

 Badger Meter
Badger Meter M2000
Field Verification Device



Badger Meter M2000 Field Verification Device User Manual

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Badger Meter M2000 Field Verification Device



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, Inc. 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, Inc., the protection provided by the equipment may be impaired.

QUESTIONS OR SERVICE ASSISTANCE

If you have questions regarding the product or this document, please visit us on the web at www.badgermeter.com or call your local Badger Meter representative.

ABOUT THE FIELD VERIFICATION DEVICE

The Field Verification Device is a portable test device for the Badger Meter electromagnetic flow meters. The M1000, M2000 and the M5000 meters can be tested using this device.

With the Field Verification Device, accurate verification of meter functionality is assured without taking the meter out of the pipeline and interrupting the process. The complete verification test takes approximately 20 minutes and results can be downloaded to a Microsoft® Windows® 8, 7, XP or Vista®, personal computer.

FIELD VERIFICATION DEVICE FUNCTIONS

- Determines if the meter amplifier is within one percent of the original factory calibration.
- Verifies the functionality of all the meter's inputs and outputs.
- Measures electrode resistance and integrity.
- Measures coil resistance and integrity.
- Measures coil insulation resistance.
- Measures current and frequency output.
- Evaluates the signal processing functionality.
- Provides pass/fail results to aid in troubleshooting.

FIELD VERIFICATION DEVICE KIT COMPONENTS

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

1. One (1) Field Verification Device +5V AC, 3.0A power adapter
2. Four (4) AC power conversion connectors
3. One (1) USB PC data cable
4. One (1) DC power adapter
5. Two (3) Verification cable harnesses: one each for the M1000, M200 and M5000



Figure 1: Kit components

CABLE CONNECTIONS

Cable Harness

The cable harnesses are tagged with M1000, M2000 or M5000 on the outer harness wire cover so the user can differentiate between the two.

Connect the 25-pin connector of the corresponding cable harness to the top of the Field Verification Device and secure it with the two screws on the left and right.



Figure 2: 25-pin connection

Power Connector

The Field Verification Device is a battery powered unit. Before using the Field Verification Device, make sure it is fully charged by connecting it to either the AC or DC power adapter.



AC Power Adapter



Car Charger (DC Power)



USB to PC (DC Power)

Figure 3: Power and PC connections

NOTE: The USB connector is used for either the DC power adapter or for downloading the test information to a PC.

M1000

Communication Settings

M1000 port adjustment

Navigate to Main Menu > Communication and adjust as follows:

- Interface: Modbus RTU
- Port address: 1
- Mode: RS232
- Baud rate: 9600
- Parity: Even

Check that the hardware DIP switches are adjusted for an RS232 interface.

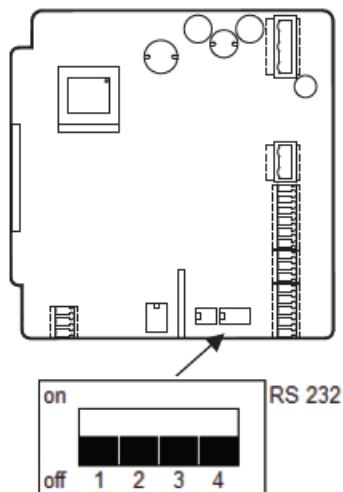


Figure 4: M1000 dip switches

Disconnect the power to the amplifier before connecting the cable harness to the Field Verification Device.

Opening the Cover

1. Using a 1/4 inch slotted screwdriver, remove the two right-hand screws from the 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 the amplifier for reference. Existing connections should also be disconnected before the Field Verification Device cable harness is installed.

NOTE: Disregard any meter screen errors.

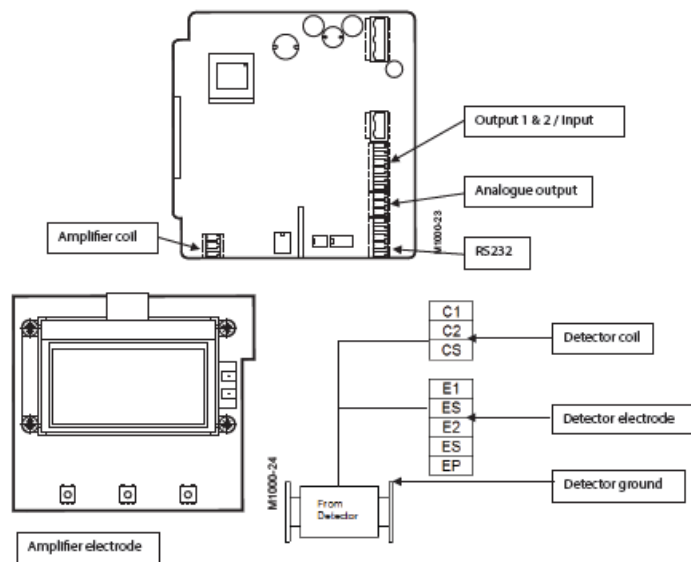
On the M1000 cable harness, the following connectors are tagged:

