Megger

MJÖLNER 200/600

Micro-ohmmeter

User guide

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CE

Contents

1 Safety

Symbols on the instrument

Caution, refer to accompanying documents.

Caution, risk of electric shock.

Protective conductor terminal.

WEEE, Waste Electrical and Electronic Equipment. Please utilize your local WEEE collection facilities in the disposition of this product and otherwise observe all applicable requirements. The unit can also be returned to Megger at any timeat at no charge for the disposal.

Information duty regarding substances on REACH article 33, SVHC-list

This product contains a coin cell battery which contains 1,2- dimethoxyethane (CAS 110-71-4) above 0.1% by weight.

Safety instructions

Important
Read and comply with the safety instructions.
Always comply with local safety regulations.

Warning

1. Before measuring resistance in circuit breakers or disconnecting switches (isolators), always check to see that the object being tested is closed and grounded at least on one side.
2. Do not connect the instrument to inductive loads. This can cause high voltages when removing the current clamps.
3. After completing your measurements, you can follow the normal procedures that are used to demagnetize current transformer cores after DC has passed through a current transformer.
4. Never open a circuit breaker while MJÖLNER is connected to it.
5. Connection points for current cables can become hot during current generation.
6. Current continues to flow for a while after the MJÖLNER is turned off. How long it continues depends on the ratio of the components in the L/R circuit.
7. High voltage/current on input/output terminals.
8. Do not attempt to service the instrument yourself. Opening or removing covers may expose you to dangerous voltage. If you attempt to service the instrument yourself the warranty is no longer valid.
9. Do not use any accessories that are not intended for use together with the instrument.
10. Disconnect the instrument from the mains before cleaning. Use a damp cloth for cleaning. Do not use liquid cleaners or aerosol cleaners.

Important

1. The instrument is intended for use in an industrial environment. It generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with these instructions, may cause interference to other devices in the vicinity. If this equipment does cause interference with other devices, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
   - Reorient or relocate the receiving device.
   - Increase the separation between the equipments.
   - Connect the equipment into an outlet on a circuit different from that to which the other device(s) is connected.
   - Consult the manufacturer or field service technician for help.

2. Always turn the equipment off before connecting.
3. The MJÖLNER is equipped with a mains plug having a third (earthing, grounding) pin. This plug will only fit into an earthing/grounding type power outlet.
   The outlet used should be tested regularly for proper impedance of the protective earth wire.
4. Always use manufacturer approved and supplied cable sets.
5. Always connect protective earth (ground).
   Use the grounding cable connected to the Grounding Terminal page described in chapter "3 Control panel" on page 10
6. Never leave the instrument unattended while it is turned on.
7. Use only approved mains detachable cable set with the instrument. Main supply cables shall be rated for the maximum current for the equipment and the cable shall meet the requirements of IEC 60227 or IEC 60245. Mains supply cables certified or approved by a recognized testing authority are regarded as meeting this requirement.
8. Unplug the instrument from the mains supply when it is left unattended or not in use.
9. Do not expose the instrument to rain or moisture.
10. Refer all servicing to Megger authorized personnel.
11. If you need to return the instrument, please use either the original crate or one of equivalent strength.

2 Introduction

The MJÖLNER 200 and 600 are designed to measure the resistance of circuit breaker contacts, bus-bar joints, contact elements in bus-bars and other high-current links.

When contact resistance rises because of oxidation, loosened or improperly tightened threaded joints, temperatures rise abnormally at the points of contact. This abnormal heating reduces conductivity thereby accelerating the rise in temperature — and this often leads to serious trouble.

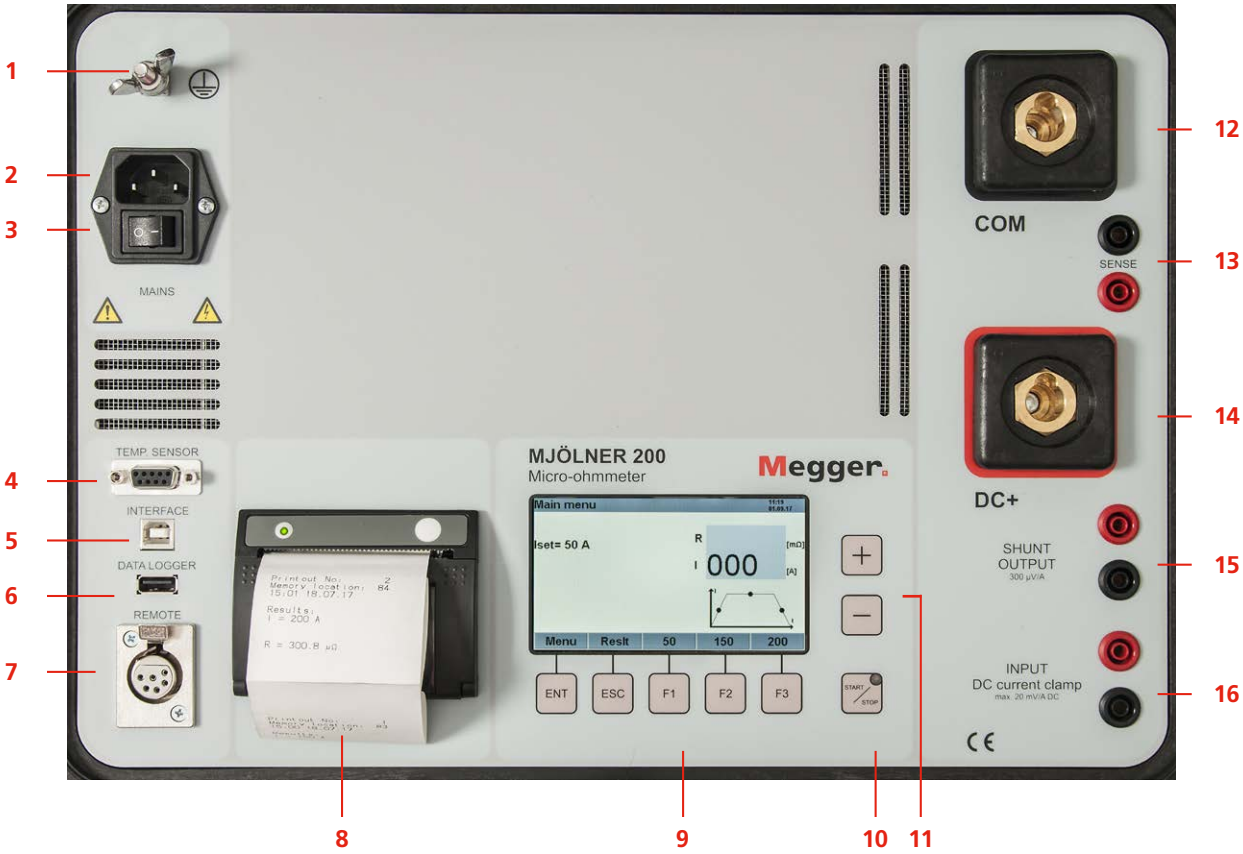
The MJÖLNER micro-ohmmeters can be used to detect such problems early so that they can be remedied long before trouble starts. Checking contact resistance at regular intervals provides a clear indication of the state of your system.

