

Injector flow meter

IFM-2

User manual



Contents

1. Introduction.....	3
2. Specifications.....	3
3. Connection.....	3
3.1 Rear panel.....	3
3.2 Front panel.....	5
3.3 Injection sensor.....	6
4. Device operation.....	6
4.1 Making measurement.....	7
4.2 Recording mode.....	7
4.3 Device settings.....	8
5. IFM-2 PC Software.....	9
5.1 Software installation.....	9
5.2 Driver installation (Windows 7).....	9
5.3 Driver installation (Windows 8/8.1/10/11).....	12
5.5 Software operation.....	13
8. Troubleshooting.....	20

1. Introduction

IFM-2 Injector Flow Meter is designed to test performance of Common Rail injectors on the test bench. IFM-2 allows simultaneous measurement of delivery and back leak of single tested injector.

The device is an independent flow meter and therefore works with all test benches and injector tester equipment.

Included RPM sensor enables to display flow value in relation to the number of injections. Thanks to unique technology, it is not necessary to use additional filters at the device is resistant to contamination.

IFM-2 can be connected to PC or laptop via USB connection. The included software allows the user to visualize flow rates on graph as well as perform injector tests based on user defined database.

After testing the report can be printed showing tested injectors performance. It is possible to print results for whole injector set at once (up to 6).

2. Specifications

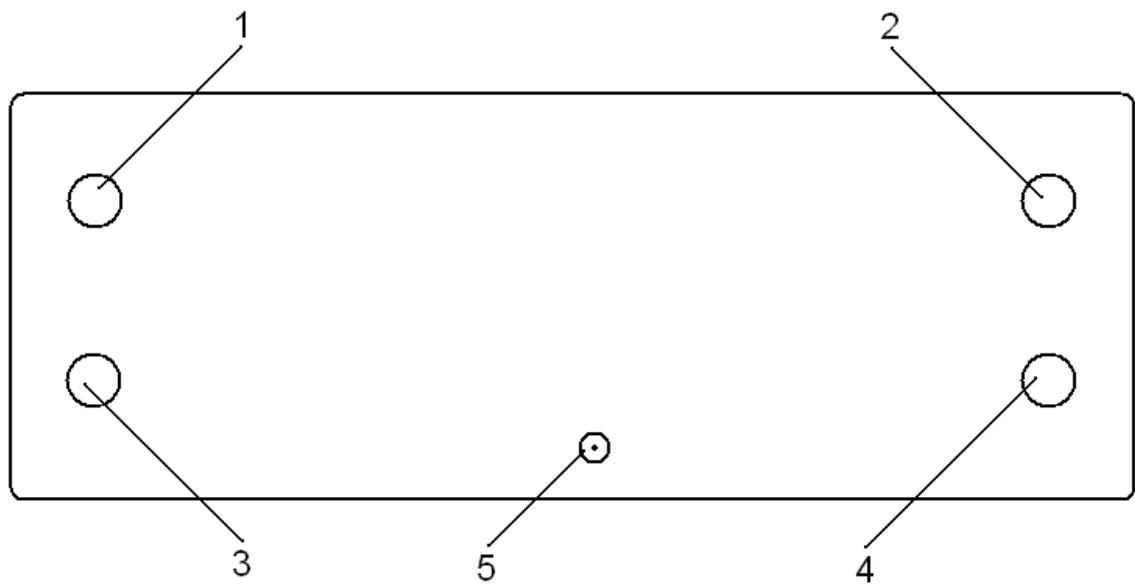
Supply voltage:	12V DC (use stabilized DC power supply only)
Power consumption	max. 12W (1A)
Medium:	test oil or diesel fuel (see information below)
Operating conditions:	temp. 0 – 50°C
Flow measurement:	1 – 500 ml/min (0.001 – 0.5 l/min)
Available units:	ml/min, l/h, mg/inj, ml/N injections
Accuracy:	2%
Injection speed:	25....5000 IPM (injections per minute)



For measurements we recommend using calibration fluid compliant with ISO 4113, following manufacturer's recommended exchange period. When working with regular diesel fuel it is necessary to shorten exchange period to a maximum of 1 month, regardless of the intensity of use.

