

Users Manual

Phenix Technologies Inc.

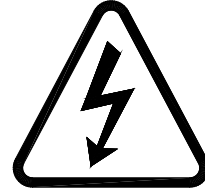


MICRO-OHMMETER
MODEL NUMBER MRM-100
Version 1.1

DK/ELL/LEO/slu
May, 2004

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PRODUCT INFORMATION**CAUTION**

CAUTION: Contact with the test leads on this equipment can cause harmful electrical shock. Do not touch test leads while a test is in process.

SAFETY AND CAUTION NOTES

1. Contact with the test leads on this equipment can cause harmful electrical shock. Do not touch test leads or test object while a test is in process.
2. Insure the micro-ohmmeter is properly grounded through the power cord before proceeding with a test.
3. Turn the micro-ohmmeter off and unplug power cord before reaching inside. Damage to the tester and hazardous shock to personnel will result if this procedure is not followed.
4. Insure that the equipment to be tested is de-energized and properly isolated.
5. Use care to avoid damaging the micro-ohmmeter during disassembly and re-assembly procedures.
6. This unit should only be operated by someone familiar with high current testing and safety procedures.

Phenix Technologies, Inc. assumes no liability for unsafe or improper use of test equipment.

PRODUCT SPECIFICATIONS

Input:

100 to 240 VAC, 50/60 Hz, single phase, 5 Amps.

Resistance Measurement Range:

1 $\mu\Omega$ to 240m Ω , non-inductive.

Test Current:

10 to 105 Amps, selectable in 1 Amp steps.

Uncertainty:

+/- 1% of reading, +/- 0.4 $\mu\Omega$ at 100 Amps or +/-4 $\mu\Omega$ at 10 Amps.

Resolution:

1 $\mu\Omega$ to 199 $\mu\Omega$: 0.1 $\mu\Omega$

200 $\mu\Omega$ to 1999 $\mu\Omega$: 1 $\mu\Omega$

2.00m Ω to 19.99m Ω : .01m Ω

20.0m Ω to 240.0m Ω : 0.1m Ω

Termination:

30 foot cables with alligator clamps. C clamps are also available

Keyboard:

10 number keys, 26 letter keys, and 14 function keys.

Control:

Embedded microprocessor

Display:

4 X 20 LCD screen

Computer Port:

RS-232 ASCII Commands

Memory:

The MRM-100 can store up to 300 measurements in memory.

Type of Cooling:

Two cooling fans

Uncertainty Temperature Range:

18°C to 27°C (64°F to 81°F)

Operating Ambient Temperature:

-7°C to 45°C (19°F to 113°F)

Storage Temperature:

-20°C to 57°C (-4°F to 135°F)

Dimensions:

16.5" W x 15.25" D x 11.25" H (419 mm W x 388 mm D x 286 mm H)

Weight:

Unit: 28.5 lbs. (13 kg)

Cables/ Bag/Accessories: 19.5 lbs. (8.8 kg)