- Output 1 & 2 / Input (6-pin connector)
- RS232 (5-pin connector)
- Analog output (3-pin connector)
- Detector electrode (5-pin connector)
- Detector coil (3-pin connector)
- Amplifier electrode (5-pin connector)
- Amplifier coil (3-pin connector)
- Detector ground (alligator clip)



M1000 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, ES, EP.
3. Plug the Amplifier Coil Output into the circuit board connector labeled CS, C2, C1.
4. Plug the Output 1 & 2/ Input into the board output connector labeled 1 to 6.
5. Plug the Analog Output into the board output connector labeled 9 to 8.
6. Plug the RS232 connector into the board connector labeled ABZYG.
7. Connect the harness wire connector labeled Detector Electrode to the 5-wire connector from the detector.
8. Connect the harness wire connector labeled Detector Coil to the 3-wire connector from the detector



M2000

Communication Settings

M2000 port A adjustment

Navigate to Main Menu > Communication > Port A and adjust as follows:

- Interface: Modbus RTU
- Port address: 1
- Baud rate: 9600
- Data bits: 8
- Parity: Even
- Stop bits: 1

Disconnect the power to the amplifier before connecting the cable harness to the Field Verification Device.

Opening the Cover

1. Using a 1/4 inch slotted screwdriver, remove the two right-hand screws from the 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 the amplifier for reference. Existing connections should also be disconnected before the Field Verification Device cable harness is installed.

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Disregard any meter screen errors.

On the M2000 cable harness, the following connectors are tagged:

- Out 1 and 2 RS232 (7-pin connector)
- Output 3 and 4 Input (7-pin connector)
- Analog Output (2-pin connector)
- Detector Electrode (6-pin connector)

- Detector Coil (3-pin connector)
- Amplifier Electrode (6-pin connector)
- Amplifier Coil (3-pin connector)
- Detector Ground (alligator clip)



M2000 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 8 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.

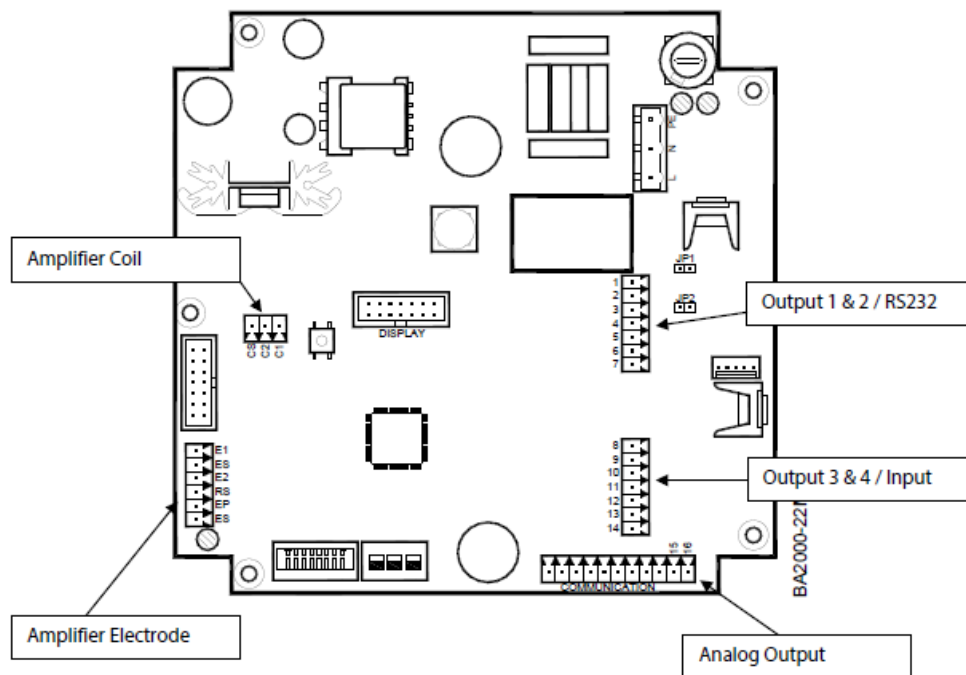


Figure 5: M2000 wire harness circuit board connectors

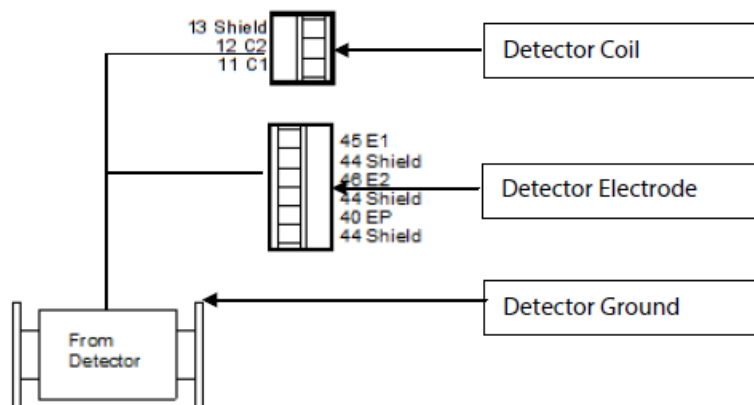


Figure 6: M2000 detector connections

M5000

Communication Settings

M5000 port adjustment

Navigate to Main Menu > Communication and adjust the port as follows:

- Interface: Serial
- Baud rate: 9600
- Parity: Even
- Address: 1

NOTE permanent enabled interface decreases considerably the battery life-time. We therefore recommend to disable the interface after use.C

CAUTION

DO NOT DISCONNECT THE POWER TO THE TRANSMITTER WHILE CONNECTING THE CABLE HARNESS TO THE FIELD VERIFICATION DEVICE BECAUSE THIS CAN AFFECT THE TOTALIZER READING.

Opening the Cover

1. Using a 1/4 inch slotted screwdriver, remove the two top screws from the 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. Existing connections should also be disconnected before the Field Verification Device cable harness is installed.

NOTE: Disregard any meter screen errors.

On an M5000 cable harness, the following connectors are tagged:

- RS232 (4-pin connector)
- Input (2-pin connector)
- Output 1 (2-pin connector)
- Output 2 (2-pin connector)
- Output 3 (2-pin connector)
- Output 4 (2-pin connector)
- Detector Electrode (5-pin connector)
- Detector Coil (2-pin connector)
- Amplifier Electrode (5-pin connector)
- Amplifier Coil Output (2-pin connector)
- Detector Ground (alligator clip) M5000

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, \perp , E2, \perp , 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 input into the board output connector labeled input.

NOTE: Phase 1 boards do not have an input connector. If you are performing a verification check on a phase 1 board, do not connect the input connector.

9. Plug the RS232 into the board output connector labeled RS232.
10. Connect the harness wire connector labeled Detector Electrode to the 5-wire connector from the detector.
11. Connect the harness wire connector labeled Detector Coil to the 2-wire connector from the detector.

NOTE: The M5000 communication must be set to Serial: Main Menu > Communication > Interface_Serial. Turn the Interface to Off when testing is complete.

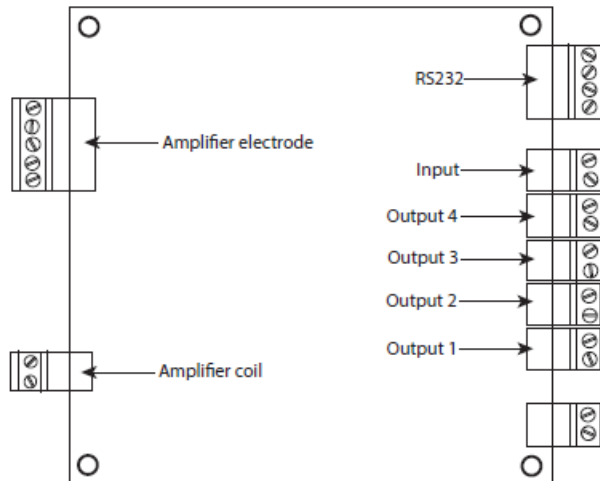


Figure 7: M5000 wire harness circuit board connectors

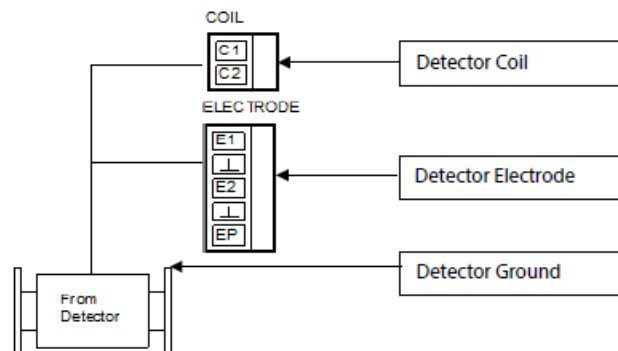


Figure 8: M5000 detector connections

DISPLAY AND KEYPAD

Display

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

Keypad

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



Figure 9: Field Verification Device functions

Power Key

The On/Off power key on the lower right applies or removes power to the Field Verification Device.

