Badger Meter Europa GmbH

Field Verification Device

for ModMAG® M2000 and
B-MAG™ I M5000

User manual

September 2011

MID_VD_BA_02_1109

1. Basic safety recommendations

Before installing or using this product, please read this instruction manual thoroughly. Only qualified personnel should install and/or repair this product. If a fault appears, contact your distributor.

Installation
Do not place any unit on an unstable surface that may allow it to fall.
Never place the units above a radiator or heating unit.
Route all cabling away from potential hazards.
Isolate from the mains before removing any covers.

Power connection
Use only the type of power source suitable for electronic equipment. If in doubt, contact your distributor. Ensure that any power cables are of a sufficiently high current rating.
All units must be earthed to eliminate risk of electric shock.
Failure to properly earth a unit may cause damage to that unit or data stored within it.

Protection class
The device has protection class IP 46 and needs to be protected against dripping water, water, oils, etc.

Setup & operation
Adjust only those controls that are covered by the operating instructions. Improper adjustment of other controls may result in damage, incorrect operation or loss of data.

Cleaning
Switch off all units and isolate from mains before cleaning.
Clean using a damp cloth. Do not use liquid or aerosol cleaners.

Repair of faults
Disconnect all units from power supply and have it repaired by a qualified service person if any of the following occurs:

- If any power cord or plug is damaged or frayed
- If a unit does not operate normally when operating instructions are followed
- If a unit exposed to rain/water or if any liquid has been spilled into it
- If a unit has been dropped or damaged
- If a unit shows a change in performance, indicating a need for service.

⚠ WARNING

Failure to adhere to these safety instructions may result in damage to the product or serious bodily injury.

RoHs
Our products are RoHs compliant.

Battery disposal
The batteries contained in our products need to be disposed of as per your local legislation acc. to EU directive 2006/66/EG.

2. Verification Device

2.1 Disclaimer

The user/purchaser is expected to read and understand the information provided in this manual, follow any listed safety precautions and instructions and keep this manual with the equipment for future reference.
The information in this manual has been carefully checked and is believed to be entirely reliable and consistent with the product described. However, no responsibility is assumed for inaccuracies, nor does Badger Meter assume any liability arising out of the application and use of the equipment.
Should the equipment be used in a manner not specified by Badger Meter, the protection provided by the equipment may be impaired.

2.2 Product identification information

Record the product identification numbers from the nameplate.

Modular Mag Meter
Model Number M5000_____

Serial number _____

Tag number _____(if applicable)__

2.3 Product description

Field Verification Device is a portable test device for the electromagnetic flow meters type ModMAG® M2000 and the B-MAG™ I M5000.
With the Field Verification Device, accurate verification of meter functionality is assured without taking the meter out of the pipeline ("wet" test) and interrupting functionality. Meter diagnosis and calibration can be performed on-site. A "dry" test (removing the meter and benchtesting) can also be performed. The complete verification test consumes approximately 20 minutes and results can be downloaded to a Microsoft Windows® personal computer.

2.4 Functions

The Verification Device also:

- determines if the meter is within one percent of the original factory calibration.
- verifies the functionality of all of the meter's inputs and outputs.
- measures electrode resistance and integrity.
- measures coil resistance and integrity.
- measures coil insulation resistance.
- measures current and frequency at previously selected flow rate.
- evaluates the signal processing functionality.
- verifies that there is no high-voltage noise disturbing the coil circuit.

2.5 Components

The Field Verification Device is packaged in a foam-lined, durable, plastic case and includes the following components:

① 2 pcs. verification cable harnesses: One for the ModMAG® M2000 and one for the B-MAG™ I M5000 meters.
② 4 pcs. AC power conversion connectors
③ 1 pc. DC power adapter
④ 1 pc. amplifier AC power cord
⑤ 1 pc. Verification Device +5 VAC, 3.0A power supply

3. Cable connections

3.1 Verification Device

Connecting the cable harness:

The cable harnesses are tagged with either ModMAG® M2000 or B-MAG™ I M5000 on the outer harness wire cover so that the user can differentiate between the two.

Connect the 25 pin connector of the corresponding cable harness to the top of the Verification Device and fix it by the two screws on the left and right.

Power connector:

AC power supply

Car charger via USB cable (DC power)

USB connector:

3.2 ModMAG® M2000

Switch off the amplifier before connecting the cable harness of the Verification Device.

Opening the cover:

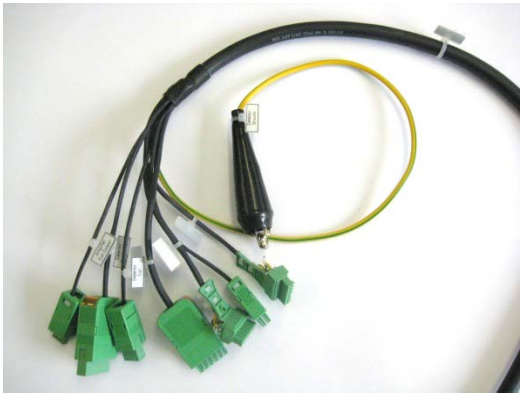
1. Using a 1/4" slotted screwdriver, remove the two right-hand screws from front of the amplifier.
2. Loosen the two left-hand screws until the screw heads protrude above the surface of the amplifier door.
3. Open the amplifier door from right side to left.

Connecting the cable harness:

The individual connector wires are labeled as to where each connector is to be connected onto the internal circuit board of the amplifier. A connection instruction label has been placed inside of the amplifier for connection reference.

