



CURRENT RELAY TESTING SET

USER'S MANUAL



LET-4000-RDM

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USER'S MANUAL

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**ADDENDUM 1: "TM-01-MC MULTIFUNCTION
TIMER"**

LET-4000-RDM PACKING LIST

1	LET-4000-RDM Power Unit
1	LET-4000-RDM Control and measuring Unit
2	Nylon protection bags
1	Interconnecting Cable
1	Supply Cable
1	Output Connection Cable and accessories
1	Timer (TM01) accessories kit
1	Measurement Certificate
1	Warranty
1	Manual

1. DESCRIPTION

1.1. INTRODUCTION

The LET-4000-RDM set is designed to make the testing of primary protection relays as fast and as functional as possible.

Since the set can produce up to 8KA, it is vital to have sufficient power to hook up long connecting cables without problems; nominal power is therefore 8000VA. Due to the size and weight, the makers opted for twin units - a Power Unit and a Measuring Unit, detailed below.

1.2. POWER UNIT

Inside the power unit are the regulating, production, and connecting elements essential for the proper operation of the set. It comes in a steel casing, heat-enamelled with anti-rust epoxy paint of sufficient rigidity. It is fitted with wheels for convenience of movement and contains the following elements:

1 Continuous-regulation autotransformer with motorized control having the following technical characteristics:

- **Power supply:** 220V \pm 10%, 50-60Hz.
- **Output:** 0-220V.
- **Power:** 8KA

2 Current-producing transformer having the following technical characteristics:

- **Primary:** 220V, 50-60Hz.
- **Secondary:**
 - 2V 4000A
 - 4V 2000A
 - 8V 1000A
 - 16V 500A
- Power in each output range: 8KVA.

The apparatus is fitted with a set of copper-strip connecting terminals of adequate dimension for the high current.

In addition, the power input has an automatic magnothermal cutoff switch of sufficiently calibrated.

1.3. CONTROL AND MEASURING UNIT

This unit houses the control and regulating devices, the connection and disconnection control, chronometer for timing relay action and digital ammeter to measure current output. It is connected to the power unit by 5m of multi-wired cable. Details of each of these systems which make up the control and measurement and are given below.

1.3.1. Regulating control.

Comprises two buttons respectively marked "UP" (Current increase) and "DOWN" (Current decrease). It also incorporates two LEDs indicating regulator status, marked "MIN" (minimum) and "MAX" (maximum) respectively.

The two buttons activate the servomotor of the continuous-regulation autotransformer located in the power unit.

1.3.2. Measurement of output current.

Output current is measured via a digital instrument with 3 1/2 digits and a switching system for the different measurement ranges, each range has its own indicating leds.

The technical characteristics are as follows:

- o Ranges: 0-500/1000/2000/4000A.
- o Accuracy: $\pm 0.5\%$

IMPORTANT: Each range ONLY WORK with the correspondent tap. If you have selected the 500A range in the ammeter and you are connected in the 1000A tap the ammeter will not be metering the output in the 1000A tap.

1.3.3. Measurement of action time

The action time of the relay being tested is measured via a digital chronometer incorporated in the set. The technical characteristics are as follows:

- o Measurement range: 00.001sec to 99999sec.
- o Start signal: By internal contact with the current output connection signal
- o Stop signals: - Potential-free contact (open or closed).
- o Presence or absence of voltage from 5-250V either AC or DC.

For more information see Annex 1 timer TM-01-MC.

2. OPERATING INSTRUCTIONS

2.1. GENERAL REMARKS

The LET-4000-RDM is simple and convenient to use test set, for any operator possessing the minimum knowledge of electricity normally needed by someone in charge of testing. The apparatus is designed to maintain maximum nominal amperage in each range under continuous service; this means that much higher currents may be sustained for short intervals, provided that the maximum output voltage is sufficient for the impedance connected to it. In such cases the ammeter's measurement range may be insufficient; in such an event, an external ammeter must be used. In any case the power unit is heat-protected throughout, so that if temperature exceeds the set limits, current output is cut off and cannot be restored until the temperature is low enough to operate without risk to the system.