Function Keys

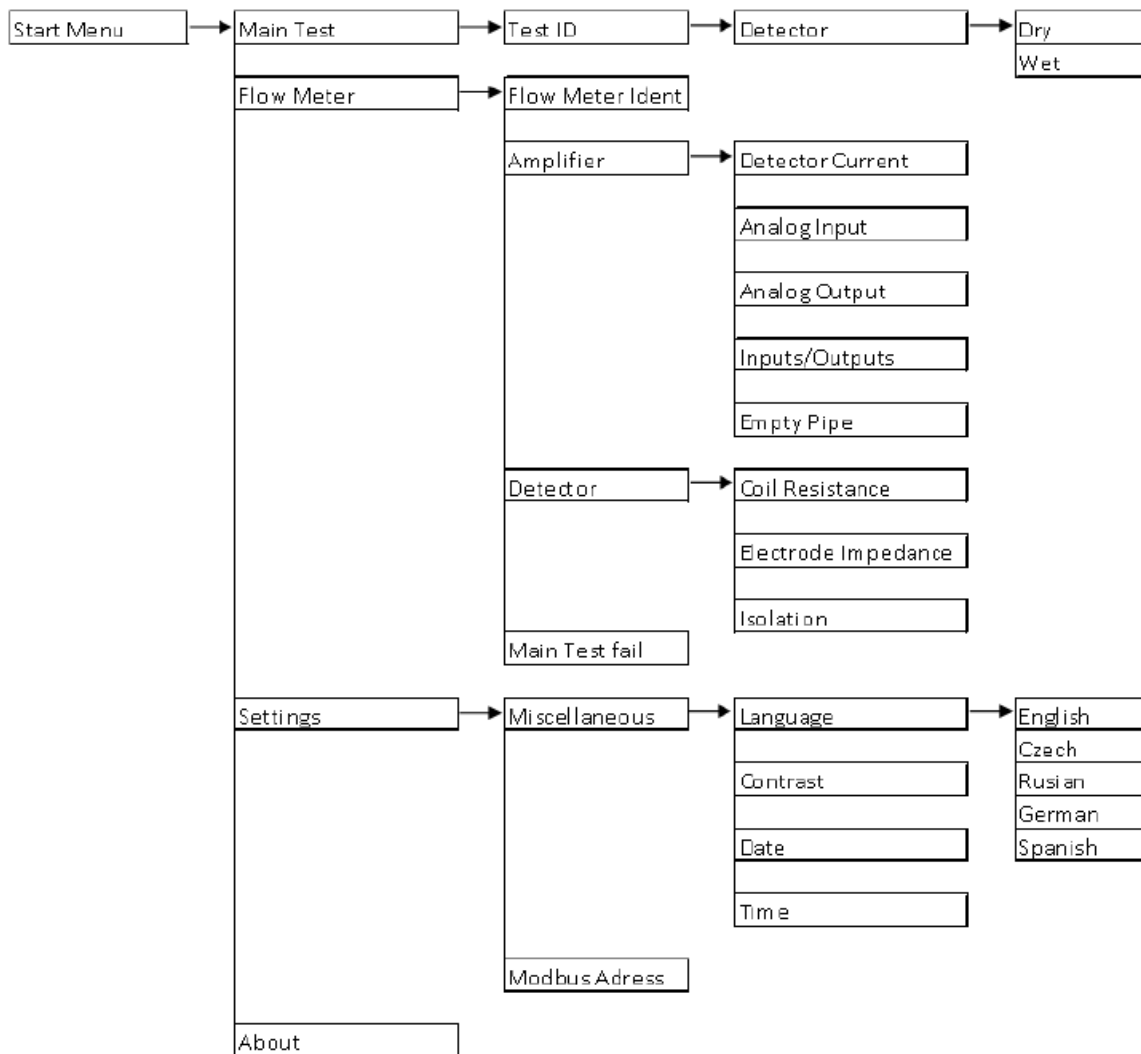
- The two top soft keys on the left and right side of ▲ are the Left Select and Right Select keys. These are option selection keys and provide menu access.
- The ▲, ▼, ◀, and ▶ keys provide menu navigation.
- The OK key confirms a menu selection.
- The Alt key provides no function.
- The left arrow is the Back/Delete key.

Alpha/Numeric Keys

The primary purpose of the alpha-numeric keys is for entering the serial number of a meter PCB if it is not automatically recognized by the internal firmware or external software. The alpha/numeric keys are also used for Test ID entry.

MENU STRUCTURE

Refer to the following chart when navigating the Field Verification Device menus.

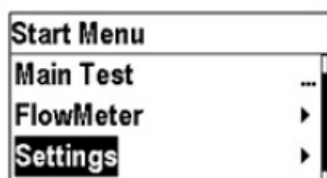


FIELD VERIFICATION DEVICE SETTINGS

Press On/Off on the Field Verification Device and wait for the SelfTest to complete. This takes a few seconds. After the SelfTest, the display shows date, time, battery capacity and firmware version. Check to make sure the date and time are correct because the test reports are stored and printed with this data.



When the Start Menu appears, press Left Select.