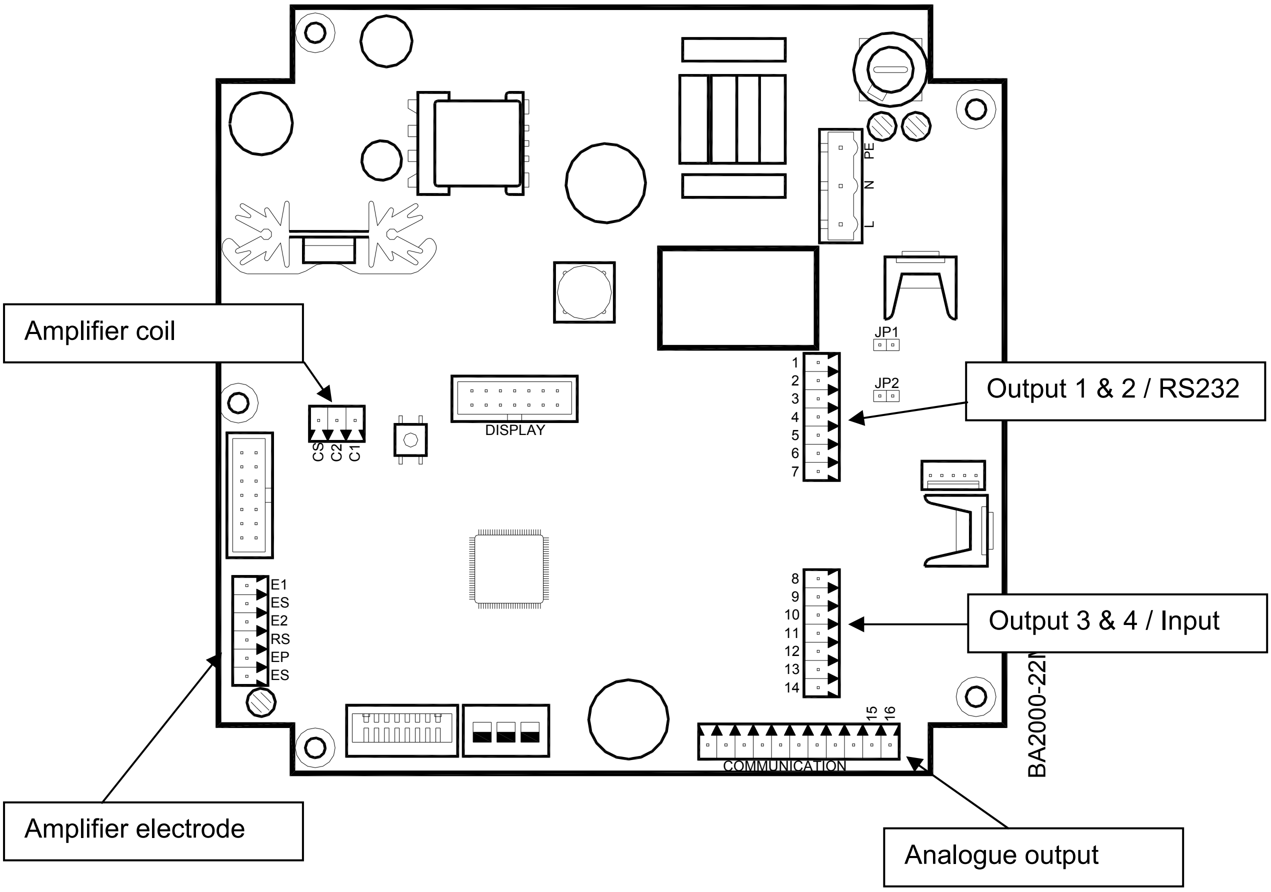
On ModMAG® M2000 cable harness are following connectors:

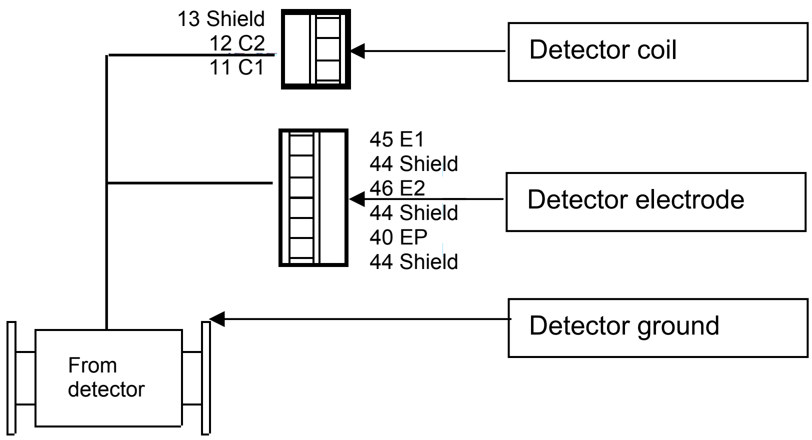
1. Output 1 & 2 / RS232 (7 pins)
2. Output 3 & 4 / Input (7 pins)
3. Analog output (2 pins)
4. Detector electrode (6 pins)
5. Detector coil (3 pins)
6. Amplifier electrode (6 pins)
7. Amplifier coil (3 pins)
8. Detector ground (alligator clip)



Harness connections

1. Clip the alligator clip labeled "Detector Ground" to either of the hex nuts mounted on top of the meter flanges.
2. Plug the connector labeled "Amplifier Electrode" into the circuit board connector labeled "E1, ES, E2, RS, EP, ES".
3. Plug the "Amplifier Coil Output" into the circuit board connector labeled "CS, C2, C1."
4. Plug the "Output 1 & 2/ RS232" into the board output connector labeled "1 to 7."
5. Plug the Output 3 & 4 / Input" into the board output connector labeled "1 to 14".
6. Plug the "Analog output" connector into the board connector labeled "15 and 16" in connector row of "COMMUNICATION / Analog out" on the right side.
7. Connect the harness wire connector labeled "Detector Electrode" to the 6-wire connector from the detector.
8. Connect the harness wire connector labeled "Detector Coil" to the 3-wire connector from the detector.