3. Connection

3.1 Rear panel



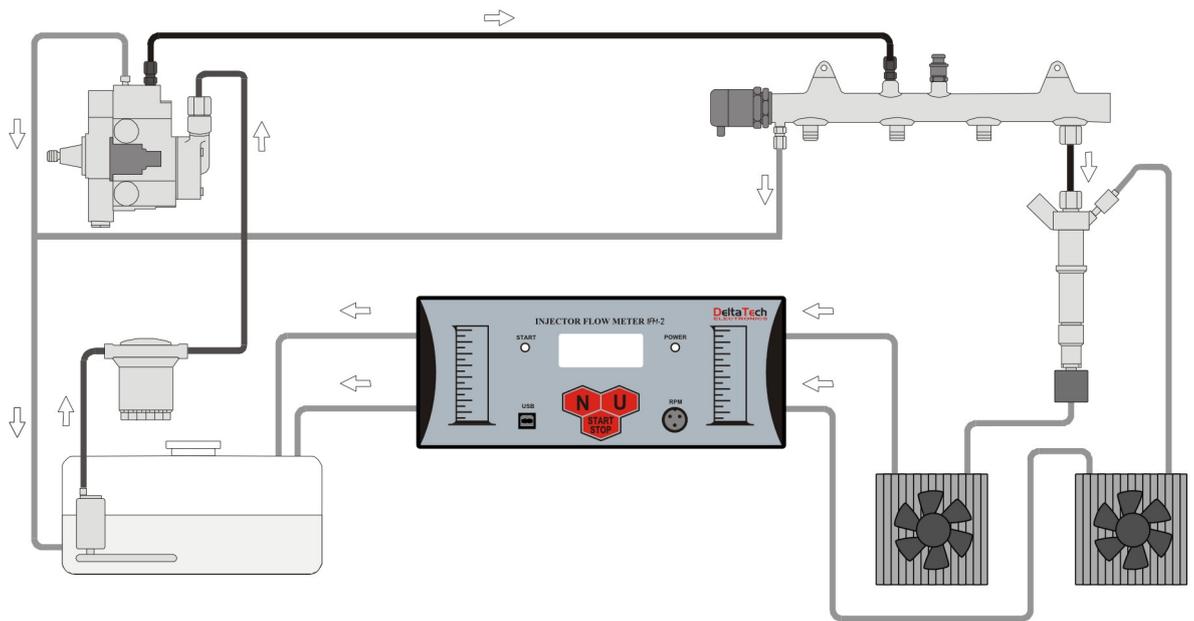
1. Channel A – inlet
2. Channel A – outlet
3. Channel B – inlet
4. Channel B – outlet
5. Power connector (12V DC)

The device is powered with 12V plug-in AC adapter (included). Use only regulated DC power supply with an output current of min. 1A.

To be able to perform measurements, connect the inlets and outlets of channels A and B to the tested injector.

1. Connect channel A inlet to injector output (use injector adapter included).
2. Connect channel A outlet to the test bench fuel tank.
3. Connect channel B inlet to injector recovery port.
4. Connect channel B outlet to the test bench fuel tank.

Correct measurement set-up is shown below:

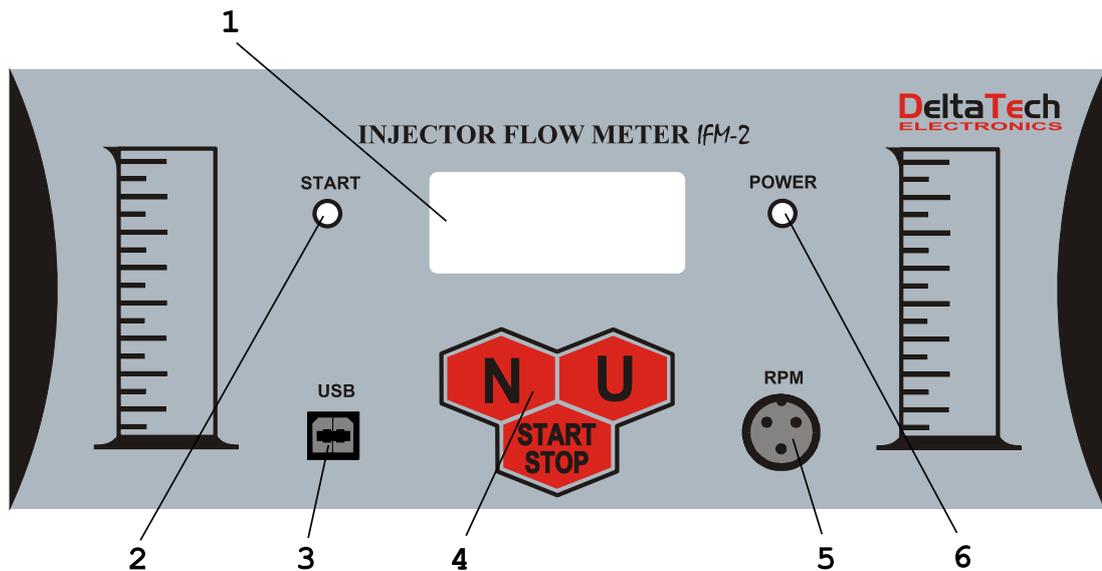


In accordance with the standards of injector performance measurements using test oil, standard temperature of fuel on test bench is 40 ± 2 °C. However, the temperature of fuel entering flow meter should be below 40°C. To ensure the required accuracy maintain oil temperature of 20-30 °C. Such conditions occur usually in test benches made by leading manufacturers. Install fuel coolers if necessary.



Do not attempt to open the device. Careless handling can lead to damage or deterioration of accuracy.

3.2 Front panel



1. LCD display
2. *START* indicator
3. USB connector
4. Keypad
5. RPM sensor connector
6. *POWER* indicator

- RPM connector for injection sensor (see 3.3).
- USB connector for PC connection. With dedicated PC software the user may graphically visualize measurement data and get access to editable test plan database. See section 5 of this manual for details.

3.3 Injection sensor

The injection sensor (included) allows to measure injection speed generated by injector tester. For injection sensor to work properly it should be connected in parallel to the circuit of tested injector. Alternatively, the injection sensor can be connected to other injector tester output if available.