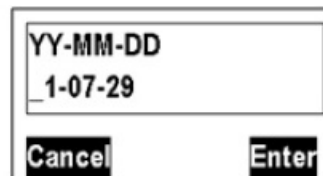
Language

1. Select StartMenu > Menu User > Settings > Misc > Language using Right Select.
2. Select the appropriate language. (The default language is English.)



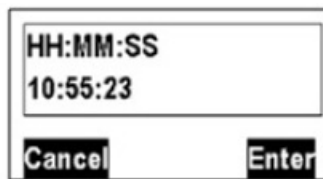
Date

1. Select StartMenu > Settings > Misc > Date.
2. Edit the day, month and year in the edit box by using the numeric keypad. Use ► to move the cursor.
3. Press Right Select to confirm the new date.



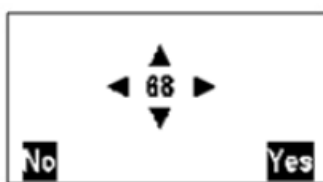
Time

1. Select StartMenu > Settings > Misc > Time.
2. Edit the hour and minutes in the edit box by using the numeric keypad. Use ► to move the cursor.
3. Press Right Select to confirm the new time.



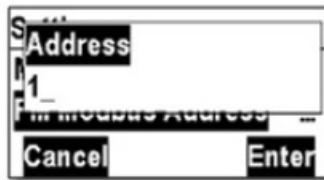
Contrast

Adjust the contrast of the display using ◀ ▶ ▲ and ▼ and press Right Select to confirm the new setting.



Flow Meter Modbus Address

1. Select StartMenu > Settings > FM Modbus Address.
2. Edit the Address in the edit box by using the numeric keypad. Use Back/Delete to remove the last number position.
3. Press Right Select to confirm the new address.
4. Be sure that the flow meter is programmed with the same modbus address or communication will fail. The default address is 1.



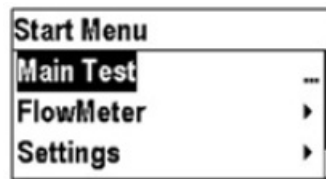
FIELD VERIFICATION DEVICE TESTS

Main Test

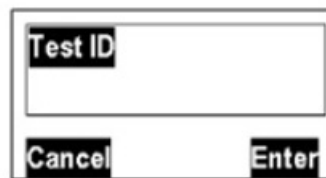
The main test is the standard process for meter testing. The result of this test is automatically stored in the memory of the Field Verification Device and can be uploaded to the PC program.

Perform the following steps

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 Field Verification Device.
3. Switch on the flowmeter to be sure that the meter is not in programming mode when the test is started.
4. Press On/Off on the Field Verification Device and wait for the SelfTest to complete.
5. When the Start Menu appears in the display, press the upper left function key.
6. When the Main Test option is highlighted, press OK.



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.



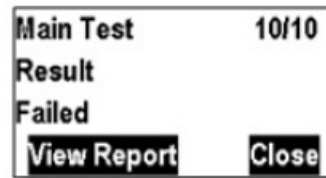
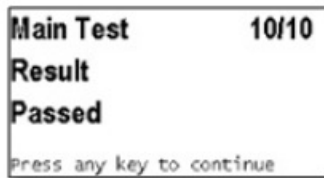
8. Select Dry or Wet using Left Select or Right Select based on the inside condition of the detector tube. This selection has influence on the test results of the electrode measurement.



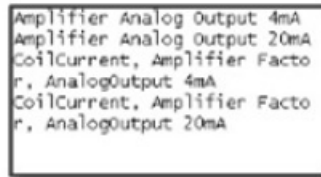
9. The testing is completed automatically in 10 steps. During the test the flow meter shows Testing in progress on the display. The result is Passed or Failed.

Follow the onscreen prompts when necessary.

WHEN TESTING AN M5000, DO NOT DISCONNECT THE BATTERY DURING THE TEST, OTHERWISE THE TOTALIZERS VALUES MAY BE GET LOST! THE NOTE OF THE VERIFICATION DEVICE "SWITCH OFF THE POWER" ONLY REFERS TO DEVICES THAT REQUIRE MAINS POWER.



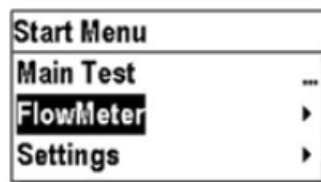
10. If the test Failed, press Left Select to see the results. See the example below.



MANUAL TESTS

The result of the manual tests are not stored in the memory of the Field Verification Device and cannot be uploaded to the PC program.