Amplifier coil
Output 1 & 2 / RS232
Output 3 & 4 / Input
Amplifier electrode
Analogue output
DISPLAY
CS C2 C1
E1 ES E2 RS EP ES
PE N L
JP1
JP2
1 2 3 4 5 6 7
8 9 10 11 12 13 14
15 16
COMMUNICATION
BA2000-22M


13 Shield
12 C2
11 C1
Detector coil
45 E1
44 Shield
46 E2
44 Shield
40 EP
44 Shield
Detector electrode
Detector ground
From detector

3.3 B-MAG™ I M5000

Opening the cover:

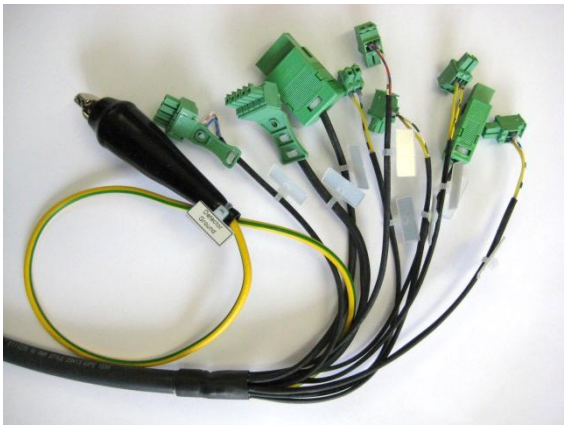
1. Using a 1/4" slotted screwdriver, remove the two top screws from front of the amplifier.
2. Loosen the two bottom screws until the screw heads protrude above the surface of the amplifier door.
3. Open the amplifier door from top to bottom.

Connecting the cable harness:

The individual connector wires are labeled as to where each connector is to be connected onto the internal circuit board of the amplifier. A connection instruction label has been placed inside the amplifier for connection reference.

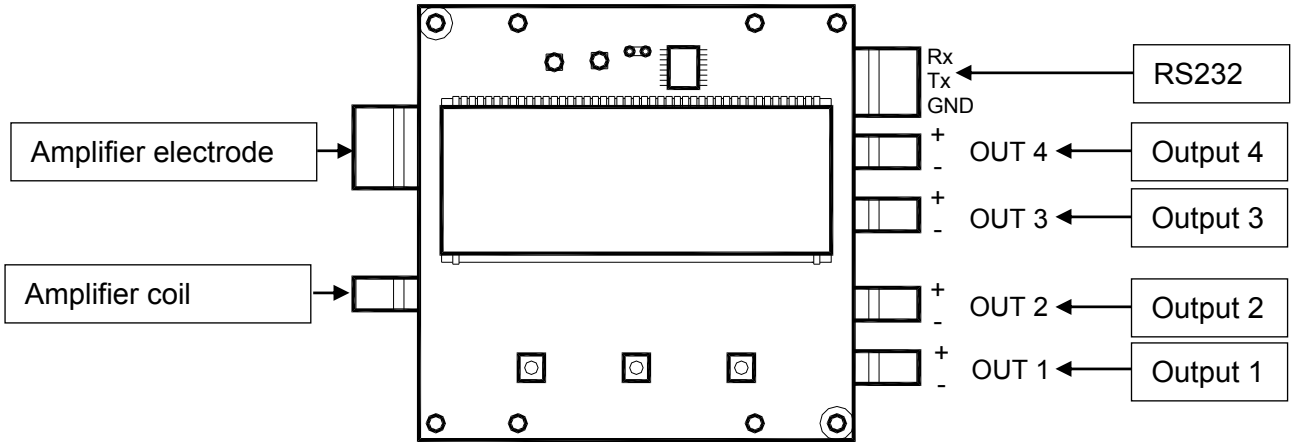
On B-MAG™ I M5000 cable harness are following connectors:

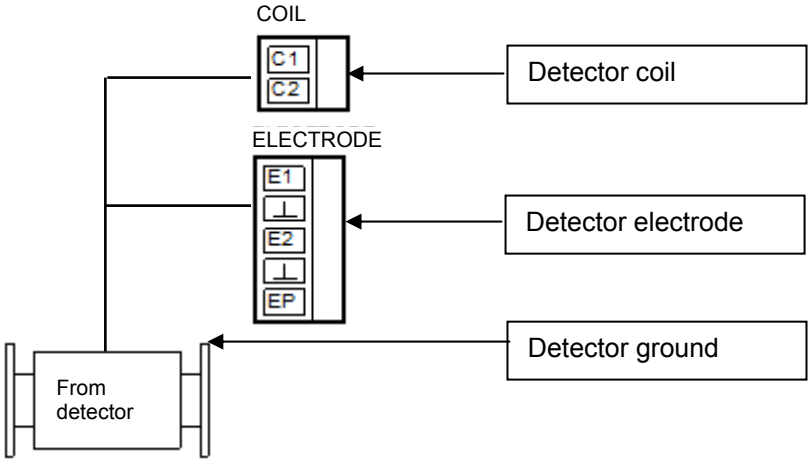
1. RS232 (4 pins)
2. Output 1 (2 pins)
3. Output 2 (2 pins)
4. Output 3 (2 pins)
5. Output 4 (2 pins)
6. Detector electrode (5 pins)
7. Detector coil (2 pins)
8. Amplifier electrode (5 pins)
9. Amplifier coil (2 pins)
10. Detector ground (alligator clip)