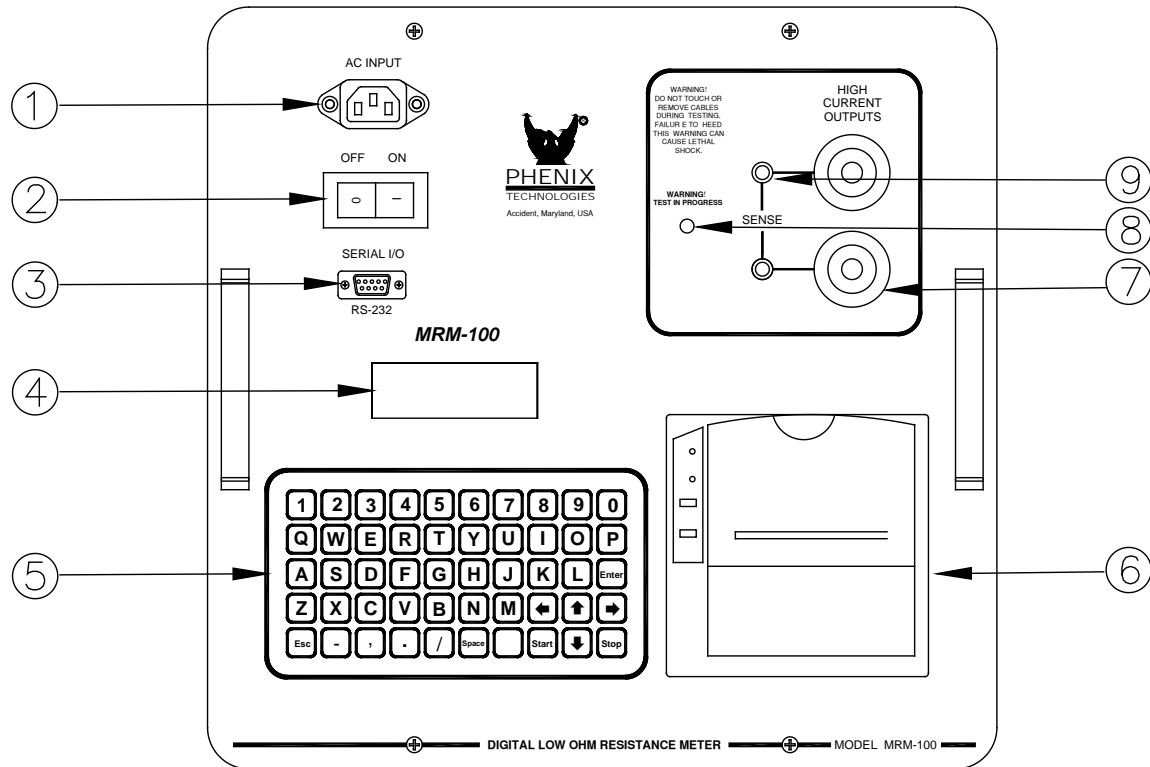
INTRODUCTION

The MRM-100 is a portable micro-Ohmmeter used to test circuit breaker contact resistance, or anywhere low resistance measurements at currents up to just over 100 Amps are required. The MRM-100 uses a low voltage, high current power supply to run a user-defined test current of between 10 Amps to 105 Amps to any resistive load that requires no more than 2.5 Volts across it to test. The MRM-100 does detect if the test is able to reach desired current, and allows for immediately stopping the test.

THEORY OF OPERATION

The MRM-100 uses a two-voltmeter method where each voltage reading implements a four-wire Kelvin connection. One voltmeter monitors the voltage across a known, highly stable shunt that passes the test current through it, while the other voltmeter monitors the voltage across the unit under test. A test current is then applied (see ANSI C37.09 and IEC 62771-100 for test current requirements). This current is ramped up, held for a period of time and then ramped down. While the current is relatively constant, the voltages across the known resistance and unit under test are amplified and filtered. Then they are sampled several times by analog to digital converters to reduce any noise, and processed by a microcontroller. The microcontroller calculates the ratio between the test current and sensed voltage to determine the resistance. The micro-Ohmmeter is designed to test resistances of 1 micro-Ohm to 240 milliohms.

CONTROLS AND INDICATORS



- 1. AC Line Cord Input Connector:**
Plug into a suitable grounded receptacle. See specifications for voltage and current requirements.
- 2. Main Power Switch:**
Turning the switch On / Off energizes or de-energizes the MRM.
- 3. RS-232 Port:**
This port allows communication with a Personal Computer for data acquisition and remote control, when supported by appropriate optional software.
- 4. LCD Display:**
This 4x20 Character display, shows all relevant information during testing and setup.
- 5. Keypad:**
This keypad is used to enter test parameters.
- 6. Built In Printer:**
The built in dot matrix printer is designed to print test results immediately or to provide a printout of saved tests.

CONTROLS AND INDICATORS (Continued)

7. High Current Output Connection

This receptacle is for connection of the high current output leads.

8. Output Energized Indicator:

This indicator illuminates under any of the following conditions:

- a. A test is in progress.

No test cables should be connected, disconnected or handled while this light is on.

9. Output Sense Lead Connection:

This receptacle is for connection of the sense leads required for the four wire measurement.

ELECTRICAL SET-UP

Line / Generator Powered Operation

Locate the desired location for the test set. Prepare the main power input cable for plugging into the proper facility or generator power. Leave plug unconnected at this time. Ensure that generator is properly grounded with facility ground or ground (earthing) rod.

Measurement Lead Connection

WARNING: Main power switch on front panel must be in the OFF position before proceeding. Insure test specimen is de-energized, discharged, and properly isolated!

1. Connect the measurement cables with red leads to the positive terminal (if applicable) of the unit under test.
2. Connect the measurement cables with black leads to the negative terminal (if applicable) of the unit under test.
3. Connect the input main power cable to appropriate power source if powering with line power.

Note: Specimen connection points for test cables must be clean and corrosion free. Any contamination at connection points may result in errant readings.