3 Control panel

1	Grounding terminal
2	Connection for mains voltage
3	Switch for mains voltage
4	TEMP. SENSOR This interface is for connection of a temperature probe for temperature compensating.
5	INTERFACE For communication with PC and MJÖLNER Win.
6	DATALOGGER Port to connect a USB stick for datalogging (in .csv format) during a test. Results can be viewed with Excel.
7	REMOTE For connection of optional accessories like the Remote control or the XLR Bluetooth dongle.
8	Printer
9	Keys to control the menu functions
10	Start/Stop key with status LED
11	Adjustment keys to set the measuring current and all menu values
12	DC- current output

13	Sensing terminals
14	DC+ current output
15	Shunt output
16	Clamp sense input

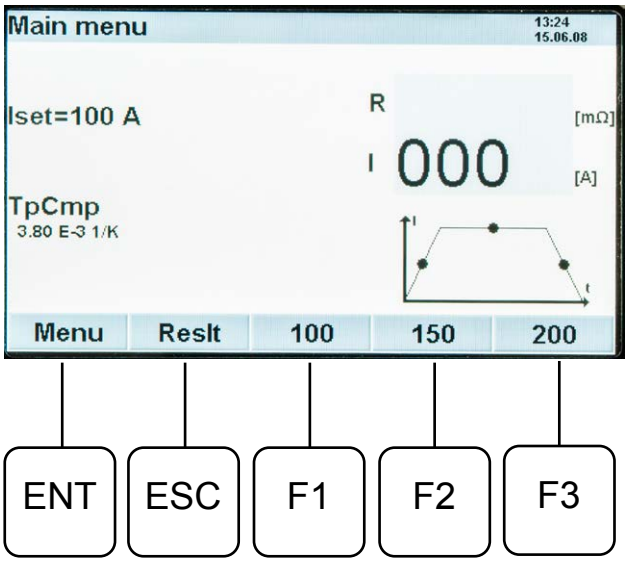
The location of the current outputs on MJÖLNER 600.



4 Menu options

4.1 Main menu

A few seconds after instrument power up the "Main Menu" will be displayed.



Legend

Iset

Iset is the previously adjusted measuring current. By using the <+> and <–> keys, right of the display, the measuring current can be changed.

TpCmp
3.80 E-3 1/K

The temperature compensation is preset for copper. It can be changed for other conductor materials.

Menu

By pressing the key <ENT>, you enter the system menu. Further explanations see below.

Reslt

Press the key <ESC>, to display the measuring results.

100 / 150 / 200

Preselected values of the measuring current. Press <F1>, <F2> or <F3> to set the measuring current "Iset". The preset value can be changed in the setup menu.

4.2 Setup menu

1] Press <ENT> to go to the "Setup Menu"

2] Use the keys <F1> and <F2> to move from one menu item to another. Press <F3> to select page 1/2 or 2/2 of the menu.

3] Press the keys <+> and <–>. to make the desired settings.

4] Press <ENT> to confirm.
Press <ESC> to go back without any changes.

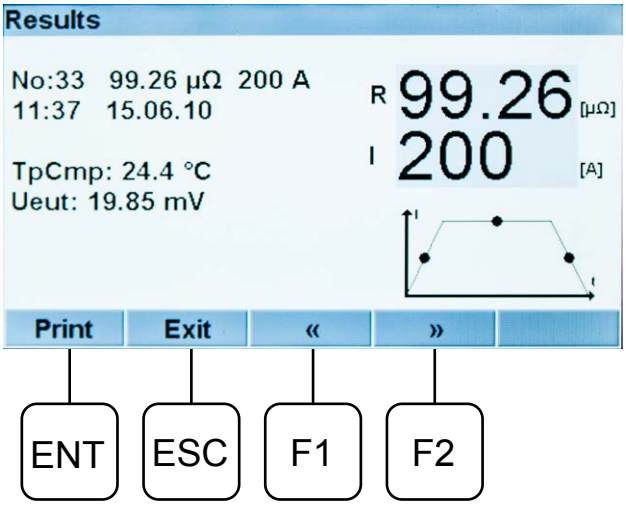
Contents of the setup menu

Menu item	Legend	Range of values
SM0	Measure mode	single continuous
	single = The measuring current only flows for a fix given time. continuous = The test current flows continuously until it is interrupted by the user.	
SM1	Preset Current 1	5 A to 200 A[1)] 5 A to 600 A[2)]
	The adjusted value appears in the main menu above the <F1> key.	
SM2	Preset Current 2	5 A to 200 A[1)] 5 A to 600 A[2)]
	The adjusted value appears in the main menu above the <F2> key.	
SM3	Preset Current 3	5 A to 200 A[1)] 5 A to 600 A[2)]
	The adjusted value appears in the main menu above the <F3> key.	
SM4	Current Clamp	on/off
SM5	0.10 … 20.00 mV/A Current Clamp. This item activates the current clamp. If the item is switched to the on position, the instrument immediately asks for the clamp sensitivity. The sensitivity should be adjusted to the value of the current clamp, the user wishes to use. The instrument then calculates the current which is bypassed by the grounding lanes and subtracts this value from the measuring current which flows through the equipment under test. The value of the sensitivity is stored, even when the clamp is turned off.	
SM6	Temp. compensation	on/off
SM7	α can be adjusted from -9.99 to 9.99 where 3.80 is the value for copper at 20°C. For other materials this value has to be changed to a value where the resistance does not change when it is heating up or cooled down.	
SM8	Erase mesurements	no/yes
	Erase all measurements that are stored in the internal memory.	