There is no need to observe polarity (+/-) - the wires can be connected in any way. The sensor can work with both electromagnetic and piezoelectric injectors. Maximum allowable working voltage is 200V.

4. Device operation

The device has three buttons located on the front panel:

N – number of turns selection (for measurements in relation to injector speed)

U – unit selection,
START/STOP – beginning and ending recording mode.

After power up the IFM-2 displays splash screen for a few seconds. During this time, the device self-test is performed.

Then device switches to main screen that contains:

1. Channel A flow
2. Channel B flow
3. Fuel temperatures for channels A i B
4. Test bench speed (RPM)

A	0.0 ml/min
B	0.0 ml/min
Tem.	20°C / 20°C
IPM	0

To change display units press the U button. Units will be changed in following order:

- ***ml/min*** (milliliters per minute = cubic centimeters per minute)
- ***l/h*** (liters per hour)
- ***mg/inj*** (milligrams per injection)
- ***ml/N injections*** (milliliters per N injections, N can be selected)

The *N* button allows to select number of injector turns used when ***ml/N injections*** is selected. The values can be switched in the following order: **50, 100, 150, 200, 300, 500, 1000**.

4.1 Making measurement

To perform a measurement it is necessary to set required parameters on injector tester device and starting injector testing in continuous mode. When making first measurement after connecting new injector wait until oil removes air from fuel lines. After that the device shows correct values. It is not needed to wait for given number of injections as the device already measures injection speed and calculates number of injections per selected number of injections.



Please ensure that no air is present in lines connecting injector and flow meter during the measurement. Failing to do so lead to inaccuracy and unstable readout.

4.2 Recording mode

The user may want to use recording mode to get more precise (averaged) results. Pressing **START/STOP** will start recording mode. This is indicated by **START/STOP** indicator light. Pressing **START/STOP** for second time terminates recording – the results will be displayed.

The screen contains maximum, minimum and average values of flow during recording.

```
ml/1000--A-----B
Max  15.1 41.3
Min  13.9 30.2
     Avg  14.3 35.4
```

To return to main screen press **START/STOP** again.

4.3 Device settings

IFM-2 device setup mode that allows to choose language default unit and enter manual flow meter corrections for even more precise measurements.

To enter setup mode please unplug power from device. When the device is off, hold **N** and **U** buttons and then turn on the power.

Language selection menu should appear:

```
> English
  Polski
```

After selecting language using **N** and **U** buttons, confirm selection by pressing **START/STOP**.

```
Units:
> ml/min
```

Then select default unit which will be selected in the device on startup. **U** changes unit while **N** changes number of turns in *ml/ N turns* unit. Confirm selection by pressing **START/STOP**.

In the next step manual adjustment of flow meter is possible (in range of -20% - +20%) for both channels.

```
--Adjustment-A--
> +0.0 %
--Adjustment-B--
```

If necessary change correction coefficient using *N* and *U*. Pressing **START/STOP** will allow correction of second value. Pressing **START/STOP** again will save setting and reboot the device.

5. IFM-2 PC Software

5.1 Software installation

After downloading software package, extract the archive and run *Start.exe* from the main folder.

To install IFM-2 software click *Install*. In the next steps you must accept the license agreement, specify the destination folder, and choose whether you want to create a desktop icon. Each wizard step should be confirmed by clicking *Next*.

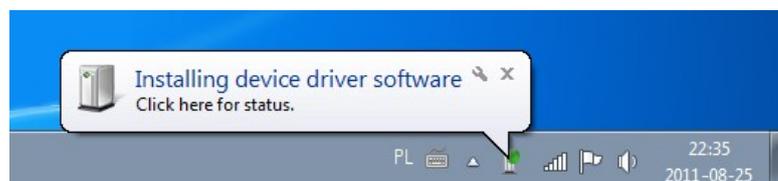
During installation a database engine setup will display. It is necessary to install database engine for IFM-2 software to work properly.

After completing the installation, the confirmation will appear.

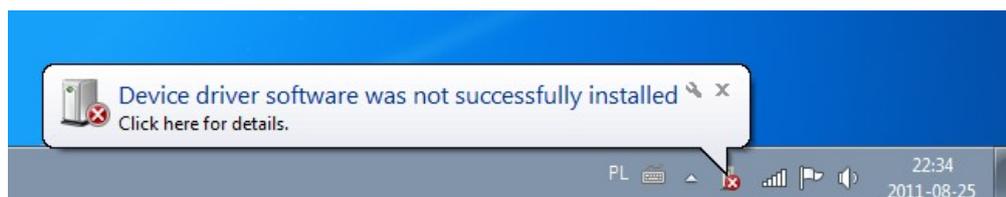
5.2 Driver installation (Windows 7)

The driver installation procedure is slightly different on the newer Windows versions.