MRM MENU TREE

STARTING SCREENS

MRM START UP SCREEN

						P	H	E	N	I	X							
				T	E	C	H	N	O	L	O	G	I	E	S			
		M	R	M	-	1	0	0			V	E	R	-	1	.	0	0
		<	P	R	E	S	S		A	N	Y		K	E	Y	>		

Press any key (except "Esc") to proceed.

TEST OPERATOR ID SCREEN

E	N	T	E	R		O	P	E	R	A	T	O	R		I	D	:		
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
P	R	E	S	S		<	E	n	t	e	r	>		T	W	I	C	E	

Operator identification may be entered here and is shown on printouts as well as saved tests. Leave blank if not wanted for test. To delete the existing entry, move cursor to the left with left arrow and use delete key.

①	→			1	.	P	E	R	F	O	R	M		T	E	S	T	S		
②	→			2	.	O	P	E	R	A	T	O	R		I	D				
③	→			3	.	S	A	V	E	D		R	E	S	U	L	T	S		
④	→			4	.	S	Y	S	T	E	M		S	E	T	U	P			

MRM MAIN MENU

The following numbers are keyed to the screen shot above.

- 1) If "1" is pressed, a test setup is begun.
- 2) If "2" is pressed, the operator identification can be altered.
- 3) If "3" is pressed, saved results can be recalled.
- 4) If "4" is pressed, the meter itself can be set up.
- 5) If "1" is pressed, the following screen is displayed.

PERFORMING TESTS**TEST DESCRIPTION SCREEN**

E	N	T	E	R		T	E	S	T		I	D	:						
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
P	R	E	S	S		<	E	n	t	e	r	>		T	W	I	C	E	

Any information about the next test can be given here (up to 20 characters).

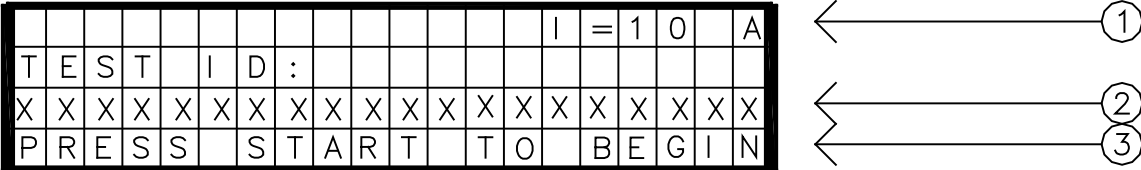
TEST CURRENT SET-UP

E	N	T	E	R		T	E	S	T		C	U	R	R	E	N	T	
							1	0			A							
P	R	E	S	S		<	E	n	t	e	r	>		T	W	I	C	E

Any current from 10Amps to 105Amps (in one amp steps) can be entered here. The actual test current will vary somewhat from the entered current but will be close. If current as entered results in a level slightly below the minimum or slightly above the maximum allowed for test, entry can be changed by one amp steps to bring current level within specification.

READY FOR TEST SCREEN

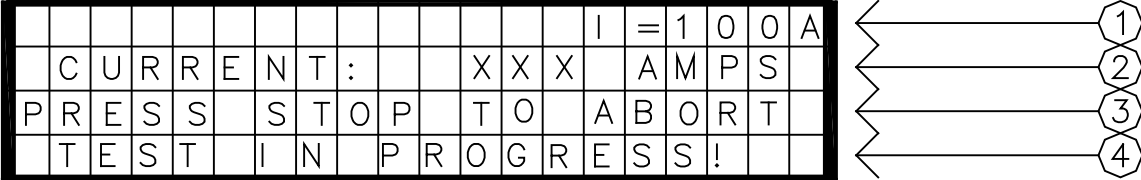
When "Enter" is pressed, the meter shows the following screen:



This screen shows information about the test and how to begin.

- 1) This shows at what current the test will be at.
- 2) This displays the test ID information entered.
- 3) The green "Start" button on the keypad begins the test.

TEST IN PROGRESS SCREEN



This screen is what is shown while the test is running.

- 1) This is the approximate current the test is run at.
- 2) This is the current being measured. This should ramp up to about the current shown on the first line.
- 3) If the test current is to be cut off, press the red "Stop" button on the keypad.
- 4) This warns the user (along with the beeper and the red warning light) there may be a high current going through the test cables.

When the test is completed, the following screen will appear.