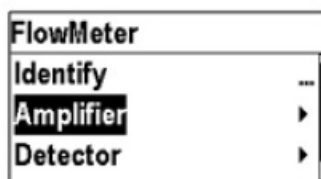
1. Switch off the flow meter and connect the specific wire harness to the amplifier circuit board.
2. Connect the male D-25 connector of the harness to the corresponding female connector on the Field Verification Device.
3. Switch on the flowmeter and be sure that the meter is not in programing mode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



Amplifier Test

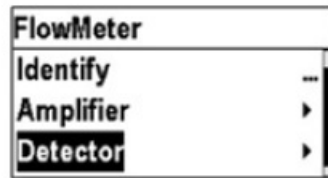
- Detector current—The current [A] and excitation frequency [Hz] are measured
- Analog input—Amplification and linearity is measured [div/V]
- Analog output—Offset and linearity is measured [mA]
- Inputs/outputs—The Input and output function are tested as well as output frequency [Hz]
- Empty pipe

Detector Test

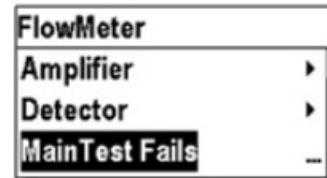
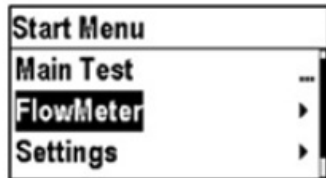


- Coil resistance—Measures the resistance of the coils [Ohm]
- Electrode impedance—Measures the impedance of the 3 electrodes (measuring and empty pipe) in [Ohm]

- Isolation—Measures the resistance of the coils against ground [Ohm]

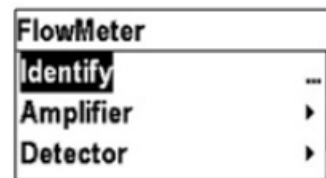
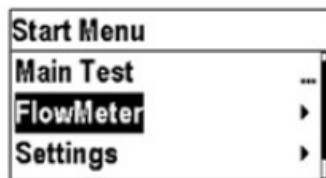


Main Test Fails



Shows the test result of the last Main Test.

Meter Identification

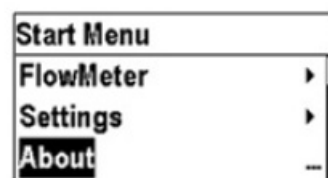


The menu displays information about the connected flow meter.

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

About

-



Information about the Field Verification Device

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

- Flash Os Checksum
- Date of last analog input calibration
- MCU revision

PC SOFTWARE

Installation of the PC Software

The software is downloaded from www.badgermeter.com. Follow the onscreen prompts for downloading and installing the software. After the download is complete, an icon is installed on the Desktop named Verification Device.

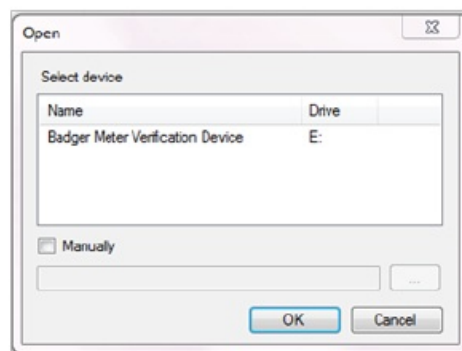
Please download your software using the QR code or the link below: www.badgermeter.com/software-firmware-downloads

If you need any support, please reach out to mag@badgermeter.com

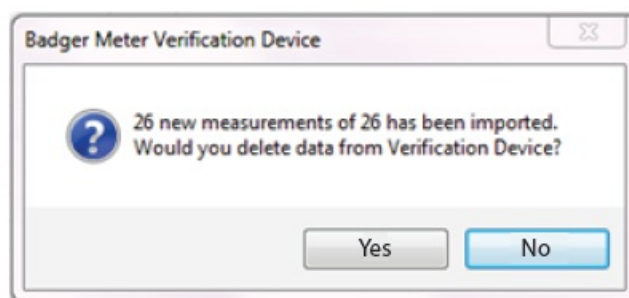


Download of the Verification Tests

1. Start the PC program by clicking the Field Verification Device icon on your desktop.
2. Connect the Field Verification Device via the USB cable to the PC and switch the Field Verification Device on.
The display on the Field Verification Device shows USB Mass Storage.
3. The following PC window will be opened automatically. Select the Badger Meter Verification Device and click OK. If the window will not open click FILE and OPEN (Ctrl+O) in the upper task bar.
- 4.