Owing to the large number of possible applications of the set, these notes do not include specific practical examples. They simply indicate how to obtain the desired current readings and how to interpret the measurements.

2.2. RECEPTION AND START-UP

Check that the elements included in the packing list are there and that they show no signs of damage from transportation. Should there be any such damage, contact us or our representative before starting up the apparatus.

Once unpacked, the procedure for starting up the apparatus is as follows:

1. Connect the two units together (Power and Control) with the cable supplied. Special care should be taken to tighten the connector fixing screws properly.
2. Ensure that the power supply is $220V \pm 10\%$, 50 or 60Hz (see point 8).
3. Check that the automatic cutoff on the power unit is in position "0" (off).

4. Check that there is no moisture in the system and that it is not in contact with extraneous live conductors.
5. Connect the set to the power supply from the two terminals on the power unit. Use cable of minimum 6mm^2 section.
6. Set the automatic cutoff to position "I" (on). This energizes all the control and measurement circuits but not the power circuits. The following elements should light up:

- Power Unit

- o "Set connected" indicator light.

- Control Unit

- o Ammeter measurement range indicator (Whichever is selected). Turn the selector to check that all range indicators are working.
 - o The ammeter display should show $.000 \pm 2$ digits.
 - o The green button/light marked OFF on the "REGULACION" section.
 - o The timer display should show "00". On energising, the timer will often start counting. Press the RESET button to return it to "00".
 - o The yellow diode marked "MIN" should light up, indicating that the power regulator is at zero setting. If this is not the case, press the button marked "DOWN" until the "MIN" indicator lights up.
 - o Once all these checks are run, the power unit can be tested. Procedure is as follows.
7. Connect one of the contacts of an AC voltmeter in the 20V range to the terminal marked "0". The other voltmeter contact should be connected to the terminal marked "0-16V max. 500A".

8. Press the red button/light marked "ON" in the "REGULACION" section of the control unit. The green "OFF" light should go out and the red light come on. This energizes the power circuit.

NOTE: The voltage surge on connecting the autotransformer may produce infeed current peaks up to 20 times the nominal maximum (18A), although of very short duration (approx. 2ms). For this reason, if there is protection on the LET-4000-RDM power intake, this should be set for a minimum time of 10msg, otherwise the set may trip before time.

9. Press the button marked "UP" on the control unit until the LED marked "MAX" lights up. This LED indicates that regulation is at maximum. The voltmeter connected earlier should show approximately 20% more than the nominal voltage at the contact - in this case, 16V + 20%. Move the voltmeter contact connected to the live terminal to check measurement at all the output marked thus:
 - o 0 - 16V max 500A
 - o 0 - 8V max 1000A
 - o 0 - 4V max 2000A
 - o 0 - 2V max 4000A
10. Press the button marked "DOWN" on the control unit until the LED marked "MIN" lights up.
11. Press the green button/light marked "OFF" on the "REGULACION" section of the control unit. This should come on and the red "ON" light should go off. The power circuit is now deactivated.
12. Remove the voltmeter which was connected to the power unit terminals.

Next, check the current measuring unit for correct functioning procedure is as follows:

13. Ensure that the "MIN" indicator in the "REGULACION" section of the control unit is lit. If not, press the "DOWN" button until the led lights up.
14. Use a cable of appropriate section to connect the terminals marked "0" with the terminal marked "0-16V max. 500A".
15. Turn the selector marked "AMP RANGE" on the control unit to the "500" range. The corresponding indicator should light up.
16. Press the red button/light marked "ON" in the "REGULACION" section of the control unit. The green "OFF" light should go out and the red light come on. The power circuit is now energized. You will see that the measuring instrument immediately gives a reading.
17. Press the button marked "UP". You will see that the current in the measuring instrument rises very rapidly. hold down the button until you obtain a reading of "500".
18. Press the green button/light marked "OFF" in the "REGULACION" section of the control unit. This should light up and the red "ON" light go out. The power circuit is now deactivated.
19. Press the button marked "DOWN" on the control unit until the LED marked "MIN" lights.
20. Repeat nos. 13 to 20 for each of the other outputs, with the appropriate settings.