RESULT SCREEN

T	E	S	T		N	O	T		S	A	V	E	D										
					C	U	R	R	E	N	T	:			X	X	X		A	M	P	S	
					R	E	S	I	S	T	A	N	C	E	:	X	X	X	X	m	Ω		
										T	E	S	T			R	E	S	U	L	T	S	

mΩ = milliohms

OR

uΩ = micro-Ohms

CYCLES BETWEEN
MESSAGES

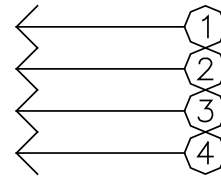
P R E S S " P " T O P R I N T
< E n t e r > T O C O N T I N U E
P R E S S " S " T O S A V E

This shows the measured resistance as well as the actual test current. The top line is shown only until "S" is pressed. The last line gives options as well as affirms these are the results. To return to the Main Menu from this screen, press "ENTER" and "Esc"

If "Enter" is pressed, the following screen appears.

CONTINUE SCREEN

T	E	S	T		N	O	T		S	A	V	E	D										
					P	R	E	S	S		<	S	>		T	O		S	A	V	E		
					P	R	E	S	S		<	R	>		T	O		R	E	T	E	S	T
					<	E	n	t	e	r	>		T	O		C	O	N	T	I	N	U	E



- 1) The first line will appear if the test has not yet been saved to memory.
- 2) This reminds the user how the test can be saved.
- 3) To repeat the test at the same current and test ID, press "R".
- 4) To run a different test press "Enter".

If for some reason the operator presses the "Stop" key while a test is in progress, the following screen appears:

TEST ABORTED SCREEN

W	A	R	N	I	N	G	!										
C	U	R	R	E	N	T	:			X	X	X	A	M	P	S	
T	E	S	T	A	B	O	R	T	E	D	!						
		<	P	R	E	S	S		A	N	Y		K	E	Y	>	

From here, pressing any key gives the following screen:

ABORTED CONTINUANCE SCREEN

P	R	E	S	S		<	R	>		T	O		R	E	T	E	S	T
<	E	n	t	e	r	>		T	O		C	O	N	T	I	N	U	E

This gives the user the option to retest the unit at the same current and test ID, or start a new test.

Pressing "Esc" will return user to the main menu.

SAVED RESULTS

		1	.	P	E	R	F	O	R	M		T	E	S	T	S			
		2	.	O	P	E	R	A	T	O	R		I	N	F	O			
		3	.	S	A	V	E	D		R	E	S	U	L	T	S			
		4	.	S	Y	S	T	E	M		S	E	T	U	P				

Pressing “3” at the MRM Main Menu screen for “Saved Results’ produces the following screen.

SAVED RESULTS SCREEN

T	E	S	T	#	1	2	3	4	5	6									
M	M	/	D	D	/	Y	Y					H	H	:	M	M	:	A	M
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<	D	>		D	A	T	A		/		<	P	>		P	R	I	N	T

U S E ▲ O R ▼ T O S C R O L L

← ①

← ②

TEST ID ENTERED PREVIOUSLY

⌋ CYCLES BETWEEN MESSAGES

- Information provided by this screen is:
- 1) Saved test number, and
 - 2) The day and time the test was performed.

A test identifier typed in by the operator is also given.

The screen can scroll between the different saved tests as well as give options to see or print the data. If “P” is pushed, complete information for the selected saved test is printed.

If “D” is pressed to see the data one gets the following screen:

SAVED DATA SCREEN

T	E	S	T	#	1	2	3	4	5	6	7								
C	U	R	R	E	N	T	:				X	X	X	X		A	M	P	S
R	E	S	I	S	T	A	N	C	E	:		X	X	X	X			m	Ω
E	S	C		E	X	I	T	/		<	P	>		P	R	I	N	T	

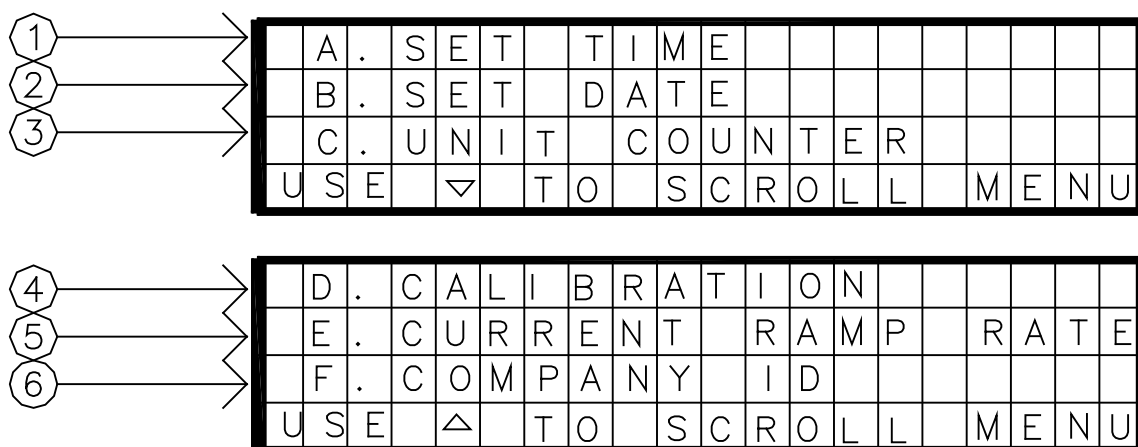
This gives the results of the saved test.