Contents of the setup menu		
Menu item	Legend	Range of values
SM9	Buzzer	On/Off
	Key click and audio warning during the measurement.	
SM10	Time format	12h/24h
SM11	Date format	DDMMYY MMDDYY YYMMDD
SM12	Time	0 …12 / 0 …23
	Adjust the hours of the internal clock.	
SM13	Time	0 … 59
	Adjust the minutes of the internal clock.	
SM14 SM15 SM16	Date	XX.XX.XX
SM17	Printer	0 … 9999
	Counter for the printouts of the printer. Printouts will be numbered continuously. This value defines the number of the next printout.	
SM18	Printer	all values summary
	To get an extended printout with additional values on the printer printout, this item needs to be switched on. Values like shunt voltages and ramp times are printed out. This is only possible for the actual measurement. These additional values are not stored in the internal memory and are lost, when moving to another result in the memory.	
SM19	Language	English Deutsch Français Espagñol Svenska
SM20	Display Ueut	yes/no
SM21	Auto pol detection: Disables automatic correction of sense polarity.	yes/no
SM22	Pass/Fail: Enter submenu for changing limits by the [Ent] key. In the submenu the limits for the measurement analysis may be changed.	change limits
[1] MJÖLNER 200 [2] MJÖLNER 600		

4.3 Result window

After a measurement the result is shown on the display. The result window can also be activated by pressing the <ESC> key when in the main menu. During continuous mode, the result window is continuously updated..



- The first row: Shows memory location, the resistance result and the injected current.
- The second row: Shows the time and date for the measurement.
- The third row: Shows clamp current if a clamp is used (when testing with both sides grounded).
- The fourth row: If temperature compensation is selected in the "Setup menu" the "TpCmp" and value is shown.
- The fifth row: If "Display Ueut" is selected in the "Setup menu" the voltage across the test object is shown.
- The last row has functions activated by the buttons:

ENT	Press to print the result on the internal printer
ESC	Press to return to "Main Menu"
F1	Press to step back in memory
F2	Press to step forward in memory

Memory

Results are automatically saved in the memory in sequence 0 to 99 (100 results). When the memory is full the old information will be overwritten in the same sequence.

5 Operating instructions

5.1 General application

Important

Read and comply with the safety instructions.
Always comply with local safety regulations.

Note *If you are measuring resistance in a breaker or disconnecting switch (isolator), make sure that it is closed before starting. High current must only flow throughout a short interval.*

1] Make certain the mains are de-energized on both sides of the breaker. Ground the breaker at least on one side and make certain it is closed.

2] Keep the MJÖLNER disconnected from the mains while making connections.

3] Ground the MJÖLNER.

4] Connect one current cable between one side of the object being tested and the DC+ terminal on MJÖLNER. Connect the other current cable between the other side of the object being tested and the COM terminal on MJÖLNER.

5] Connect the two sensing cables on two sides of the test object and as close to the test object as possible.

Note *The sensing cables must be connected inside the current cables. Otherwise the test data may be incorrect. See Fig. 5.1*

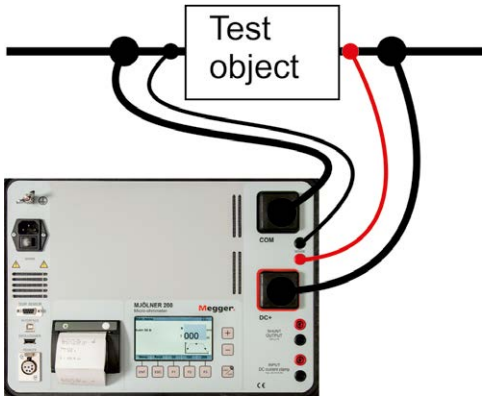


Fig. 5.1 On MJÖLNER 600 the current outputs have reverse position.

6] Connect the MJÖLNER to the mains and switch it on.

7] Set the test current using the keys <+> and <-> or use one of the preselected currents using the <F1>, <F2> or <F3>.

Note *If you are using the instrument the first time, make sure that the continuous mode (Setup Menu SM0, see above) is not selected. Also verify that the current clamp is switched off (Setup Menu SM 4, see above).*

8] Press the <START/STOP> key.
The measurement is announced by a red blinking LED, and if activated a pulsating audio alarm (Buzzer).
The result is shown after some seconds.
The result is saved, you can make a printout and/or run a new test

9] You can stop the measurement by pressing <START/STOP> or <ESC> keys.

10] Turn off and disconnect the MJÖLNER from the mains before doing any disconnection work or moving any cables or wiring.

USB memory stick (optional)

When performing a test and at the same time have a USB memory stick, FAT32 formatted, connected to the DATALOGGER connector. The test is saved in csv format to the USB stick. The measurement can be viewed in e.g. MS Excel.

Note *If the USB stick contains many files the save process may take longer time than with an empty one.*

Remote control (optional)

The remote control has most of the functionality in the MJÖLNER such as starting and stopping, setting the test current and read out the test values, see "5.5 Remote operation" on page 17

XLR Bluetooth dongle (optional)

MJÖLNER Win tests can be done remotely with an android mobile, see "5.5 Remote operation" on page 17.