NOTE: If all the foregoing steps are completed satisfactorily, the set is ready to use. In the event that the apparatus fails to respond properly in any of these steps, please contact us or your representative immediately.

2.3. CURRENT REGULATION

2.3.1. Application and precautions

The purpose of the LET-4000-RDM system is to inject a given current to a receiver. This may be anything from a simple wire to a complex assembly such as a direct protective relay or an indirect protective relay operating through a measurement transformer. It is very important that the user fully understands the operative principle of the apparatus as set forth below, in order to avoid damage to the receivers being tested. The regulating system establishes a given voltage between the "0" terminal and the selected terminal, as indicated on each one. The resulting current will obviously depend on the Z impedance of the load. This means that if we take, for instance, the "0-500A" output, whose maximum output is 16V, and connect it to a load of 0.01W, at maximum regulation we will have a current equal to $16/0.01$, that is 1600A, which could cause the kind of damage described earlier. Logically, therefore, regulation must begin with the minimum value shown by the corresponding LED.

If the impedance connected is very low, even at minimum setting, there may be some residual current if the regulator output is not exactly zero.

2.3.2. Regulating procedures

One immediate consequence of the foregoing considerations is:

There is no way of knowing beforehand what regulating position will ensure a given current on any receiver.

This means in principle that there must be an empirical regulating procedure, which we shall call "direct", and a prior calculation procedure, which we shall call "indirect".

2.3.2.1. Direct procedure

This consists in using the regulator to set the output at the desired level starting from zero. The procedure is as follows:

Connect the receiver with cables of appropriate section, ensuring that the connections are properly tightened.

Select the ammeter measurement range corresponding to the selected output.

Check that the regulator is set at minimum ("MIN" LED lit); if it is not, press the "DOWN" button until it lights.

Press the "ON" button to activate the voltage output.

Use the "UP" button to obtain the desired value. You may not attain this value even with the regulator set at maximum. This indicates excessive impedance in the output, which must then be optimized by increasing the section and reducing the length of the conductors, checking the quality of the connection, etc. When the output is disconnected with the green OFF button, the supply of current to the receiver is immediately cut off.

2.3.2.2. Indirect procedure

In many cases it may not be possible to set a given current level by direct procedure, owing to the characteristics of the receiver. In such cases we can use the "indirect procedure". This consists in determining impedance in the receiver by means of a reduced current input. Procedure is as follows:

- o Hook up the receiver with cables of adequate section, ensuring that the connections are properly tightened.
- o Select the ammeter measurement field corresponding to the selected output.
- o Check that the auto transformer is set at minimum "0"
- o Connect a voltmeter to the output terminals, set at the most suitable range for the selected output.
- o Press the "ON" button to activate the voltage output.
- o Turn the auto transformer until the voltage is at least 10% of the final value desired. Then take a reading from the voltmeter and ammeter.
- o Press the OFF button to disconnect the voltage output.
- o Calculate the impedance of the load using the formula:

$$Z = \frac{V_r}{I_r}$$

where:

V_r = Voltmeter reading

I_r = Ammeter reading.

We can thus calculate the no-load voltage needed to obtain a given current value by applying the following formula:

V_r = Voltage to be attained without load.

I_r = Current desired on connecting output.

Once V_r is obtained, the procedure is as follows:

- o Disconnect one of the connecting cables to the receiver.
- o Connect output (ON).
- o Turn autotransformer to adjust output to the V_r value calculated.
- o Disconnect output (OFF).
- o Reconnect cable to receiver
- o Without touching the regulator, reconnect the "ON" output. The current input value will then be as calculated with possible variations in the power supply.

2.3.2.3. Connection to the receiver

The quality of the connection to the receiver is vital for testing. Allowance must be made not only for the resistance of the connection, but also for induction, which is most important at the high ampere levels with which the LET-4000-RDM operates. In order to minimize this effect, the connections should be run as close together as possible, and even joined with clips if they are very long. Connecting cables should never be run far apart, as they generate a loop.