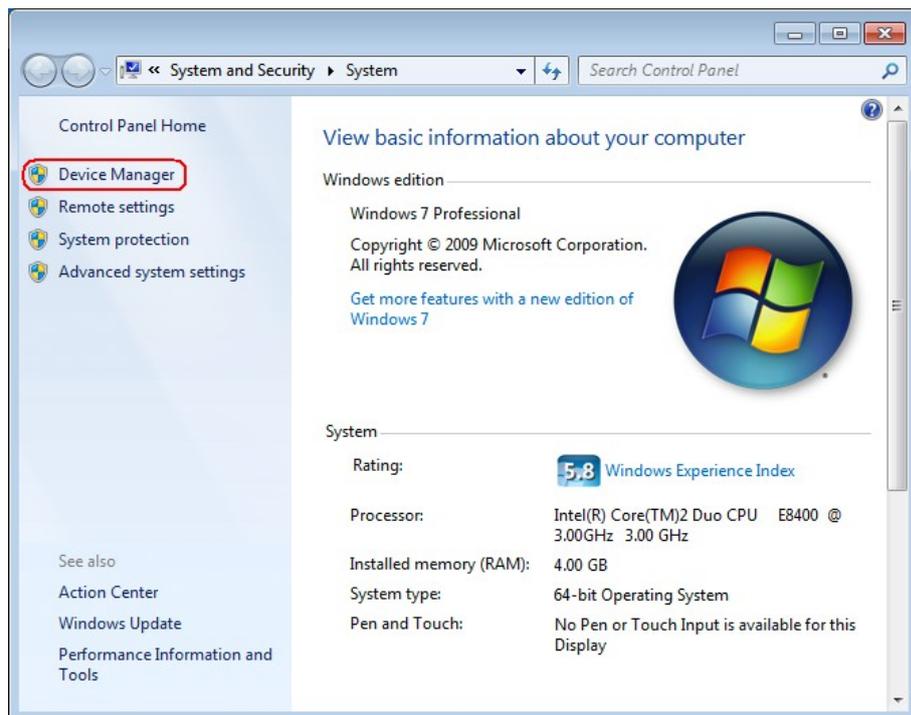
Connect the device to the USB port. Notification will appear in the lower right corner of the screen.



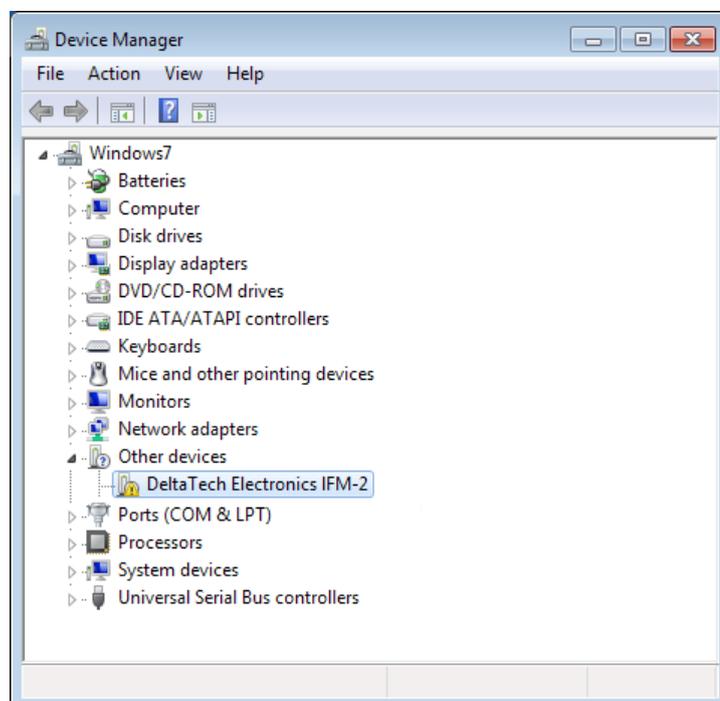
After a while the warning will display as the driver will not install automatically:



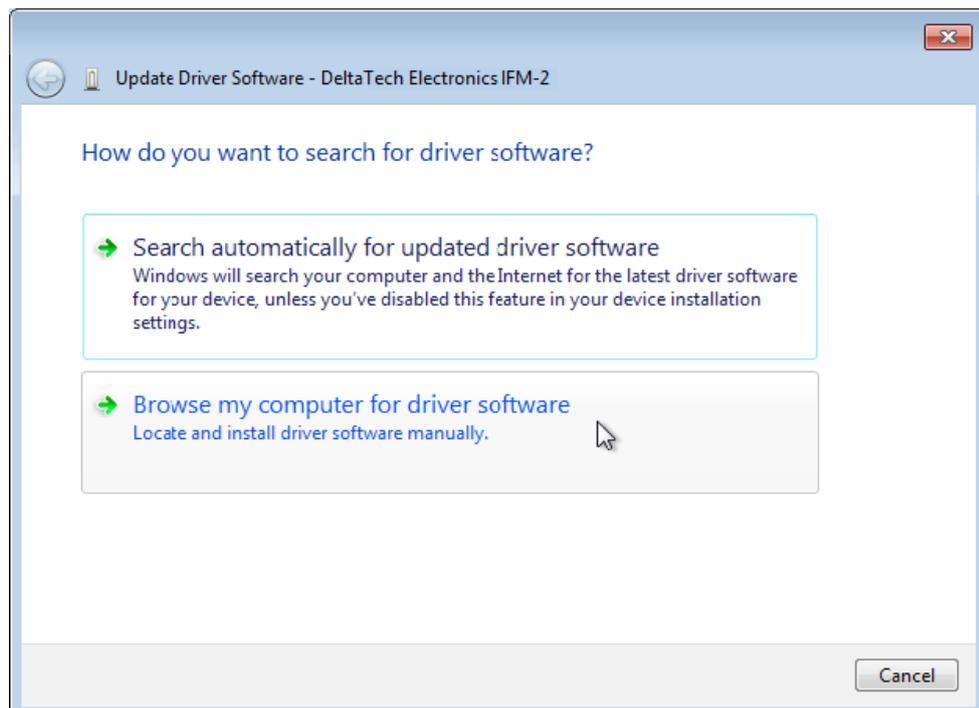
Right-click the *Computer* and select *Properties*:



Click *Device manager*, this will invoke the list of devices. Among others there should be *DeltaTech Electronics IFM-2* on the list.