Temperature probe (optional)

The temperature probe is used for temperature compensation of conductors (copper and other metals). See "SM7" in section "4.2 Setup menu" on page 12.

1] Connect the cable to the TEMP. SENSOR terminal on MJÖLNER.

2] Attach the sensor tight and to the midpoint of the test object.

5.2 Safety functions

High temperature

If the temperature in MJÖLNER rises too high, the instrument automatically starts to derate the current. When the internal temperature rises above 50°C, the instrument starts to reduce the maximal current. The derating between 50°C and 70°C is linear.

At 60°C you get about 150 A (MJÖLNER 200).
At 60°C you get about 450 A (MJÖLNER 600)

At 70°C you get 100 A (MJÖLNER 200).
At 70°C you get 300 A (MJÖLNER 600)

Above 70°C, the unit will shut off and indicates an error message.

The temperature must drop before you can continue.

5.3 Printer

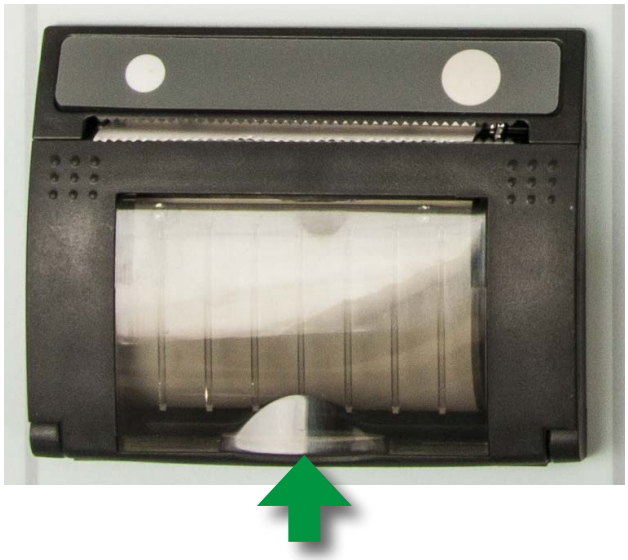
The thermal printer needs no service except from replacing the paper roll.

Replacing printer paper

1] Open the printer by pulling the transparent lid upwards until the cover snaps up. Then open the cover, see figure below.

2] Remove the empty roll and put the new one into place.

Note *See section "7 Specifications" for printer paper information.*



5.4 Using MJÖLNER Win

MJÖLNER Win software is delivered on a USB flash drive.

Note *To use MJÖLNER Win together with a MJÖLNER 200/600 a software code has to be entered to unlock the MJÖLNER.*
The software code is an optional accessory and must be ordered.

Installing MJÖLNER Win

Note *For Win 8 and Win 10. You need to have administrator rights to install it.*
Right click the program when you run the install and select "Install as administrator".

1] Insert the MJÖLNER Win USB flash drive into the PC and click "Run Set-up.exe".

Unlock the MJÖLNER

1] Press and hold <F1> and <F2> while switching on MJÖLNER.

2] In the "Service menu"go to menu item "S7" and enter the software code. See section "3" on page 10.

When MJÖLNER is unlocked, "*PC" is shown in the start up menu.

Connect a PC to MJÖLNER

1] Connect a USB A/B cable between MJÖLNER and PC.

2] From MJÖLNER Win main menu, select “File” and “Options”.

3] Set the COM port used. Check the COM port on the computer(device manager).

4] Select “Instrument” and “Remote control”.

Note: *If the communication is not correct a demo menu version will be displayed.*

Test set up

1] Select “File” and “New breaker/test object”

2] Type in object test nameplates and location on PC to save the tests.

3] New test is started from MJÖLNER Win with the “Start/Stop” button.

4] Test can also be started from any of the preset current buttons. For example clicking on “Set current 2”.

5] Select “File” and “Open breaker/test object” to list previous tests.

6] Select “File” and “Print/Export into file” for printout of test to .csv(Excel) format or save to PDF.
See below PDF print out.

Note *You can add comments to the test report by double clicking the comments row.*
When selecting “Instrument” and “Readout instrument memory” all existing tests in MJÖLNER will be listed in MJÖLNER Win.

5.5 Remote operation

Note *The Remote control is an optional accessory.*

Using the Remote control

The remote control has most of the functionality in the MJÖLNER such as starting and stopping, setting the test current and read out the test values.

1] Connect the Remote control cable to the "REMOTE" terminal on MJÖLNER.

2] Connect the sensing leads to the two banana sockets or to the sockets on MJÖLNER.

Using the XLR Bluetooth dongle

Note *The XLR Bluetooth Dongle is an optional accessory.*

If MJÖLNER is locked for use with MJÖLNER Win

- The use of a current clamp and temp sensor is not activated.
- The buzzer function is not enabled.
- Previous tests made on MJÖLNER cannot be read out from MJÖLNER.

If MJÖLNER has been unlocked for use with MJÖLNER Win

- You can email test results.
- You can use the current clamp and temp sensor function.

Setup for the XLR Bluetooth dongle

1] From the android mobile, download the app “Micro-Ohmmeter Remote”.

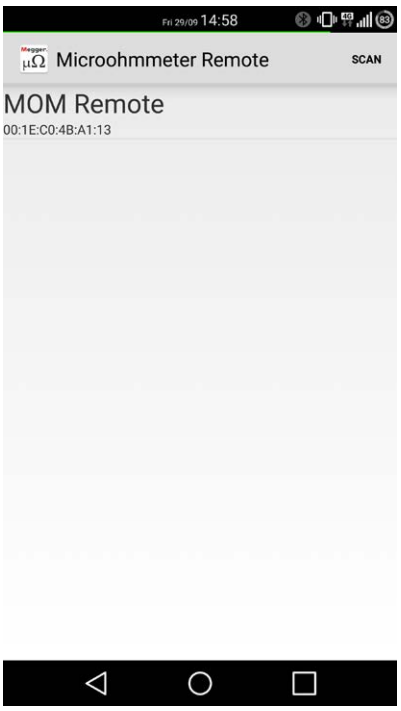
2] Enable the Bluetooth function on the mobile.