2.4. USING THE TIMER

The logical chronometer incorporated in the LET-4000-RDM is a system for measuring the time lapse between two events. This chronometer has of course been designed to work with electrical devices, and therefore it starts and stops in response to "open/close contact" or "voltage absence/presence signals. For more details see ADDENDUM 1.

2.4.1. Description

The timer is in the upper right section of the apparatus, with all its controls located on the mounting plate. These are:

- o Connector for test contact.
- o Connector for test voltage.
- o "Open/close/off" selector switch for contact tested.
- o "Absence/presence/"off" selector switch for voltage tested.
- o Reset button
- o 5-digit display up to 99999sec.

The system will always measure the time elapsing between connection of the current output when the "ON" button is pressed and the occurrence in the relay of any of the events described above. The technical characteristics of this particular system are as follows:

- o Maximum measurement: 99999 seconds.
- o Resolution: 0.001 seconds.
- o Accuracy: ± 0.0003 seconds.
- o Max. signal input voltage: 220V DC, AC.
- o Min signal input voltage: 5V DC, AC.

In the LET-4000-RDM when the power circuit disconnects immediately the timer stop. To reconnect the power circuit, press the "RESET" button, which will turn the timer back to zero.

2.5. TESTING RELAYS

Following is a description of the general way of applying a given level of current to a relay in order to test its I/t response curve. Obviously, time must be measured from the moment the full test current is applied. Since the output current depends on the load represented by the relay measuring circuit, as we explained earlier, this current must first be adjusted to the relay. In order to do this as quickly as possible and avoid heating, the current is raised from 0 to the desired level, then power is immediately cut off by pressing the "OFF" button. Naturally adjustment, as it is activated by the power button. As timing is not required at this stage, the chronometer should be zeroed by pressing "RESET".

On completion of preliminary adjustment, the LET-4000-RD is ready to run the test once the relay has been left to recover its initial state. First, connect the relay timing stop signal via one of the connectors provided. A contact or voltage signal may be selected as appropriate using the switches. Press the "ON" button, which will immediately give the desired current level in the relay and start the timer. When the relay trips, the timer will stop, indicating the time elapsed, and the test is complete.

3. SPECIFICATION

TECHNICAL CHARACTERISTICS

- o Power supply.....220V 50/60Hz.
- o Output.....Selectable in 4 ranges.
 - 0 - 500A 0-16V.
 - 0 - 1000A 0-8V.
 - 0 - 2000A 0-4V.
 - 0 - 4000A 0-2V.

CURRENT MEASUREMENT:

Digital class 0.5% of full scale measurement.

TIME MEASUREMENT:

Digital, from 00.000sec to 99999 sec, ± 0.001 sec.

Duty cycle:

MAX. CONTINUOUS CURRENT	MAX. CURRENT 60 MIN	MAX. CURRENT 15 MIN	MAX. CURRENT 3 MIN.	MAX. CURRENT 1 MIN.	MAX. CURRENT 1 SEC.	OPEN CIRCUIT VOLTAGE
4000 A	4800 A	7200 A	9600 A	12000 A	21.6 kA	2.65 V
2000 A	2400 A	3600 A	4800 A	6000 A	10.8 kA	5.30 V
1000 A	1250 A	1800 A	2500 A	3100 A	5.6 A	10.45 V
500 A	630 A	900 A	1250 A	1550 A	2.8 A	21.55 V
Cooling Time	15 min	20 min	20 min	30 min		

*Guaranteed values at ambient temperature < 25° C



NOTE: Proper cable size must be used to ensure that the current limits are achieved

DIMENSIONS

Power Unit:

- o Height.....650 mm
- o Width.400mm
- o Depth.....520 mm

WEIGHT 180 Kg.

Control and Measurement Unit:

- o Height.....520 mm.
- o Width.350 mm.
- o Depth..... 430 mm

WEIGHT 6 Kg.

4. AFTER SALES SUPPORT

4.1. WARRANTY

This is an expression of trust that our products obtain, based on the reliability and functionality standards that our customers expect.

The warranty covers the free replacement or repair of defective components for one year in the terms specified in the supplied warranty statement and registration card.