Harness connections:

1. Clip the alligator clip labeled "Detector Ground" to either of the hex nuts mounted on top of the meter flanges.
2. Plug the connector labeled "Amplifier Electrode" into the circuit board connector labeled "E1, ⊥, E2, ⊥, EP".
3. Plug the "Amplifier Coil Output" into the circuit board connector labeled " C1, C2."
4. Plug the "Output 1" into the board output connector labeled "Out1".
5. Plug the "Output 2" into the board output connector labeled "Out2".
6. Plug the "Output 3" into the board output connector labeled "Out3".
7. Plug the "Output 4" into the board output connector labeled "Out4".
8. Plug the “RS232" into the board output connector labeled "RS232".
9. Connect the harness wire connector labeled "Detector Electrode" to the 5-wire connector from the detector.
10. Connect the harness wire connector labeled "Detector Coil" to the 2-wire connector from the detector.


Amplifier electrode
Amplifier coil
Rx
Tx
GND
RS232
+
-
OUT 4
Output 4
+
-
OUT 3
Output 3
+
-
OUT 2
Output 2
+
-
OUT 1
Output 1


COIL
C1
C2
Detector coil
ELECTRODE
E1
E2
EP
Detector electrode
Detector ground
From
detector

4. Display and keypad

Display:

The display is a backlit LCD and displays the current date and time, percent of battery charge and menu indications.

Keypad:

The keypad consists of 9 function keys, 12 numerics keys and the On/Off key.

Power key:

The power key on the lower right applies or remove power to the Verification Device.

Function keys:

The 2 top “soft” keys on the left and right sides of the up arrow key provide menu access, wet or dry detector selection.

The up, down, left and right keys allow menu navigation.

The “OK” key confirms a menu selection.

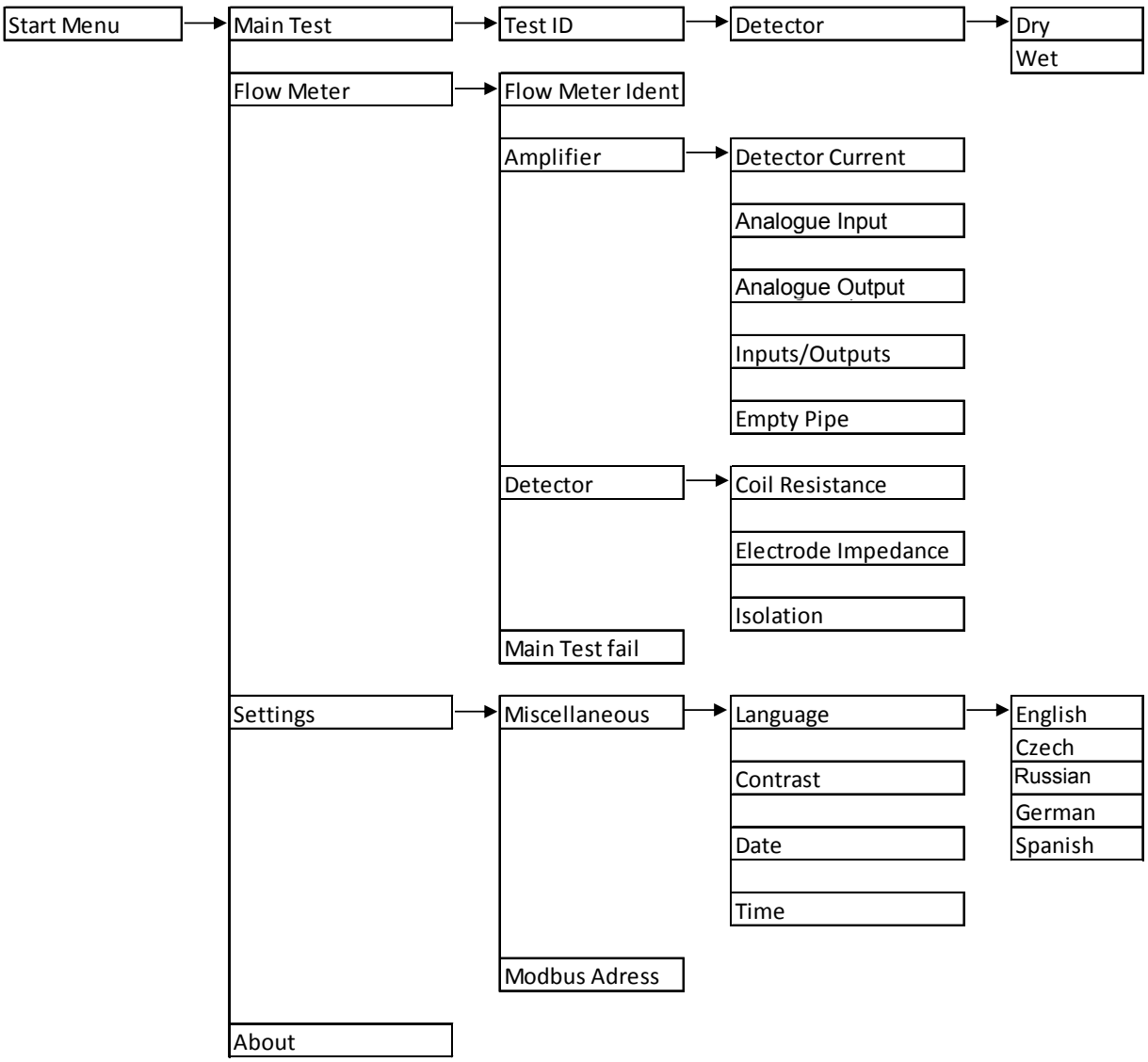
The left arrow is the “Back key” (you can return back to the previous menu) and the “Delete key”.