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



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

Field Meter Verification Device

File Tools Help

Tests

#	Date	Fluorimeter	SN	Customer tag
1	10/10/2010 12:00:21 PM	M2000	10510001	082710.6
2	9/17/2010 1:36:45 PM	M2000	10510001	082710.6
3	8/27/2010 2:39:17 PM	M2000	10519699	082710.4
4	8/27/2010 2:34:42 PM	M2000	10519699	082710.4
5	8/27/2010 12:47:30 PM	M2000	10519699	082710.2
6	8/27/2010 10:56:31 AM	M2000	10519699	082710.1
7	8/25/2010 3:52:44 PM	M2000	99010000	082510.3
8	8/25/2010 3:44:44 PM	M2000	99010000	082510.2
9	8/25/2010 3:39:40 PM	M2000	99010000	082510.1
10	8/25/2010 2:32:24 PM	M2000	99010000	082510.3
11	8/25/2010 2:25:13 PM	M2000	99010000	082510.2
12	8/25/2010 2:17:15 PM	M2000	99010000	082510.1
13	8/25/2010 9:31:22 AM	M5000	10520021	082510.10
14	8/25/2010 9:27:44 AM	M5000	10520021	082510.9
15	8/25/2010 9:20:36 AM	M5000	10520021	082510.8
16	8/25/2010 9:10:14 AM	M5000	10520021	082510.7
17	8/25/2010 8:50:51 AM	M5000	10520021	082510.6
18	8/25/2010 8:43:36 AM	M5000	10520021	082510.4
19	8/25/2010 8:39:08 AM	M5000	10520021	082510.3
20	8/25/2010 8:35:41 AM	M5000	10520021	082510.2
21	8/6/2010 4:52:36 PM	M5000	10520021	080610.4
22	8/6/2010 4:47:13 PM	M5000	10520021	080610.3
23	8/6/2010 4:41:26 PM	M5000	10520021	080610.3
24	8/6/2010 11:17:32 AM	M5000	10520021	080610.7
25	8/6/2010 11:13:09 AM	M5000	10520021	080610.6
26	8/5/2010 8:55:18 PM	M5000	10520021	
27	8/5/2010 8:17:12 PM	M5000	10520021	
28	6/25/2010 8:40:42 PM	M2000	99010000	5
29	6/25/2010 8:32:49 PM	M2000	99010000	3
30	6/25/2010 8:04:27 PM	M2000	99010000	3
31	6/25/2010 7:50:49 PM	M2000	99010000	2
32	6/25/2010 7:43:29 PM	M2000	99010000	1
33	6/25/2010 7:35:36 PM	M2000	99010000	4
34	6/25/2010 7:28:57 PM	M2000	99010000	1
35	6/25/2010 7:13:26 PM	M2000	99010000	3
36	6/25/2010 7:06:00 PM	M2000	99010000	2
37	6/25/2010 6:42:46 PM	M2000	99010000	2
38	6/25/2010 6:36:53 PM	M2000	99010000	1
39	6/25/2010 4:43:03 PM	M2000	99010000	9
40	6/25/2010 3:24:30 PM	M2000	99010000	2
41	6/25/2010 3:21:04 PM	M2000	99010000	1
42	6/25/2010 3:17:27 PM	M2000	99010000	3
43	6/25/2010 3:12:52 PM	M2000	99010000	2

Measurement

Identification

Tester name

Company

Customer tag 113456789

Location

Department

Save changes

Results

Parameter name	Value	Expected	Low limit	High limit	Units
Detector Electrode 1 Resistance	106168000		100000	Infinity	Ohms
Detector Electrode 2 Resistance	29550400		100000	Infinity	Ohms
Detector Electrode 3 Resistance	105536000		100000	Infinity	Ohms
Detector Coil Isolation	105777000		10000000	Infinity	Ohms
Amplifier Coil Current	0.200672	0.200788	-1%	+1%	A
Amplifier Excitation Frequency	7.5	7.5	-10%	+10%	Hz
Detector Coil Resistance	43.4363		30	55	Ohms
Amplifier Analog Output 4mA	0.00396998	0.004	-1%	+1%	A
Amplifier Analog Output 20mA	0.01959504	0.02	-1%	+1%	A
Amplifier Empty Pipe 1	35767.9	30000	-50%	+50%	Ohms
Amplifier Empty Pipe 2	9229.36	10000	-50%	+50%	Ohms
Amplifier Factor, signal 100%	769571000	769744000	-1%	+1%	div/V
Amplifier Factor, signal 50%	769457000	769744000	-1%	+1%	div/V
Amplifier Digital Output 1 Normally Op.	1	1	-0%	+0%	
Amplifier Digital Output 2 Normally Op.	1	1	-0%	+0%	
Amplifier Digital Output 3 Normally Op.	1	1	-0%	+0%	
Amplifier Digital Output 4 Normally Op.	1	1	-0%	+0%	
Amplifier Digital Output 1 Normally CL	0	0	-0%	+0%	
Amplifier Digital Output 2 Normally CL	0	0	-0%	+0%	
Amplifier Digital Output 3 Normally CL	0	0	-0%	+0%	
Amplifier Digital Output 4 Normally CL	0	0	-0%	+0%	
Amplifier Digital Output Forward	9995	1000	-1%	+1%	Hz
Amplifier Digital Output Reverse	9995	1000	-1%	+1%	Hz
Amplifier Digital Input Half Powered	0	0	-0%	+0%	
Amplifier Digital Input Powered Up	1	1	-0%	+0%	
Coil Current, Amplifier Factor	0.999148	1	-1%	+1%	
Coil Current, Amplifier Factor, Analog	0.998618	1	-1%	+1%	
Coil Current, Amplifier Factor, Analog	0.998527	1	-1%	+1%	
Coil Current, Amplifier Factor, Digital O	0.998648	1	-1%	+1%	
Coil Current, Amplifier Factor, Digital O	0.998648	1	-1%	+1%	