3] Connect the XLR Bluetooth Dongle to the "REMOTE" terminal on MJÖLNER.

4] Start the Megger Micro-Ohmmeter app in the mobile

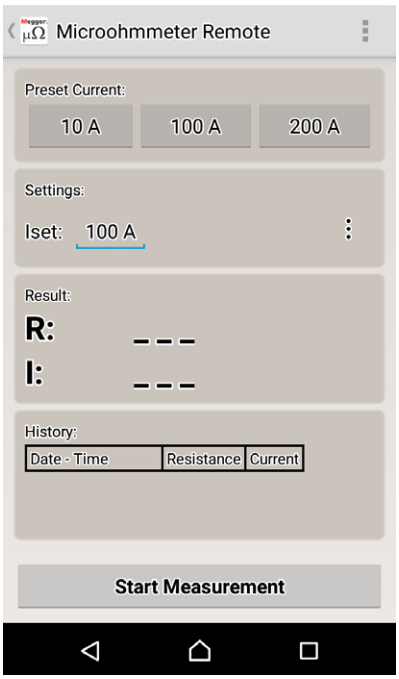
5] Press on the “SCAN” area.
After a while the Bluetooth communication is enabled.

6] Press the “MOM Remote” area.



The XLR bluetooth dongle will light up.
The below menu appears on the mobile.

7] Make your settings.



8] Press the “Start Measurement” button. Measurement results can be sent (in .csv format) via email for later retrieval.

5.6 Verify the measuring current

Important

Read and comply with the safety instructions.
Always comply with local safety regulations.

Shunt output

1] Connect mV-meter to the SHUNT OUTPUT.

2] Short circuit the current outputs.

3] Set the test current to 100 A and press START.

4] Read out the mV value and then press STOP.

5] Calculate the measured current.
Shunt voltage is 100 µV/A for MJÖLNER 600
Measured current = measured mV / shunt voltage.
For example: 10 mV / 100 µV/A = 100 A
Shunt voltage is 300 µV/A for MJÖLNER 200
In this example: 30 mV / 300 µV/A = 100 A

Verify the measuring function

1] Short circuit the current outputs.

2] Connet the sense cables from the SHUNT OUTPUT to the SENSE input.

3] Sart a 100 A single measurement.

4] Read out the value on the screen.
Example for MJÖLNER 600: 99.6 µΩ
This value must be the same as in the calibration certificate (see "Shunt output value")
Example for MJÖLNER 200: 300 µΩ
This value must be the same as in the calibration certificate (see "Shunt output value")

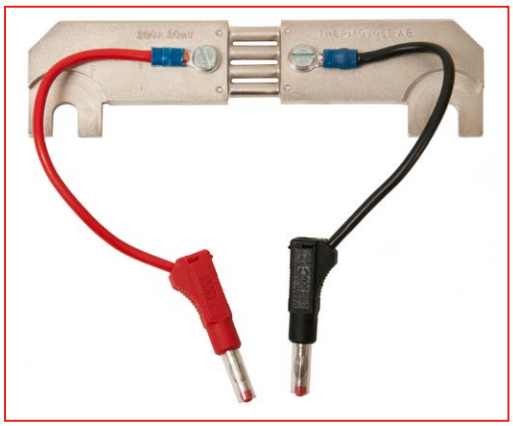
5.7 Calibration and Service menu

Calibration

1] Switch on MJÖLNER and let it be on for about 20 minutes before starting the calibration.

2] Connect an external calibrated current shunt 200 A 20 mV ±0.1% (MJÖLNER 200), 600 A 60 mV ±0.1% (MJÖLNER 600) to DC+ and COM outputs and SENSE inputs.

Note *The high current cable (35mm²) should have a minimum length of 1 m.*



3] Set test current to:
100 A (MJÖLNER 200)
300 A (MJÖLNER 600)
and make a measurement. (See section "5 Operating instructions", points 6 to 10)

4] Note the result and turn off MJÖLNER.

5] Press and hold <F1> and <F2> while switching on MJÖLNER.

6] In the "Service menu" – go to "Calibration".

7] Set the "Gain adjust" value (possible to set between 0.700 – 1.300) so that the displayed value corresponds to the shunt value.

8] Example: If the shunt value is 100 µΩ and the displayed value is 101 µΩ you should lower the "Gain adjust" value. Set it to 0.99.

9] Press <ESC> and make a new measurement.

10] If the measured value corresponds to the shunt value the calibration is ready if not repeat the procedure.

Service menu description

Menu item	Legend
S1 Calibration	See "3" on page 10
S2 Shunt	Only for manufacturer service
S3 t rising edge	Set the time of the rising slope/ramp up 1-3 s (M200 1-30 s). Default 1 s.
S4 t holding	Set the time for the holding/ measuring time 0.5-10 s (M200 0.5-30 s). Default 3 s.
S5 t falling edge	Set the time for the falling slope/ ramp down 0.5-3 s (M200 0.5-30 s). Default 1 s.
S6 Current source adj.	Only for manufacturer service
S7 Software enable code	Enter the SW code here if ordered separately after delivery of the MJÖLNER.
S8 Enable data output	MJÖLNER will send out a data string after each completed measurement.
S9 Enable data comm	Enables the possibility to control MJÖLNER from a PC. Note: Enabling the communication protocol S9 disables the MJÖLNER Win protocol.
S10 Advanced data logging	Enables the possibility to troubleshoot potential problem.
"S11 Current clamp only"	"Set to "On" or "Off"