Alphanumeric keys:

The primary purpose of these keys is for entering the serial number of a meter if not automatically recognized by the internal firmware or external software. Other functions include Test ID entry.

5. Menu structure

Refer to the following when navigating the Verification Device menus:

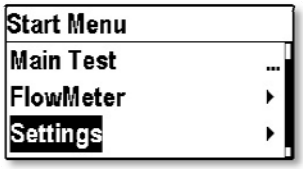


6. Settings

Press the “On/Off” button on the Verification Device and wait for the “SelfTest” to complete, which lasts a couple of seconds.

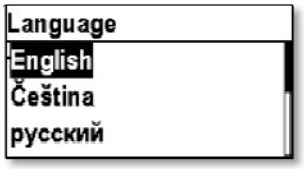
After that, following display appears and shows date, time, battery capacity and firmware version. Check if date and time are correct because the test reports are stored and printed with those data.

When the Start Menu appears on the display, press the upper left function key.



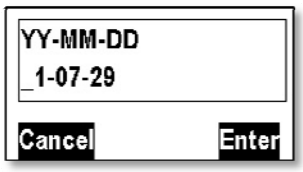
Language

1. Select a menu item from the StartMenu > Menu User > Settings > MISC > Language with the upper right function key.
2. Select the appropriate language (the default language is English).



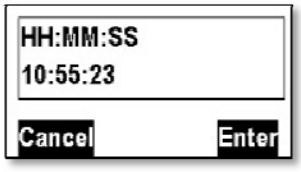
Date

1. Select a menu item from the StartMenu > Settings > Misc > Date.
2. Edit the day, month and year in the editbox by using the numeric keypad. Use the right arrow key to move the cursor.
3. Confirm the new date with the upper right function key.



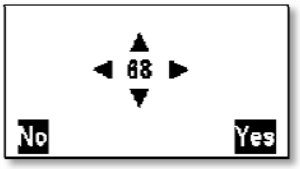
Time

1. Select a menu item from the StartMenu > Settings > Misc > Time.
2. Edit the hour and minutes in the editbox by using the numeric keypad. Use the right arrow key to move the cursor.
3. Confirm the new date with the upper right function key.



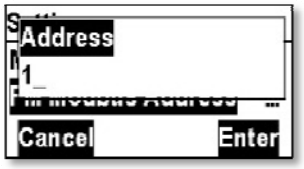
Contrast

Adjust the contrast of the display via the function keys (arrows) and save the adjustment with “Yes”



Flow meter Modbus® address

1. Select a menu item from the StartMenu > Settings > FM Modbus® address.
2. Edit the address in the editbox by using the numeric keypad. Use the “Delete” arrow key to remove the last number position.
3. Press the upper right function key to confirm the new address.
4. Be sure that the flow meter is programmed with the same Modbus® address otherwise communication fail. Default address is 1.



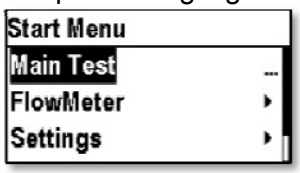
7. Tests

7.1 Main test

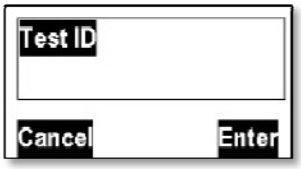
The main test is the standard process for meter testing. The result of this test is automatically stored in the memory of the Verification Device and can be downloaded from the PC program.

The procedure is the following one:

1. Switch off the flow meter and connect the specific wire harness to the amplifier circuit board.
2. Connect the male D-25 connector of the harness to the corresponding female connector on the Verification Device.
3. Switch on the flow meter and be sure that the meter is not in the programming mode when the test starts.
4. Press the “On/Off” button on the Verification Device and wait for the “SelfTest” to complete.
5. When the Start Menu appears on the display, press the upper left function key.
6. When the Main Test option is highlighted, press the “OK” button.

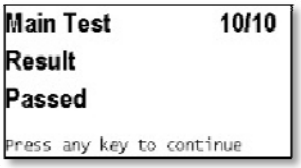


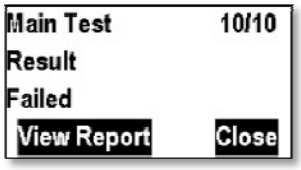
7. Press the appropriate numbers on the numeric keypad for the Test ID and press “OK”. The Test ID is a value which can be used as a customer tag.