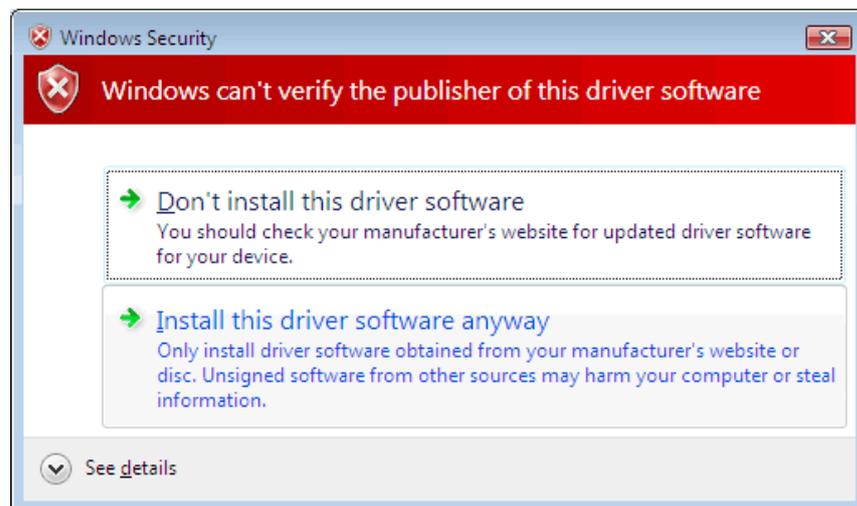
Right-click *DeltaTech Electronics IFM-2* and select *Update device driver* from the pop-up menu. The following window will appear:



Choose *Browse my computer for driver software* and specify the driver path:

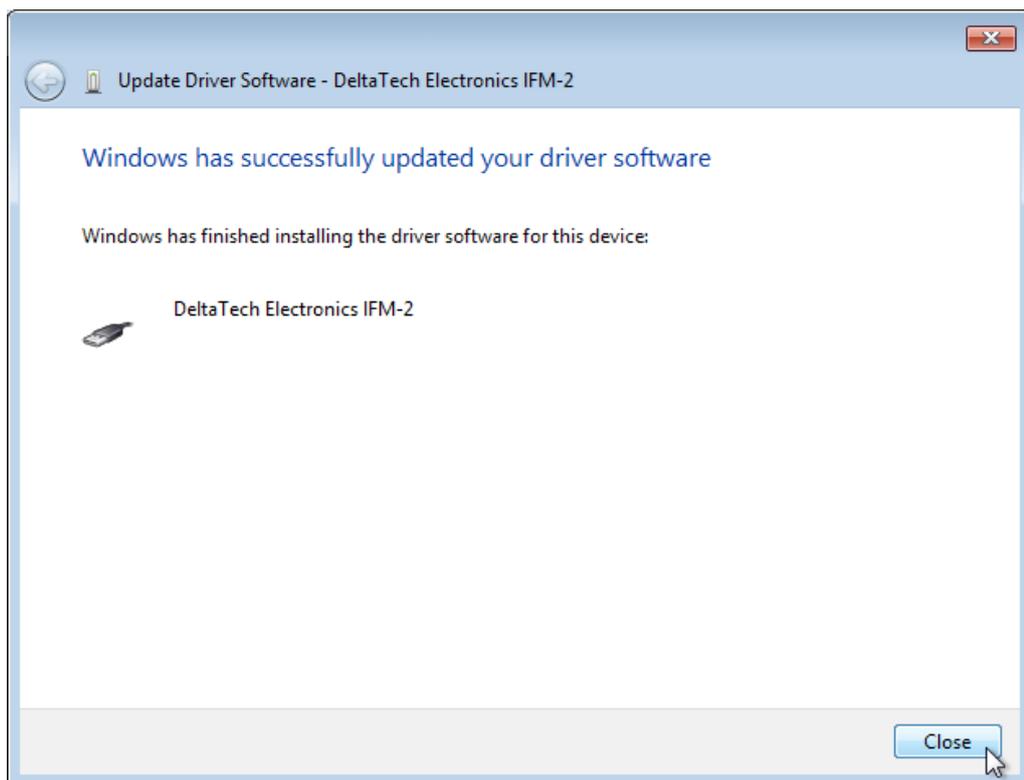
Select *Driver* folder in the installation folder and click *Next*.

The system will display untrusted publisher warning:



Select *Install this driver software anyway*.

After a while installation should be completed:



5.3 Driver installation (Windows 8/8.1/10/11)

To install driver properly in Windows 8/8.1/10/11, it may be necessary to start the computer in special mode.