Damages resulting from improper handling of the product, use outside the scope and limits of the product's specifications, negligence, installation not in accordance with the standards or warnings listed in the Instructions Manual and servicing or manipulation by unauthorized persons are not covered by the warranty.

4.2. CUSTOMER SUPPORT

EUROSMC guarantees the supply of materials and components for its products up to 3 years after discontinuation. This support is extendable to 5 years for technical service.

4.3. OTHER EUROSMC PRODUCTS

Portable Relay Test Equipment and Software

Medium & High Voltage Circuit Breaker Analyzer

Primary injection units up to 20.000 A

Digital handheld chronometer.

Digital handheld phase angle meter

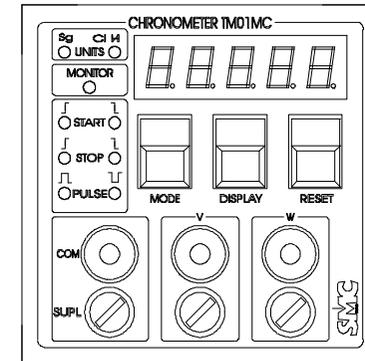
Digital Portable microhmeter up to 100 A Test current.

Test systems for automatic miniature circuit breakers.

Voltage and current regulation equipment.

Step & Touch Voltage measurement equipment

ADDENDUM 1: "TM-01-MC MULTIFUNCTION TIMER"



1. INTRODUCTION

This timer was designed as an instrument necessary in our current injection test set for testing relays. Its function is to determine of the most important parameters in relay testing, the timing reaction of the trip time. This timer is incorporated in the unit, with the intention of minimizing the number of test instruments needed to be carried for tests in field use.

2. CONTROLS AND FUNCTION DESCRIPTION

2.1. MEASUREMENT DISPLAY

This display is made up to 5 digits of 7 segments, with the decimal point on the right hand side.

2.1.1. INDICATORS

UNITS: This group is made by 2 LED's, which indicate the measurement shown



- Sg Measurement in seconds from 00.000 to 99999, and automatically changes the decimal point.
- CI/Hz Measurement in cycles, the frequency measurement in Hertz, works as a frequency meter. Frequencies from 20.000 to 4000.0 Hz., can be measured

MONITOR: This LED indicates the input state of the timer



If the LED is lit, the input is closed between W and COM (common) or the presence of voltage between V and COM (common)

2.2.2. FUNCTION MODES

The various function modes are selected by the press button key marked MODE; and determines the various combinations that can be used to start and to stop the timer. As well it selects, if the timer, is the timer mode or frequency mode.

START: These 2 LED's indicate the type of operation of the injection control in which the timer will start



- Start with current Injection
- Start with injection cut off

STOP: These 2 LED's indicate the type of signals received in the input tap, in which the timer will stop and hold the timing measurement



- Stop with the circuit (tap COM and W) or the presence of voltage (tap COM and V)
- Stop with the circuit open (tap COM and W) or the absence of voltage (tap COM and V)

PULSE: These 2 LED's indicate the type of signal in the Input tap of the timer, which will stop or start the timer



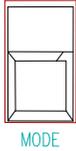
- Starts with the circuit closed or with the presence of voltage
- Stops with the circuit open or the absence of voltage
- Starts with the circuit open or the absence of voltage
- Stops with the circuit closed or the presence of voltage



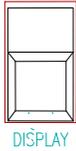
FREQUENCY: If the LED CI/Hz is lit it measures the frequency input in the tap COM and V

2.2.3. PRESS BUTTON CONTROLS

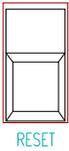
These are made up of 3 press button switches:



MODE: Each time this button is pressed it will automatically change the function mode. The total function modes are 7, in which 4 modes are to start and stop the timer, 2 for the pulse mode, and 1 for the frequency measurement



DISPLAY: This mode selects time measure in either seconds or cycles



RESET: When this button is pressed, it stops and resets the timing reading displayed, having the unit ready to start the following test. If the press button remains pressed for more than 2 seconds “...” appears in the display, which deactivates the timer and it’s internal functions of HOLD and TRIP of the unit which is installed.