5.8 Troubleshooting

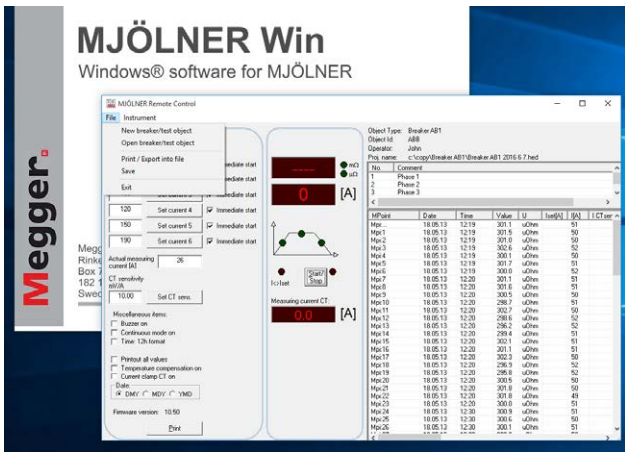
Fault	Possible cause	Remedy
I ≠ Iset lamp lit (on panel)	Resistance too high for the selected current	Reduce the current
Sense line broken! (on display)	Sense line defective or broken. Since the sense voltage is so low, the instrument can have difficulties to detect the polarity. This would lead to the "sense line broken" error.	Verify the sense line connections. For resistances below 10micro Ohms, the automatic detection of the polarity can be deactivated in the menu. To avoid this, set the manual sense line detection and verify the correct plolarity of the sense lines.
Overflow (on display)	Resistance higher than 999.9 mΩ	Bad connection and/or test object
Thermal shut down	The temperature is too high	Let the instrument cool down
No current generated	Unstable or irregular mains power supply	Set mains switch to off, wait at least 3 minutes and then switch on

Note *Always set the current clamp to "Off" when not in use. Not doing this will reduce the measurement accuracy at low currents (<100 A).*

5.9 Optional accessories

Item	Art. No.
MJÖLNER Win Software key code for unlocking the MJÖLNER	BD-8010X
Remote control With 5 m (16 ft) cable	BD-90010
XLR Bluetooth dongle	BD-90011
Temperature probe	BD-90012
Thermal paper roll (for printer)	GC-00120
Extension cable set 5 m Current cables 2 x 5 m, 35 mm² and sensing cables 2 x 10 m	GA-03209
Extension cable set 10 m Current cables 2 x 10 m, 35 mm² and sensing cables 2 x 15 m	GA-03210
Calibration kit MJÖLNER 200 200 A / 20 mV shunt	BD-90022
Calibration kit MJÖLNER 600 600 A / 60 mV shunt	BB-90020
DualGround kit DC Current clamp 200 A (incl. cables)	XA-12992
"Dual ground kit DC Current clamp 1000A (incl. cables)"	XA-12990

MJÖLNER Win



The MJÖLNER Win program makes it easy to manage/ save all test results in a simple way. All information, meta-data of the test object e.g. a circuit breaker and the test results are stored together and they can easily be transferred to Microsoft® Excel for further analysis. In MJÖLNER Win you can also save test files and print out test reports.

Remote control

The remote control has most of the functionality in the MJÖLNER such as starting and stopping, setting the test current and read out the test values.

XLR Bluetooth dongle

MJÖLNER Win tests can be done remotely with an android mobile.

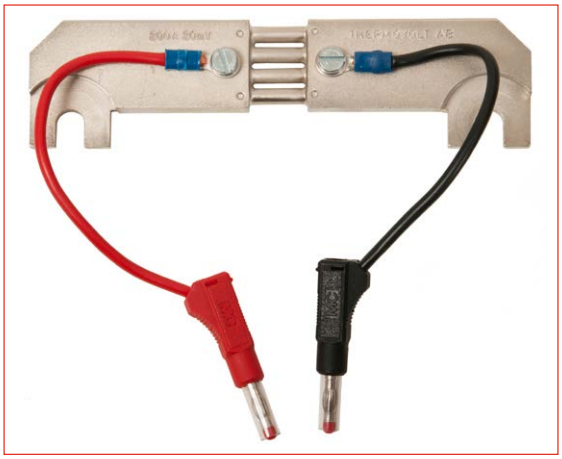
Temperature probe

The temperature probe is used for temperature compensation of conductors (copper and other metals).

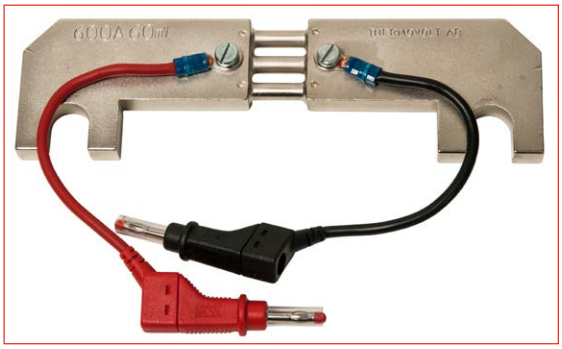
Extension cables

Extension cable sets:
5 m GA-03209
10 m GA-03210

Calibration shunts



Calibration shunt MJÖLNER 200. Shunt 200 A/20 mV



Calibration shunt MJÖLNER 600. Shunt 600 A/60 mV

DualGround kit

DualGround kit (XA-12992, 200A max.

XA-12990 max 1000A.) max. conductor size 50 mm diameter (2"), test cables 5 m.

Note: Dual ground kit XA-12992. Included in Ordering No. BD-19193 for MJOLNER 200
and in Ordering No BB-59093 for MJOLNER 600

6 Application examples

6.1 Test a circuit breaker – both sides grounded

Important

Read and comply with the safety instructions.
Always comply with local safety regulations.

Note *The measurement accuracy will be lower with both sides grounded and depends on the accuracy of the external current clamp and the ratio of the currents – circuit breaker / grounding cables.*

1] Make certain the mains are de-energized on both sides of the breaker. Ground the circuit breaker on both sides and make certain it is closed.

2] Keep MJÖLNER disconnected from the mains while making connections.

3] Ground MJÖLNER.

4] Connect one current cable between one side of the object being tested and the DC+ terminal on MJÖLNER. Connect the other current cable between the other side of the object being tested and the COM terminal on MJÖLNER.