Perform the following steps:

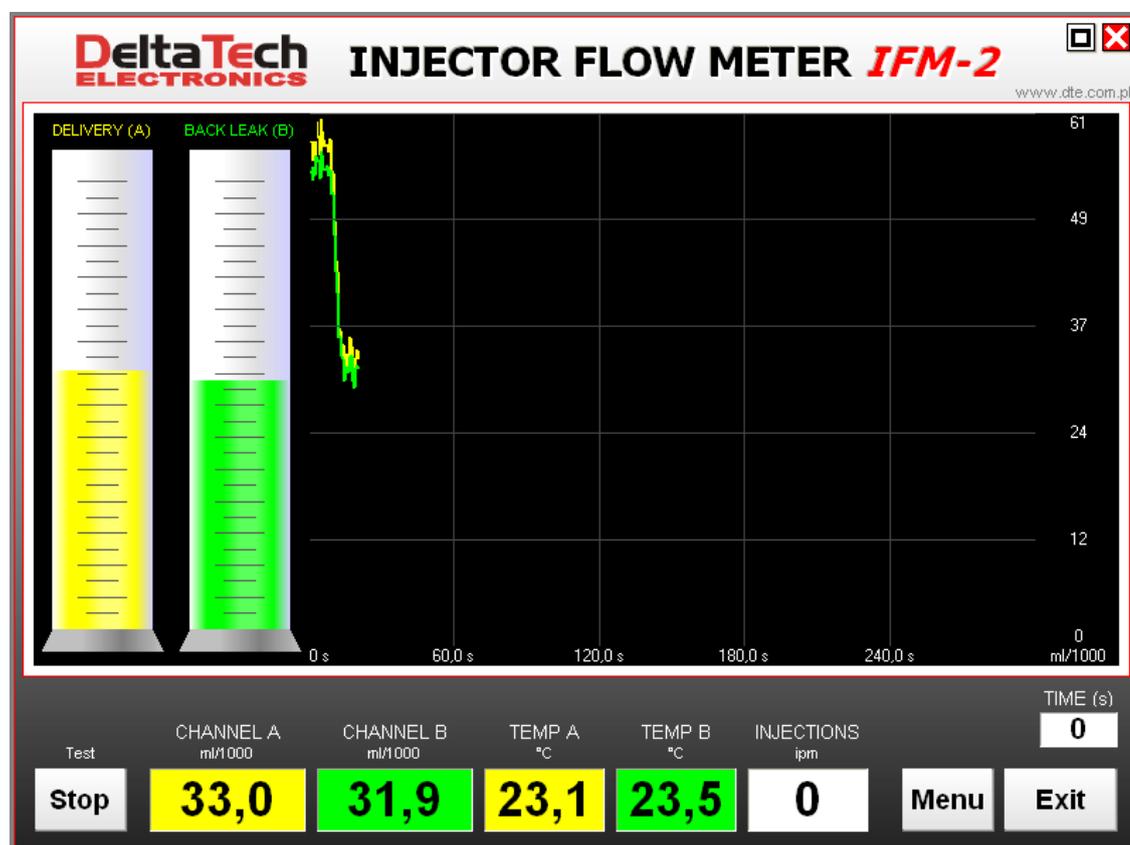
1. Display power options:
 - Windows 8/8.1: Move cursor over the top or bottom right corner of the screen and the Charm Bar will appear. Click *Settings* (gear icon) and then click *Power*.
 - Windows 10: Click *Menu Start* and then *Power*.
2. While holding *SHIFT* key click *Restart* button.
3. When an option screen will display, click *Troubleshoot*, then *Advanced options*, and then, *Startup settings*.
4. The system will display list of options available. Click *Restart*.
5. System will restart into startup settings mode. On the list displayed select number 7 (Disable driver signature enforcement) by pressing F7 key.

After performing all the steps run Device manager. The fastest way to do this is to press *WinKey* + *X* on the keyboard and select *Device manager*.

After opening device manager proceed as in Windows 7 (see previous section of this Manual).

5.5 Software operation

A) Program main window



The main part of the window is a flow graph. The graph visualizes two measured flows (channel A in yellow and channel B in green) as a function of a time.

Start/Stop – starts and stops data acquisition.

Menu – displays menu.

Exits – closes application.

CHANNEL A , *CHANNEL B*– measured flow for channels A i B (unit visible above).



Momentary values of flow displayed on a PC monitor may differ from values shown on device display even when the same unit is chosen. This is caused by different (and selectable) averaging horizon in PC software. Value shown in normal mode by device should be considered as a preview of momentary flow during PC-based measurements.

TEMP A , *TEMP B* – fuel temperature for channels A and B.

INJECTIONS – detected injection speed in ipm (injections per minute)

TIME – measurement duration.