To return to the main menu, press “Esc” as appropriate. At some instances, “Enter” must be pressed before “Esc” is allowed.

		1	.	P	E	R	F	O	R	M		T	E	S	T	S			
		2	.	O	P	E	R	A	T	O	R		I	N	F	O			
		3	.	S	A	V	E	D		R	E	S	U	L	T	S			
		4	.	S	Y	S	T	E	M		S	E	T	U	P				

SYSTEM SETUP

If "4" is pressed, one gets to the two screens (which can be toggled by the up/down arrows).

SYSTEM SETUP SCREENS

The six setup options are:

- 1) A. Viewing and setting the time for the meter
- 2) B. Viewing and setting the date for the meter
- 3) C. Viewing the unit counter (which tells how many tests have been run).
- 4) D. Viewing and setting the meter's calibration values (generally only for factory use).
- 5) E. Viewing and setting the current ramp rate. The ramp up/down speeds are approximately:
 - 1- 10 Amp/sec
 - 2- 15 Amp/sec
 - 3- 25 Amp/sec
 - 4- 35 Amp/sec
 - 5- 55 Amp/sec
- 6) F. Company name or other desired information can be entered for display on printouts.

If option "A" is pressed, the following screen appears:

SET TIME SCREEN

T	I	M	E		(A	M	,	P	M	,	2	4	H)	=	2	4	H
		H	O	U	R	S		=	0	9									
M	I	N	U	T	E	S		=	5	9									
U	S	E		◀		F	O	R		A	M	,	P	M	,	2	4	H	

T Y P E N U M B E R & E N T E R

The “1” arrow shows the hours and minutes which can be changed. The meter can also give the time in AM/PM or 24 hour time.

If option “B” is pressed the date screen appears.

SET DATE SCREEN

		M	O	N	T	H		=	0	9								
				D	A	Y		=	2	9								
				Y	E	A	R		=	0	3							
T	Y	P	E		N	U	M	B	E	R		&		E	N	T	E	R

Here the date can be modified per the instructions on the last line. To move around on the screen use the blue arrow keys on the keypad.

If option “C” is pressed, the counter screen appears.