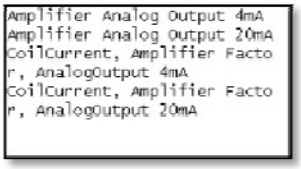
8. Select if the detector tube is inside dry or wet. This selection has influence on the test results of the electrode measurement.

9. The tests are now automatically carried out in 10 steps. During the test, the flow meter shows “Testing in progress” on the display.
10. The result will be “passed” or “failed”.





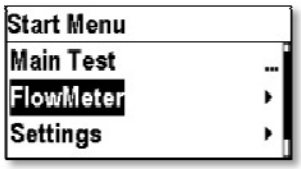
11. If the test failed, press the function key on the upper left “View Report” to see the results. See example below.



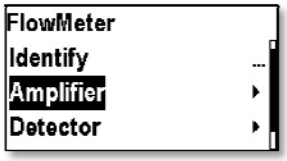
7.2 Manual tests

The result of the manual tests are not stored in the memory of the Veriification Device and cannot be downloaded from the PC program.

1. Switch off the flow meter and connect the specific wire harness to the amplifier circuit board.
2. Connect the male D-25 connector of the harness to the corresponding female connector on the Verification Device.
3. Switch on the flow meter and be sure that the meter is not in the programming mode when the test starts.
4. Press the “On/Off” button on the Verification Device and wait for the “SelfTest” to complete.
5. When the Start Menu appears on the display, press the upper left function key.
6. Select the menu “Flow Meter” and press the “OK” button

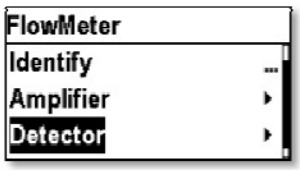


7.2 Amplifier test



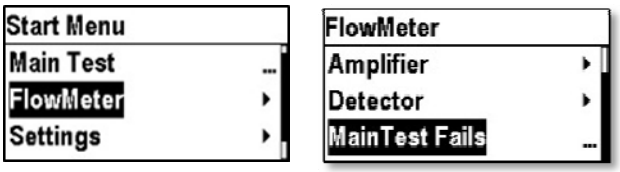
- Detector current
  The current [A] and excitation frequency [Hz] are measured
- Analog input
  Amplification and linearity is measured [div/V]
- Analog output
  Offset and linearity is measured [mA]
- Inputs/Outputs
  The in- and ouput function are tested as well as output frequency [Hz]
- Empty pipe

7.3 Detector test



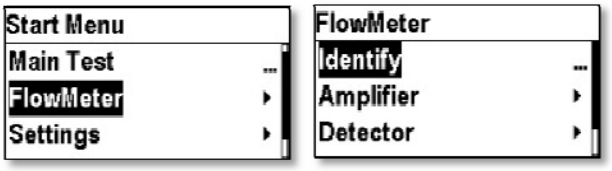
- Coil resistance
  Measures the resistance of the coils [Ohm]
- Electrode impedance
  Measures the impedance of the 3 electrodes (measuring and empty pipe) in [Ohm]
- Isolation
  Measures the resistance of the coils against ground [Ohm]

7.5 Main test fails



Shows the test result of the last main test.

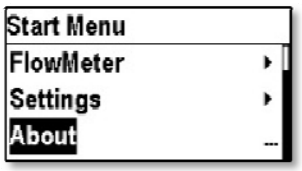
7.6 Meter identification



The menu display information about the connected flow meter.

- Product name
- Serial number
- Firmware name and version
- Compilation date
- Otp Boot Checksum
- Flash Os Checksum