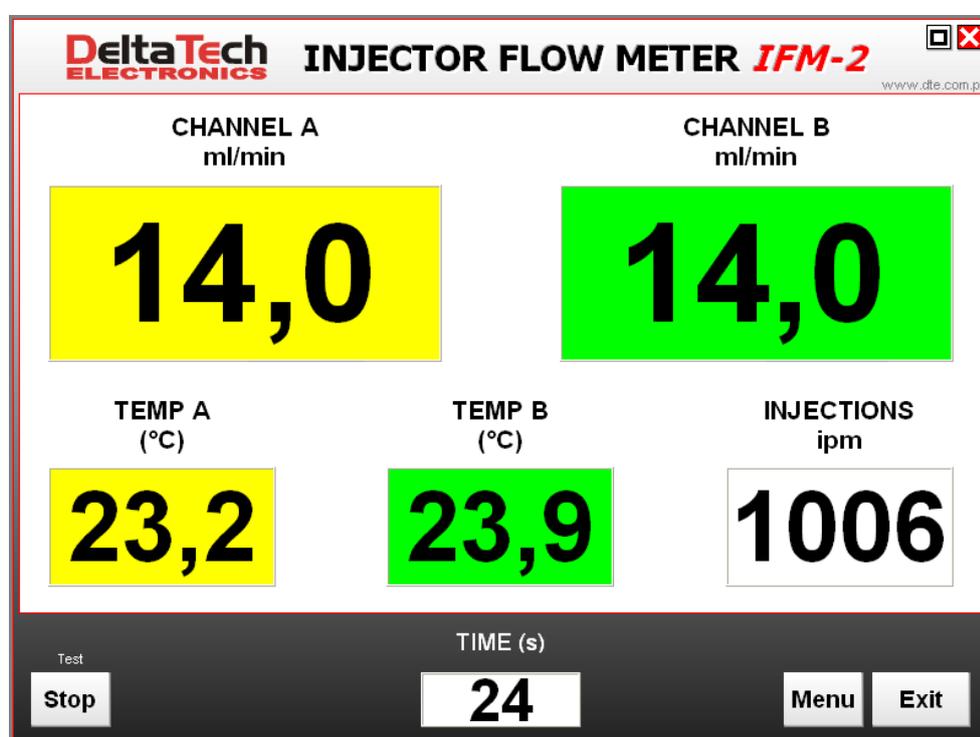
Menu list:

Injector test - measurements for 1 to 6 injectors, optionally using test database.

Graphic mode – displays main program window with flow graph.

Text mode – allows to display measured values in text mode.

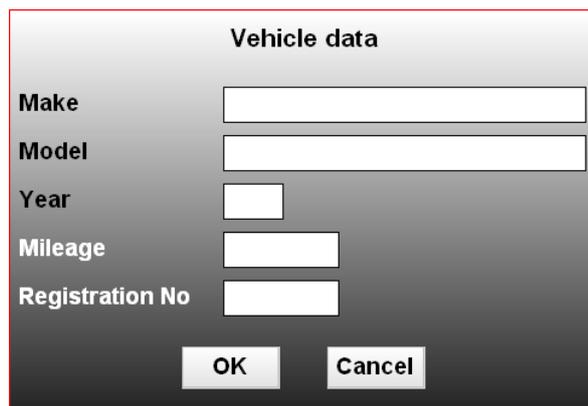
Text mode window:



Window size – switches between normal windows size or full screen.

Print – two menu items will appear:

- *To printer* – printing measurement data. Before sending data to printer the program will ask for optional vehicle data.
- *To file* – saves program window to a file (bitmap).



Vehicle data

Make

Model

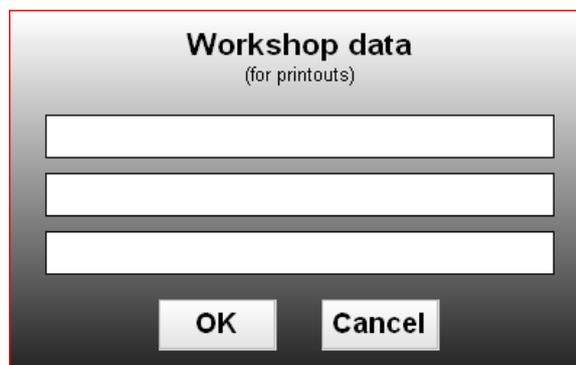
Year

Mileage

Registration No

OK Cancel

Workshop data – this option enables entering three lines of workshop information (i.e. name, address, phone no.) that will be placed on printouts.



Workshop data
(for printouts)

OK Cancel

Program settings – two items will appear

- *Language* – allows for selecting program language,
- *Unit* – changes displayed unit (in PC software).

Device settings – IFM-2 PC software is able to change IFM-2 hardware settings:

- *Device language* – default language of device.
- *Device unit* – selection of default unit that will be automatically set on power up.
- *Flow meter adjustment* – if necessary the user may make manual adjustment of the flow meter.

For settings to take effect the device should be restarted..