5] Connect the two sensing cables on two sides of the test object and as close to the test object as possible.

Note *The sensing cables must be connected inside the current cables. Otherwise the test data may be incorrect. See Fig. 6.1.*

6] Apply the external current clamp to one of the grounding cables and connect the clamp outputs to the "INPUT DC current clamp" on MJÖLNER. See Fig. 6.1.

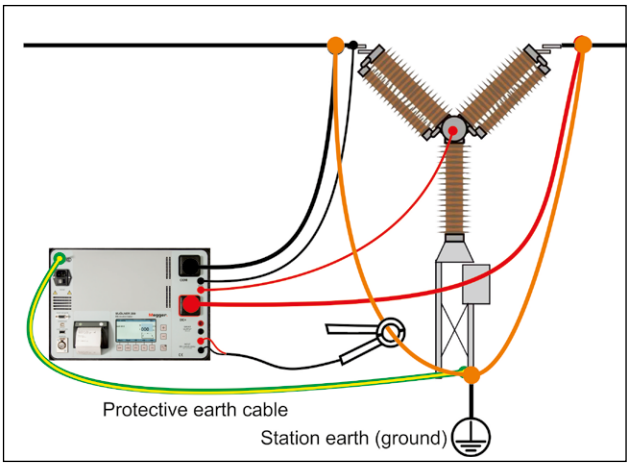


Fig. 6.1 Note that on MJÖLNER 600 the current outputs have reverse position.

7] Connect the MJÖLNER to the mains and switch it on.

8] Set the test current using the keys <+> and <-> or use one of the preselected currents using the <F1>, <F2> or <F3> key.

Note *If you are using the instrument the first time, make sure that the continuous mode (Setup Menu SM0, see section 4) is not selected.*

9] In the "Setup Menu", "SM 4" (see section 4) set the current clamp to "On" and key in the proper sensitivity of the current clamp you are using. Confirm by pressing <ENT>.

Note *Remember to 0-calibrate the current clamp.*

10] Press the <START/STOP> key.

11] You can stop the measurement by pressing <START/STOP> or <ESC> keys.

12] If the current through the ground bar was too high compared to the current through the breaker, adjust the test current and start the measurement again. Repeat this step, until the current through the breaker meets your requirements.

13] In the "Setup Menu", "SM 4" (see section 4) set the current clamp to "Off".

14] Turn off and disconnect the MJÖLNER from the mains before doing any disconnection work or moving any cables or wiring.

6.2 Measuring resistance at bus-bar joints

Important!
Read the manual and comply with the Safety instructions before using the MJÖLNER.
Always comply with local safety regulations.

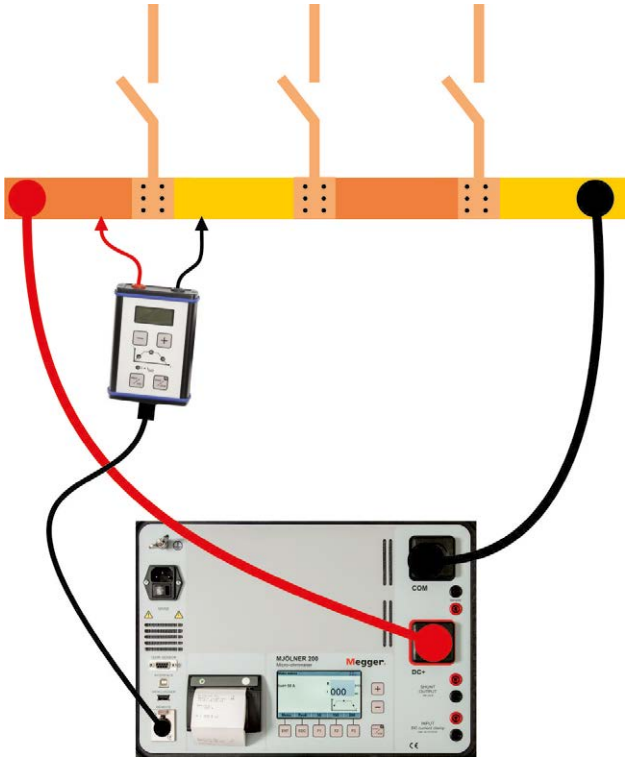


Fig. 6.2. Measuring using the remote control (BD-90010). Note that on MJÖLNER 600 the current outputs have reverse position.

Measuring using the remote control

1] Make certain the mains are de-energized on both sides of the bus-bar. Ground the bus-bar at least on one side.

Note *If grounded on both sides, see section "Test a circuit breaker - both sides grounded.*

2] Keep MJÖLNER disconnected from the mains while making connections.

3] Ground MJÖLNER.

4] Connect one current cable between one side of the object being tested and the DC+ terminal on MJÖLNER. Connect the other current cable between the other side of the object being tested and the COM terminal.

5] Connect the MJÖLNER to the mains and switch it on.

6] Connect the Remote control cable to the "REMOTE" terminal on MJÖLNER.

7] Connect the sensing leads to the two banana sockets or to the sockets on MJÖLNER.

8] Select "single in the "Setup Menu"

9] Set the test current using the keys <+> and <-> or use one of the preselected currents using the <F1>, <F2> or <F3> key.

10] Attach the sensing leads to test object.

11] Press the <START/STOP> key on the remote control or on MJÖLNER.
MJÖLNER will generate the current and stops automatically when the measurement is ready. The test result is displayed at both the remote control and MJÖLNER.
The test results are saved automatically.

12] Proceed the test by moving the sensing leads to next measuring position of the bus-bar.

13] Turn off and disconnect MJÖLNER from the mains before doing any disconnection work or moving any cables or wiring.

Measuring using an external voltmeter

1] Make certain the mains are de-energized on both sides of the bus-bar. Ground the bus-bar at least on one side.

Note *If grounded on both sides, see section "Test a circuit breaker - both sides grounded.*

2] Keep MJÖLNER disconnected from the mains while making connections.