7.7 About



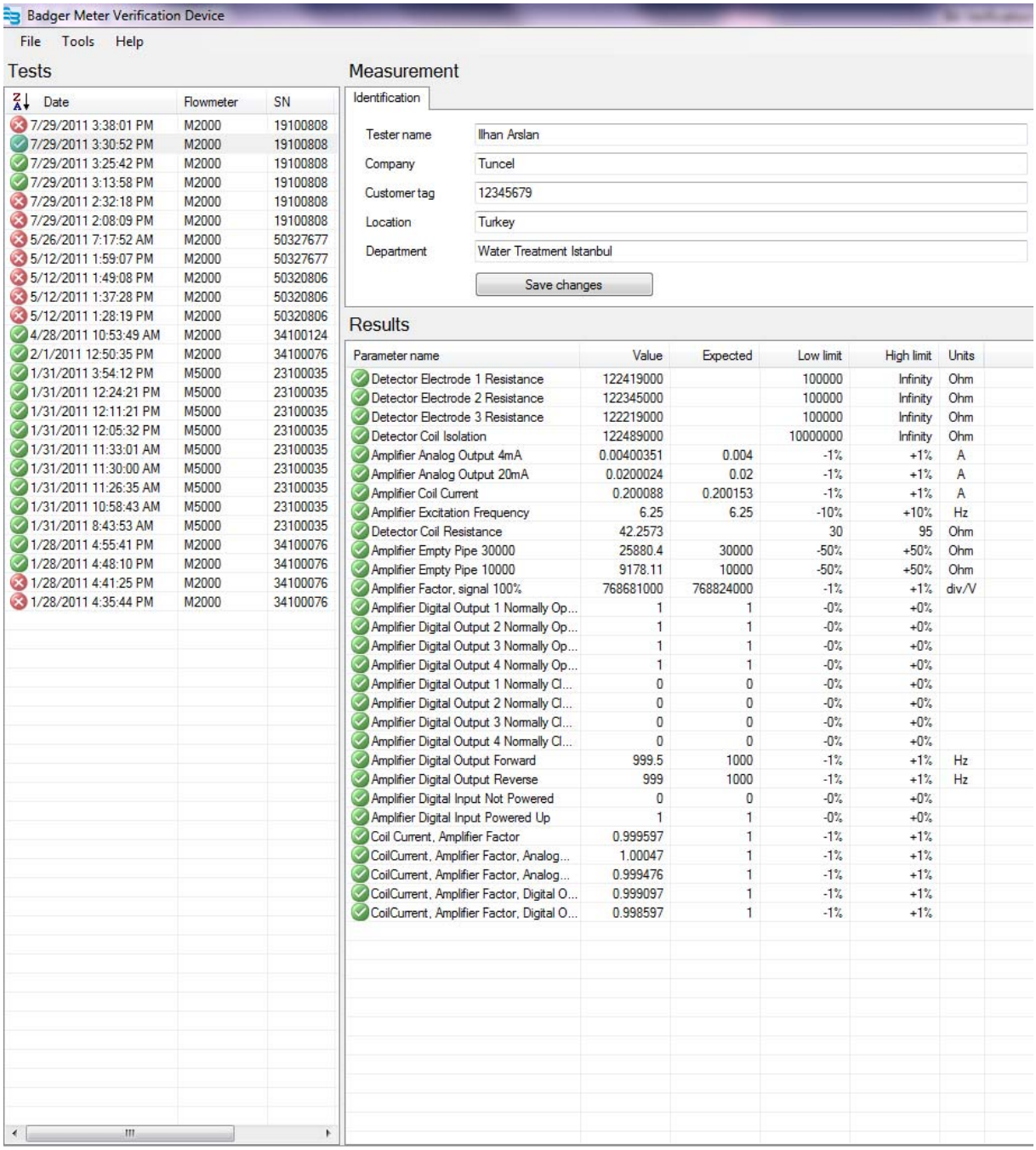
Information about your Verification Device

- Serial number
- Version
- Compilation date
- FlashOsChecksum
- MCU revision
- Date of last detector current calibration
- Date of last coils resistance calibration
- Date of last analog output calibration
- Date of last analog input calibration

8. PC software

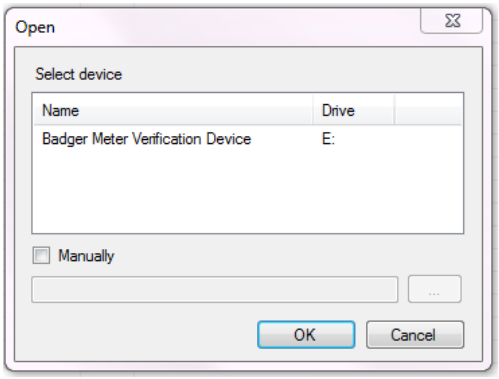
8.1 Installation of the PC software

Insert the delivered CD, open “setup.exe” and follow the instructions. An icon on the desktop will be installed named “Verification Device”.

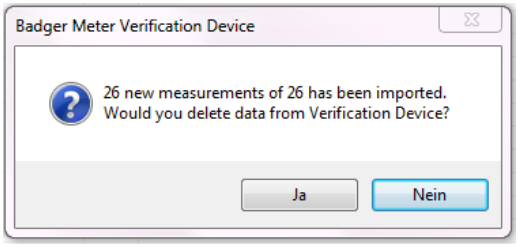


8.2 Download of the verification tests

1. Start the PC program by pressing the “Verification Device” icon on your desktop.
2. Connect the Verification Device via the USB cable to the PC and switch the device “On”. The display on the device shows “USB Mass Storage”
3. The following PC window will automatically be opened. Select the device and press OK. If the window does not open, click FILE and OPEN (Ctrl+O) in the upper task line.

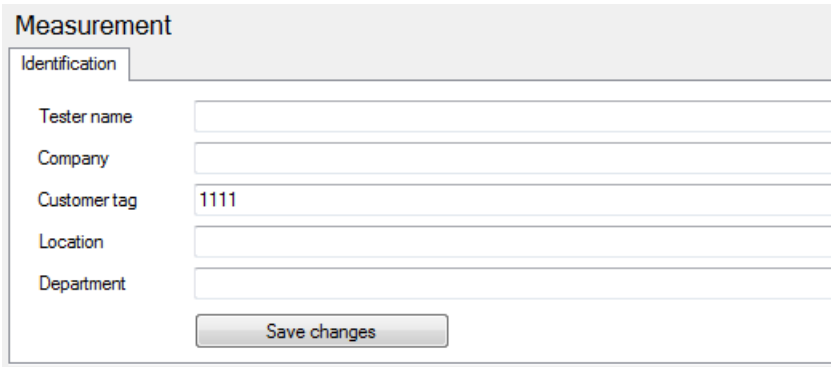


4. The measurements are automatically downloaded to the PC. You will be asked if the measurements which are on the Verification Device should be deleted or not.



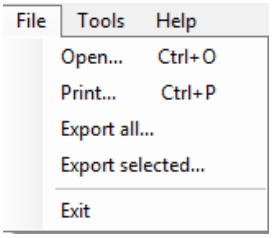
5. The downloaded measurements are displayed on the left side of the window.