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

Measurement

Identification

Tester name

Company

Customer tag 1111

Location

Department

Save changes

Print Reports

1. Select the measurement you want to print.
2. Click File and Print.

File Tools Help

Open... Ctrl+O

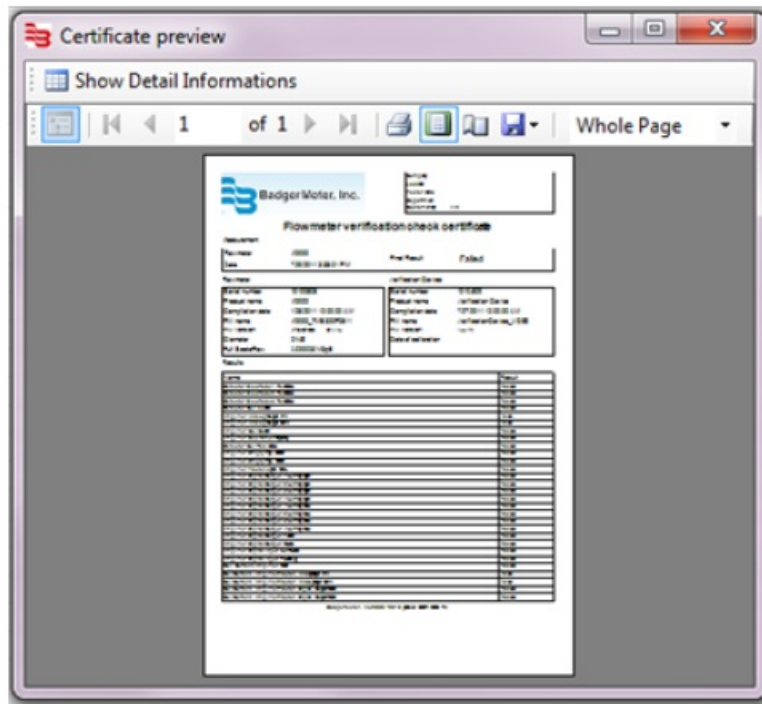
Print... Ctrl+P

Export all...

Export selected...

Exit

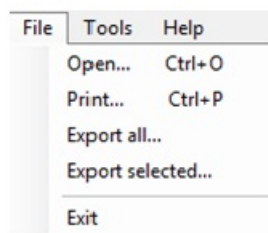
A preview window is shown:



3. Click the printer symbol.

Export Reports

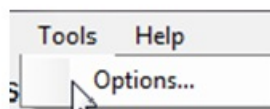
1. Select Export all... for all or Export selected... for exporting one measurement
- 2.



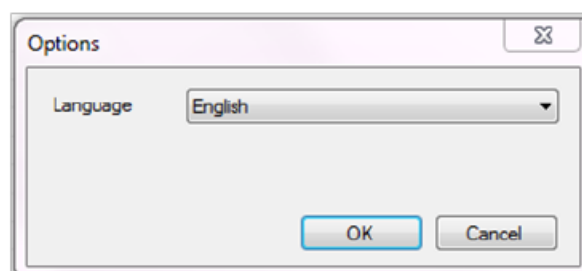
Save the data in "CSV" format to be imported to MS Excel

Language Selection

1. Select Tools and Options.



2. The Options menu opens. Select a Language. (The default is English.)




SPECIFICATIONS

Dimensions	8 3 × 4 × 1 5 inches (210 × 102 × 39 millimeters)
Weight	15 9 ounces (450 grams)
Connectors	One female D-25 Cannon connector for the meter harness communications port One USB 2 0 c computer connection or 12V DC charging One +5V AC, 3 0A power connection for battery recharging
Display	Backlit LCD Resolution = 240 × 128 pixel, visible area 38 × 72 mm
Keypad	Nine navigation-function buttons Twelve alpha-numeric serial number buttons One On/Off button One battery status indicator
Battery	Rechargeable internal Li-pol accumulator with a charging time of four hours (USB or AC-wall) or two hours (automobile utility adapter)
Protection Class	IP46

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www.badgermeter.com

Documents / Resources

	<p>Badger Meter M2000 Field Verification Device [pdf] User Manual M2000 Field Verification Device, M2000, Field Verification Device, Verification Device, Device</p>
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References

- [User Manual](#)

[Manuals+ Privacy Policy](#)

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