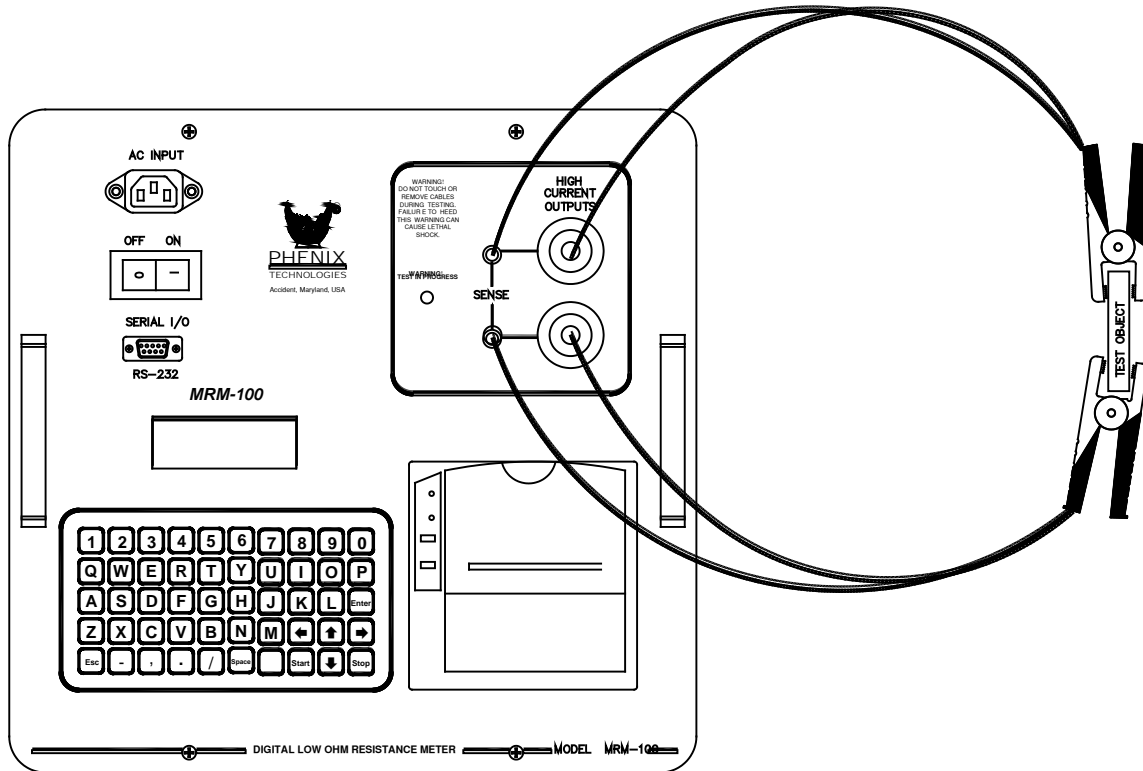
UNIT COUNTER SCREEN

			T	O	T	A	L		N	U	M	B	E	R		O	F	
							T	E	S	T	S							
							1	2	3	4	5	6	7					
P	R	E	S	S		”	E	S	C	”		T	O		E	X	I	T

This number will increment for every test performed, whether it is saved or not.

OPERATING INSTRUCTIONS UNIT UNDER TEST

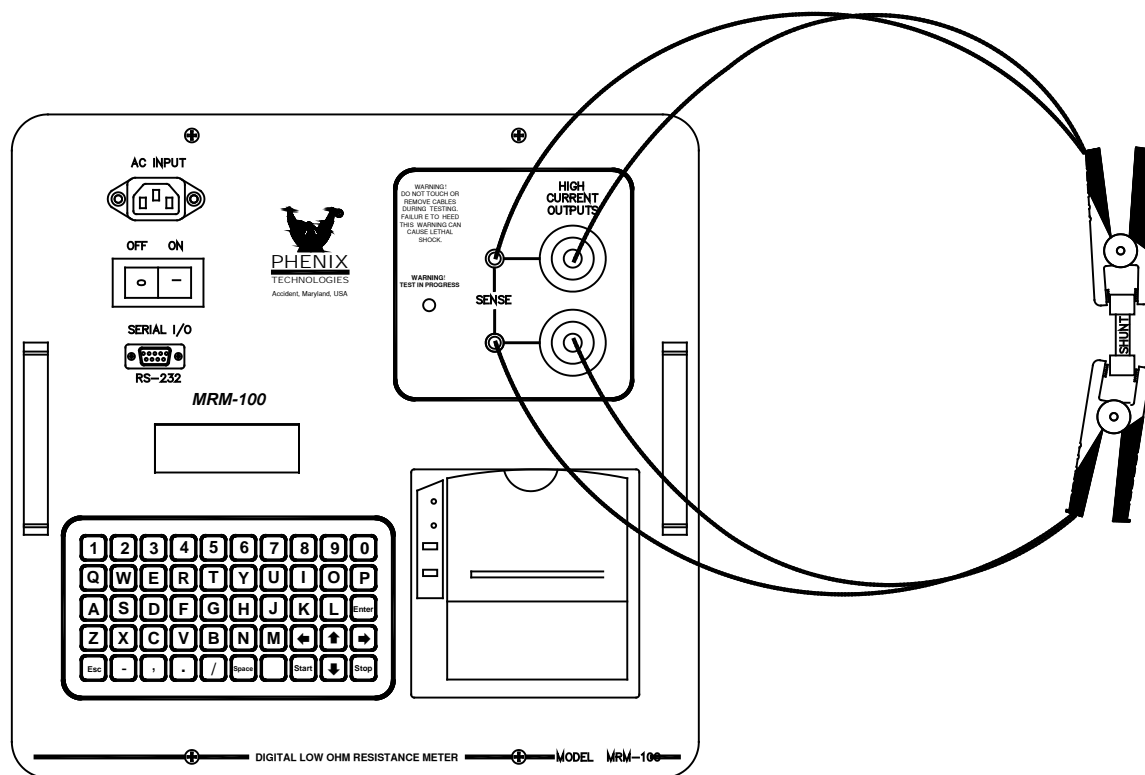
- 1) Follow the Setup Instruction described in the “ELECTRICAL SETUP SECTION”



TYPICAL UNIT UNDER TEST HOOK UP.