2.2.4. INTERNAL FUNCTIONS

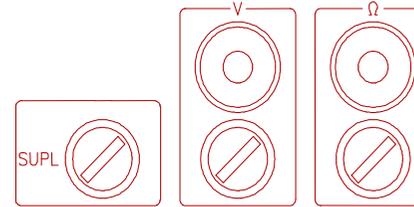
These are the internal chronometer functions which the timer has over the unit it is installed in. These are:

HOLD This retains the ammeter reading of the injection instrument. This is produced in the moment the timer stops. The injection set is free and ready to work again when the RESET button is pressed.

TRIP Approximately 1 second from the timer stopping, it also stops the current output. It is not possible the inject again until the TIMER is RESET.

2.2.5. PROTECTIONS

All fuses are located on the front panel of the timer, and clearly marked.

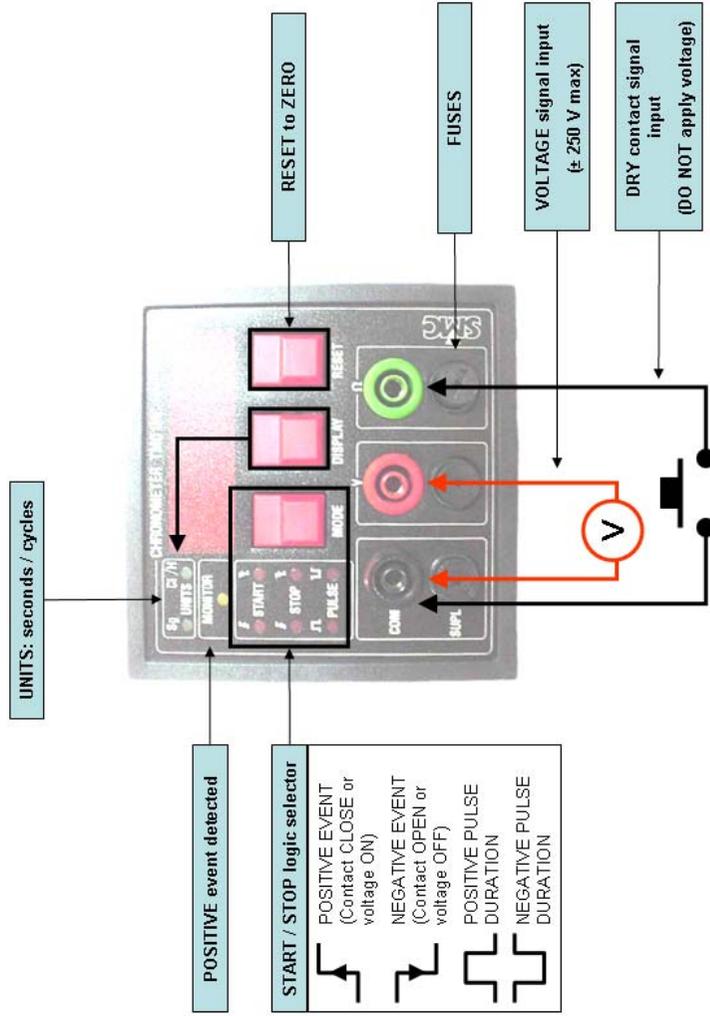


INDICATION	PROTECTION	FUSE
SUPL	Voltage Supply	50mA/250V fast 5x20mm.
V	Voltage Input	32mA/250V fast 5x20mm.
W	Contact Input	32mA/250V fast 5x20mm.



Replace only with fuses of the same type and rating. Otherwise, the warranty will be void.

TM-10-MC Built-in chronometer



SPECIFICATIONS			
Working temperature	Absolute Range	0-40° C	
	Relative Range	20 – 30° C	
Accuracy	Time measurements	± 0.01% Rd ± 1 ms	
Resolution	Maximum (in all modes) In the pulse mode, times of less than 5 ms cannot be measured	1 ms/0.05 Cycles/0.001 Hz.	
Inputs	Contact	Voltage in open circuit	10.2 V.
		Current in short circuit	13mA
	Voltage	Input Range	5-250V(ac, dc)
		Frequency	20-4000 HZ.
		Impedance Input	19 KW