days).

13.4. ENVIRONMENT

Reference Temperature	23° ± 5°C
Working Temperature Range	0° - 40°C
Working Humidity	< 80%
Storage Humidity Range	-10° - + 60°C
Storage Humidity	< 80%

13.5. ACCESSORIES

Standard accessories

Description

- GB 13A cable with 3 terminals
- Set with 4 cables (2m), 4 croc clips,
- Management Software + RS232 Optical-Serial Cable
- Zip Carrying Case
- Calibration Certificate ISO9000
- User's Manual

Optional Accessories

Description

- Set with 4 cables and 4 earth rods
- External power supply adaptor
- Flexible current clamp 1000A / 3000A

Code

MARER4KIT
MAR2250PSU

14. SERVICE

14.1. WARRANTY

Faults in manufacture and materials are fully guaranteed for 24 months from date of invoice and will be rectified by us free of charge, provided that the unit has not been tampered with and is returned to us with its housing unopened. Damage due to dropping, abuse or misuse is not covered by the guarantee. Nothing in these instructions reduces your statutory rights.

NOTE: The manufacturer reserves the right to modify the product specifications and prices if this is aimed at technological improvements

The content of this manual cannot be reproduced in any form whatsoever without prior authorisation of the manufacturer.

14.2. SERVICE

Repair & Service

There are no user serviceable parts inside this unit. Please return to Martindale Electric Company Ltd if faulty, unless fuse replacement only is necessary. Our service department will promptly quote to repair any faults that occur outside the warranty period. Please call our service and calibration department on **01923 650620** for further details.

15. APPENDIX 1 – MESSAGES DISPLAYED

Message	Description	Advices
AUTONOM:	Available memory for recording	
CLEAR ALL? (Enter)	The operator is trying to cancel all the recordings	Press ESC in order not to cancel the whole memory, press ENTER to confirm
CLEAR LAST? (Enter)	The operator is trying to cancel the last recording	Press ESC in order not to cancel the last recording, press ENTER to confirm
Data saved	The data has been saved	
DATA SIZE:	Dimensions of the stored data	
HOLD	The HOLD function has been activated	Press HOLD again to disable this function
Password:	A recording has been started and at least 5 minutes have passed from the last activity of the instrument (see paragraph 7).	Insert the password: F1, F4, F3, F2
Invalid date	The date entered is not correct	Check the date entered
Energy Measuring	The instrument is taking an energy measurement	Press F1 to stop
Memory Full	The instrument memory is full	Cancel some recordings after transferring them to a PC
No ext supply!	A recording has been started without connecting the external power supply (code MARVR2250PSU)	Verify if you really want to start the recording without the external power supply. In that case press START again.
No parameter sel	A recording has been started without selecting any value to be recorded	Press START/STOP and select at least a value entering the MENU
No Phase selected	Voltage and / or current harmonics have been selected and the corresponding flag has been enabled (HARMONICS ON) but no phase voltage or current has been selected	Select at least one phase voltage and / or current
PASSWORD ERROR	The password entered is wrong (see paragraph 8.1.6).	Check the password
PASSWORD OK	The password entered is correct	
Please wait	The instrument is waiting for the recording to be started (see paragraph 10)	
Recording	The instrument is recording (see paragraph 10)	
Too many param	More than 63 parameters have been selected (harmonics included) or More than 38 parameters with CO-GENERATION Flag enabled	Deselect some values
Too many records	The quantity of recorded data + Smp exceeds the maximum allowed (35)	Cancel some recordings after transferring them to a PC
No Unit selected		
ERR: SEQ	The Phase Sequence is not correct.	Check the Phase Sequence connection.
ERR: P-	The active powers shown on the right of the message are negative	If there is not a situation of co-generation, check if the clamps are properly connected
ERR: SEQ & P-	The active powers shown on the right of the message are negative and the Phase Sequence is not correct.	If there is not a situation of co-generation check if the clamps are properly connected / check the Phase Sequence connection.
ERR: CONNECTION	The instrument has detected a wrong connection to voltage inputs	Check the voltage connections
Error Vref	The user set a voltage reference not compatible with voltage at instrument's input.	Check Voltage Reference set in "CONFIG RECORDER"
ERR: SYNC	The System Frequency is out of range	Check the System Frequency, check setting in ANALYZER CONFIG.
Selection Error	There is a mismatch between the parameter enabled and the parameter selected for an AUX recording.	Check the parameter enabled in AUX position and the selected parameter for recording.
Error1 - Error 5	The instrument memory is damaged.	Contact Martindale Electric

16. APPENDIX 2 – RECORDABLE PARAMETERS: SYMBOLS

Symbol	Description
V1	Voltage RMS value
freq	Network frequency
I1	Current RMS value
DC	Continuous component of voltage or current
h01 - h49	Harmonic 01 - Harmonic 49 of voltage or current
ThdV	Factor of total harmonic distortion of the voltage
ThdI	Factor of total harmonic distortion of the current
P1	Active power
Q1i	Inductive Reactive power
Q1c	Capacitive Reactive power
S1	Apparent power
pf1	Power factor
dpf1	$\cos\phi$
Ea1	Active energy
Eri1	Inductive reactive Energy
Erc1	Capacitive reactive Energy