- 2) Turn On Power.
- 3) Wait for the system to boot and press any key to continue.
- 4) Enter the operator ID if desired. Press “Enter” twice.
- 5) Press “1” in the Main Menu.
- 6) Enter the test ID information if desired. Press “Enter” twice.
- 7) Enter the test current desired. Press “Enter” twice.
- 8) Press the green “START” button.
- 9) The instrument will make a beeping sound and the “Warning: Test in Progress” light will come on.
- 10) Upon completing the test, the results will be displayed unless there is an error. Press “P” to print, “Enter” to continue, or “S” to save.

OPERATING INSTRUCTIONS METER CHECK



METER VERIFICATION HOOK UP

- 1) Follow the Setup Instruction described in the "ELECTRICAL SETUP SECTION", using the supplied 100 Amp, 100 milliVolt current shunt.
- 2) Turn On Power.
- 3) Wait for the system to boot and press any key to continue.
- 4) Enter the operator ID information. Press "Enter" twice.
- 5) Press "1" in the Main Menu.
- 6) Enter the test ID information, if available. Press "Enter" twice.
- 7) Enter the test current desired. Press "Enter" twice.
- 8) Press the green "START" button.
- 9) The instrument will make a beeping sound and the "Warning: Test in Progress" light will come on.
- 10) Upon completing the test, the MRM-100 should give a result between 987 and 1013 micro-Ohms at 100 Amps or between 983 and 1017 micro-Ohms at 10 Amps.

Troubleshooting Operational Problems

Higher than Expected Readings

Resistance readings which seem higher than normal may be due to corroded terminals on the unit under test or on the measurement cables. The connections should be cleaned off and the test should be repeated. If the problem persists, follow the instructions in "OPERATING INSTRUCTIONS – METER CHECK" of this manual to verify meter operation.

Inability to Reach Test Current

If the micro-Ohmmeter is unable to run up to test current, disconnect the measurement cable from the unit under test. Then follow the instructions in "OPERATING INSTRUCTIONS – METER CHECK" of this manual. Testing the supplied shunt, the unit should be able to test from 10 to 105 Amps. The actual test current may not be exactly the current command. If a test current of at least 100 Amps is required, a current command of 105 Amps should be given.

STORAGE OF EQUIPMENT

If the equipment will be stored for a prolonged period, the following precautions are recommended.

1. The equipment should be covered and kept in a temperate, dry environment (non-condensing, -20 to 55°C).
2. In no case should the test unit be stored outdoors (unless previously specified in the original purchase agreement).

MAINTENANCE

CHANGING THE PAPER ROLL

To change the paper roll, proceed as follows: (also see diagrams on underside of printer cover)

- 1) Open the printer cover and press down the swinging support of the print mechanism at the point marked PUSH. Remove empty paper reel.
- 2) Insert the end of the roll in the slit of the print mechanism.
- 3) Press the FEED key; a few centimeters of paper automatically feed out of the printer. (power must be on). Snap paper roll into pivot arms.
- 4) Re-close the swinging support, tear off the paper and re-close the cover.

CHANGING THE RIBBON

- 1) Open printer cover.
- 2) Push on ribbon cartridge on end marked "EJECT" at "PUSH" point
- 3) Insert new ribbon cartridge with paper inserted between exposed ribbon and cartridge body.
- 4) Remove slack from ribbon by turning thumb wheel in direction of arrow. Close cover.



WARNING

- Before inserting the paper, ensure it is cut evenly.
- Do not print without paper and/or ink ribbon; this leads to the rapid deterioration of the print needles.
- Do not pull the printer carriage manually when it is switched on.
- Do not put objects inside the printer.
- Avoid blows to any part of the printer, both during and after installation.

RECOMMENDED SPARE PARTS

Phenix Technologies recommends that the customer purchase and stock the following parts for normal maintenance of the unit. The recommended quantity should be sufficient to support the unit during normal operation.

If the unit will be operated at an isolated site for an extended period or will be subjected to unusual stresses, a larger quantity of parts should be stocked as spares. In such cases, contact Phenix Technologies for a recommendation.

Current prices may be obtained by contacting the Parts Ordering Department at Phenix Technologies.