6. Select the new measurements and enter following information for each test. Customer tag is already given by enter the “Test ID” during the testing with the Verification Device. Click button “Save changes” to save the entries.

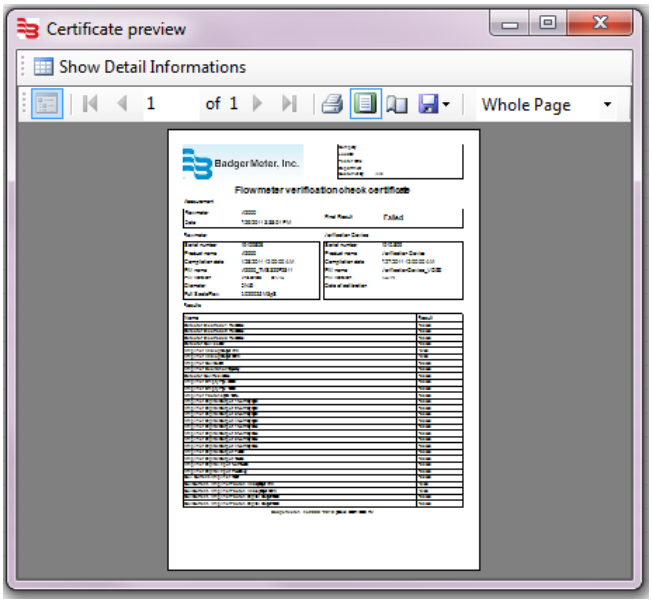


8.3 Print reports

1. Select the measurement which you want to print out
2. Click FILE and PRINT



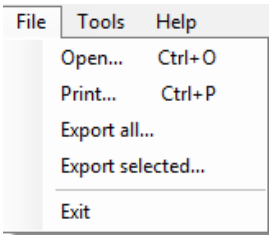
3. A preview window appears:



4. Click printer symbol for print out.

8.4 Export reports

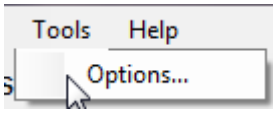
1. Select “Export all” for all or “Export selected” for exporting one measurement.



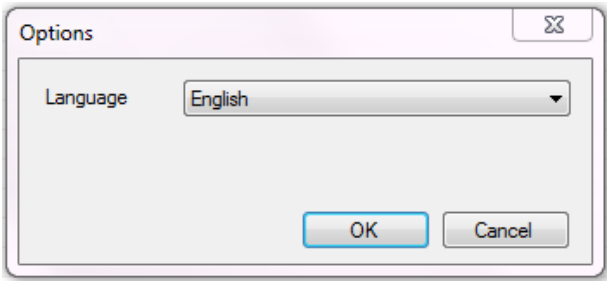
2. Save the data in “CSV” format to be imported in MS Excel.

8.5 Language selection

1. Select TOOLS and OPTIONS



2. The “Tools” menu opens a language (default is English).



9. Technical data

9.1 Features

The Field Verification Device

- determines if the ModMAG® M2000 or B-MAG™ I M5000 is within one percent of the original factory calibration.
- verifies the functionality of all of the meter's inputs and outputs.
- measures electrode resistance and integrity.
- measures coil resistance and integrity.
- measures coil insulation resistance.
- measures current and frequency at previously selected flow rate.
- evaluates the signal processing functionality.
- verifies that there is no high-voltage noise disturbing the coil circuit.
- provides certified printout showing test results.
- is capable to store 100 meter tests.

9.2 Accessories

- Test cable for ModMAG® M2000 connection
- Test cable for B-MAG™ I M5000 connection
- AC charger with EU/US connection adaptors
- Automobile utility DC power supply connector
- PC communication cables to Verification Device
- Pelican suitcase for transport

9.3 Accuracy

9.3.1 Amplifier

Input gain	± 0,1%
Excitation coil current	20-400mA; ± 0,1%
Excitation coil frequency	50/60Hz; ± 1%
Analogue outputs current	4-20mA; ± 0,1%
Digital outputs	1Hz/20 kHz; – 0,1%

9.4.2 Detector

Coil resistance	40-120 Ohm +/-1 %
Electrode resistance (against ground)	100 kOhm-10 MOhm; +/-10 %
Coil insulation (against ground)	100 kOhm-10 MOhm; +/-10 %

10. Return of goods for repair

Please copy, fill in and sign hereafter harmlessness declaration and enclose it for any return of goods you may send back for repair.

No repair will be performed prior to receiving the harmlessness declaration duly filled and signed.

Harmlessness declaration

To : _____

Attn. : _____

From : _____

Dept. : _____

Please note that no repair will be performed prior to receiving of this declaration duly signed by you!

Please send all parts clean from medium and inform us about possible medium wastes remaining in the part. For this purpose, please use this form. A security specification sheet of the medium must accompany this declaration in the following cases: Toxical, dangerous or objectionable media, or media belonging to any dangerous materials class. We inform you that uncleaned parts lead to additional costs. Extra clean costs will be charged to you.

Declaration

We herewith confirm that the part(s) sent for repair has/have been cleaned and is/are free of any liquid and/or solid wastes of the medium and/or cleaning medium: Any eventually remaining wastes are:

❍ harmless

❍ dangerous, toxic, etc. – Security specifications are attached

Signature of person in charge: _____

Name of the person in charge in capital letters: _____

Date: _____

Company stamp: _____

Hotline

Phone +49-7025-9208-0 or -30
Fax +49-7025-9208-15

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