3] Ground MJÖLNER.

4] Connect one current cable between one side of the object being tested and the DC+ terminal on MJÖLNER. Connect the other current cable between the other side of the object being tested and the COM terminal. Do not connect the sensing cables. Measurement will be done manually using an external portable voltmeter.

5] Connect the MJÖLNER to the mains and switch it on.

6] Select "continuous" in the "Setup Menu".

7] Set the test current using the keys <+> and <-> or use one of the preselected currents us-

ing the <F1>, <F2> or <F3> key.

8] Press the <START/STOP> key.

9] Using an external voltmeter, measure the voltage drop (voltage) across each contact element within every section of the bus-bar.

Note *A multimeter must be set to DC and to measure voltage.*

10] Stop the measurement by pressing <START/STOP> or <ESC> keys.

11] You must calculate the actual resistance yourself.
Example: If the voltage drop is 0.0067 V at a current of 100 A, the resistance will be 0.0067/100 ohms, i.e. 67 micro-ohms.

12] Turn off and disconnect MJÖLNER from the mains before doing any disconnection work or moving any cables or wiring.

7 Specifications

MJÖLNER 200/600

Specifications are valid at nominal input voltage. Specifications are subject to change without notice.

Environment	
Application field	The instrument is intended for use in high-voltage substations and industrial environments.
Temperature	
Operating	-20°C to +50°C (-4°F to +122°F)
Storage & transport	-40°C to +70°C (-40°F to +158°F)
Humidity	5% – 95% RH, non-condensing
CE-marking	
LVD	2014/35/EU
EMC	2014/30/EU
RoHS	2011/65/EU
General	
Mains voltage	100 - 120 / 200 - 240 AC, 50/60 Hz
Input current (max)	13 A at 100 V, 6 A at 230 V (3 sec) [1] 39 A at 100 V, 18 A at 230 V (3 sec) [2]
Protection	Fuses (200 mAT and 400 mAT) Thermal fuse, Software Shut off temperature: 70°C (158°F) internal temperature
Encapsulation **opened lid** **closed lid**	 **IP40** **IP63**
Dimensions	410 x 330x 175 mm (16.1" x 13" x 6.9") [1] 486 x 392 x 192 mm (19" x15" x 7.5") [2]
Weight	7.3 kg (16.1 lbs) [1] 13.8 kg (30.4 lbs) [2]
Display	4.3" LCD and LED
Available languages	English, Deutsch, Français, Español, Svenska
Printer	Thermal printer
Thermal paper roll	Width 57 mm, diameter 32 mm

Measurement section			
Range	0 – 999.9 mΩ		
Resolution	0.01 µΩ 0.1 µΩ 1 µΩ 10 µΩ 100 µΩ	below 100 µΩ below 1.0 mΩ below 10 mΩ below 100 mΩ below 1000 mΩ	
Inaccuracy		**Typ.**	**Max.**
180 A[1], ta 25°C, R < 100 µOhms		±0.1 µΩ	±0.5 µΩ
600 A[2], ta 25°C, R < 100 µOhms		±0.1 µΩ	±0.4 µΩ
200 A[1], ta 25°C, R < 20 µOhms		±0.03 µΩ	±0.2 µΩ
600 A[2], ta 25°C, R < 20 µOhms		±0.03 µΩ	±0.2 µΩ
20 A[1,2], ta 25°C, R < 20 µOhms		±0.05 µΩ	±0.2 µΩ
50–200 A[1] ta 10–40°C, R < 1 mΩ 50–600 A[2] ta 10–40°C, R < 1 mΩ		±0.3 µΩ	±2 µΩ
50–200 A[1] ta 0–50°C, R < 1 mΩ 50–600 A[2] ta 0–50°C, R < 1 mΩ		±0.7 µΩ	±3 µΩ
50–200 A[1] ta -20–50°C, R < 1 mΩ 50–600 A[2] ta -20–50°C, R < 1 mΩ		±1.1 µΩ	±4 µΩ
100 A [1] ta 10–40°C, 1 mΩ < R < 10 mΩ 600 A [2] ta 10–40°C, 1 mΩ < R < 8.4 mΩ		±6 µΩ [1] ±6 µΩ [2]	±25 µΩ [1] ±50 µΩ [2]
50 A, ta 10–40°C, 10 mΩ < R < 100 mΩ		±80 µΩ	±500 µΩ
5 A, ta 10–40°C, 100 mΩ < R < 500 mΩ		±1 mΩ	±10 mΩ
5 A, ta 10–40°C, 500 mΩ < R < 1000 mΩ		±2 mΩ	±20 mΩ
Current shunt	200 A, 60 mV [1] 600 A, 60 mV [2]		
Sense ranges	0-2 mV, 0-20 mV, 0-200 mV, 0-5 V		

Outputs	
DC+ / COM	
Range	5 – 200 A DC (steps of 1 A) [1] 5 – 600 A DC (steps of 1 A) [2]
Max. output voltage	5.25 V at 200 A [1] 5.25 V at 600 A [2]
Max. ripple	80 mV_{pp}, 28.3 mV_{rms} at 0 - 50°C (+32°F to +122°F)
Max. load capacity[3]	
200 A [1] **300 A [2]**	Continuous Continuous
OUTPUT 300 µV/A [1] 100 µV/A [2]	
Shunt output	From internal shunt 60 mV at 200 A [1] From internal shunt 60 mV at 600 A [2]
Inaccuracy	±1%

Inputs	
SENSE	Max. 20 V between terminals and to protective earth(ground)
INPUT **DC current clamp**	Max. 20 V between terminals and to protective earth(ground)
Input sensitivity	Adjustable 0.1 – 20 mV/A
Input impedance	>1 MΩ

1) MJÖLNER 200
2) MJÖLNER 600
3) At 25°C (77°F) ambient temperature.

Note. Current will start to derate if the temperature inside Mjölner reaches 50 degrees.

Index

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