<u>Part Name</u>	<u>Phenix Stock Number</u>	<u>Recommended Quantity</u>
Printer Paper 5 Pack	1001838	1
Printer Ribbon	1001835	1

MRM-100 PARTS LIST

Qty.	Phenix Stock #	Designation	Description
	6911000		MRM-100 MECHANICAL ASSEMBLY
	7911000		MRM-100 ELECTRICAL ASSEMBLY
1	1001226	DISPLAY	LCD, MATRIX ORBITAL (20X4)
1	1001517	PRINTER	RECEIPT PRINTER (CUSTOM-MYLOX)
1	1151200	PRINTER	DB-25P SOLDER (81F5173)
1	1780025	D1	1N4007 (1000VR,1.0A)
1	1151210	RS232	FA920 FEMALE SCREWLOCK – SCREW PACK
2	1151232	RS232	9 P SKT SOLDER-TYPE D (MALE SHELL, FEM PINS)
1	1152240	24PIN PLUG	2-640428-4, CON 24C, .156
1	1153328	AC INPUT	SCREW MOUNT POWER INLET RECEPT. 15A 250V
1	1159968	HC OUTPUT	100 AMP SOCKET, RED (06F014)
1	1159970	HC OUTPUT	100 AMP SOCKET, BLACK (06F012)
1	1509910		100A 100MV SHUNT (METER CHECK)
1	1001222	KYP1	KEYPAD 5 X 10 MATRIX
1	1356214	SENSE	MULTILAM JACK BLACK-4MM
1	1420134	LP2	RED DAYLIGHT VISIBLE 24VDC LED
1	1356215	SENSE	MULTILAM JACK-RED-4MM
1	1482902	THERMAL	THERMAL SWITCH, 65 DEG C NC
1	1509909	SHUNT	SHUNT, 100A-100MV (W/CERT. DATA)
1	1590120	PWR SPLY	CONDOR GLC75E POWER SUPPLY
1	1590125	HC PWRSPLY	LAMBDA JWS6005 POWER SUPPLY
1	1601308	SWITCH	TA45 DP CIRCUIT BREAKER 5A
5	1793287	MOSFET	HEXFET, INTL. RECT. IRFP150N
2	1899006	INDUCTOR	IND 500UH 2.0A
2	2350122	FAN	FAN 24VDC
1	30120002		OUTPUT/SENSE CABLE 30', RED
1	30120003		OUTPUT/SENSE CABLE 30', BLACK
1	31126610	PCB 1266	PCB 1266 MRM-100 MAIN BOARD
1	42000055		CONTROL PANEL
1	2100505	CASE	CASE GH1415-RM-2 (01100531)
2	2101710		HANDLE, 10501-005, 3RU
1	40400079		CHASSIS PLATE
1	40400014		CHASSIS SPACERS, 1/2" X 6.25"
1	1001838	PRINTER	5 PACK PRINTER PAPER
1	1001835	PRINTER	PRINTER RIBBON
2	2350126	CASE	FILTER SCREEN
2	2350127	CASE	FILTER GUARD
1	2100540	BAG	CABLE/ACCESSORY BAG

PARTS ORDERING INFORMATION

Replacement parts are available from Phenix Technologies, Inc.

Changes to Phenix Technologies' products are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest technical improvements developed in our Engineering Department. It is, therefore, important when ordering parts to include the serial number of the unit as well as the part number of the replacement part. When your purchase order is received at our office, a representative of Phenix Technologies will contact you to confirm the current price of the part being ordered. If a part you order has been replaced with a new or improved part, an Applications Engineer will contact you concerning any change in part number.

Your order for replacement parts should be sent to:

Replacement Parts Department
Phenix Technologies, Inc.
75 Speicher Drive
Accident, Maryland 21520

RETURNED MATERIAL

If for any reason it should become necessary to return this equipment to the factory, the Service Department of Phenix Technologies, Inc. must be given the following information:

Name Plate Information
Model Number
Serial Number
Reason for Return
Cause of Defect

If Phenix Technologies, Inc. deems return of the part appropriate, it will then issue an "Authorization for Return".

If return is not deemed advisable, other inspection arrangements will be made.

NOTE: Material received at this plant without the proper authorization shall be held as "Customer's Property" with no service until such time as the proper steps have been taken.

Your cooperation is requested in order to ensure prompt service.

ELECTRICAL DIAGRAMS

	<u>Drawing Number</u>	<u>Description</u>
1.	9901000 Sheet 1/2	MRM-100 Block Diagram
2.	9901000 Sheet 2/2	MRM-100 Interconnect