5.2.4 Injector test (diagnostic path)

When *Menu* → *Injector test* is selected the following window will appear:

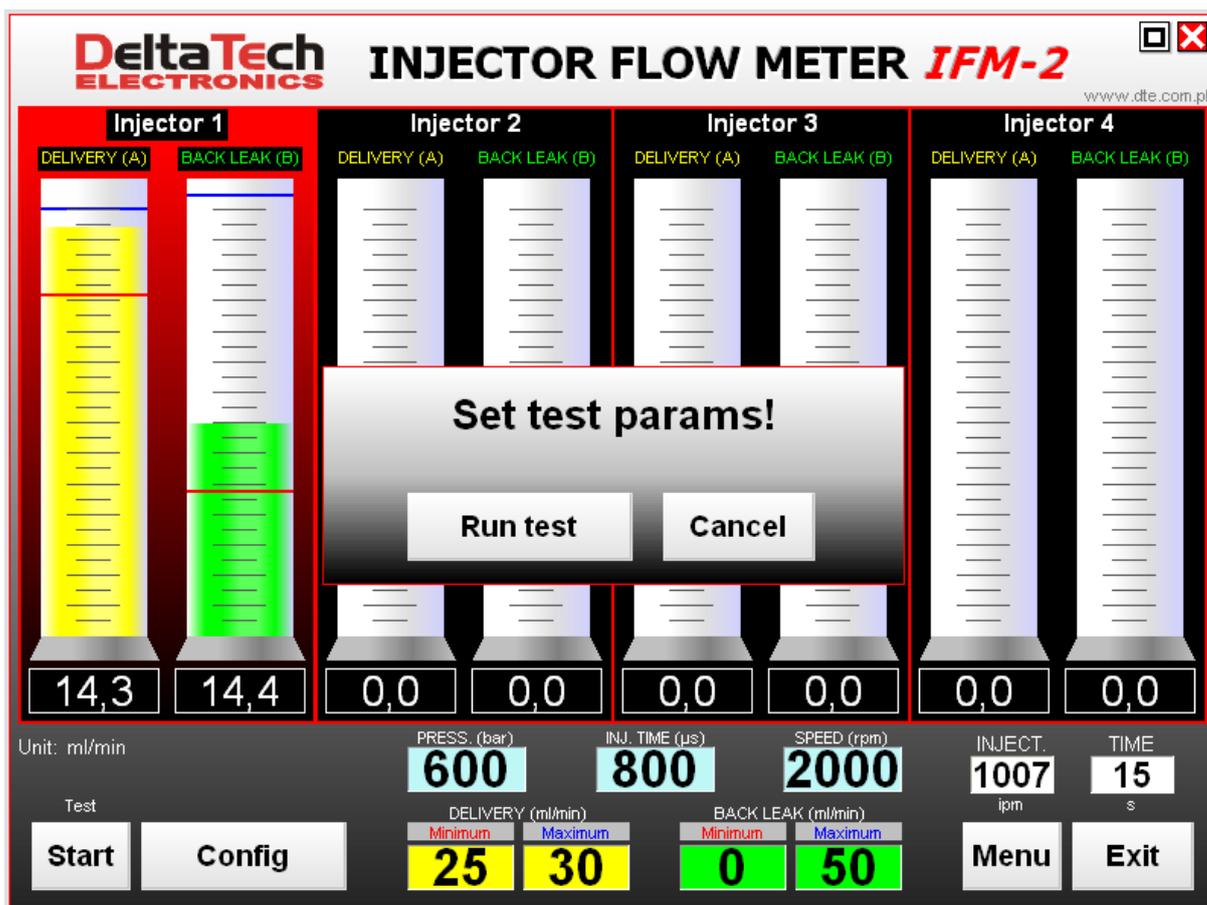
Select quantity and injectors type

Number of injectors	Type																									
<table style="width: 100%; text-align: center;"> <tr> <td style="width: 16.6%;">1</td> <td style="width: 16.6%;">2</td> <td style="width: 16.6%;">3</td> <td style="width: 16.6%;">4</td> <td style="width: 16.6%;">5</td> <td style="width: 16.6%;">6</td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td><input checked="" type="checkbox"/></td> <td><input checked="" type="checkbox"/></td> <td><input checked="" type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> </table>	1	2	3	4	5	6	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> delivery/back leak <input type="checkbox"/> delivery													
1	2	3	4	5	6																					
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>																					
Test type																										
<input type="checkbox"/> Diagnostic path <input checked="" type="checkbox"/> Own																										
Test parameters																										
<table style="width: 100%; text-align: center;"> <tr> <td style="width: 33.3%;">PRESSURE</td> <td style="width: 33.3%;">INJECT. TIME</td> <td style="width: 33.3%;">SPEED</td> </tr> <tr> <td><input type="text" value="0"/></td> <td><input type="text" value="0"/></td> <td><input type="text" value="0"/></td> </tr> <tr> <td>bar</td> <td>µs</td> <td>rpm</td> </tr> </table>	PRESSURE	INJECT. TIME	SPEED	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	bar	µs	rpm	<table style="width: 100%; text-align: center;"> <tr> <td colspan="2">Delivery</td> <td colspan="2">Back leak</td> </tr> <tr> <td style="background-color: #ffff00;">Minimum</td> <td style="background-color: #ffff00;">Maximum</td> <td style="background-color: #00ff00;">Minimum</td> <td style="background-color: #00ff00;">Maximum</td> </tr> <tr> <td><input type="text" value="0"/></td> <td><input type="text" value="0"/></td> <td><input type="text" value="0"/></td> <td><input type="text" value="0"/></td> </tr> <tr> <td>ml/min</td> <td>ml/min</td> <td>ml/min</td> <td>ml/min</td> </tr> </table>	Delivery		Back leak		Minimum	Maximum	Minimum	Maximum	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	ml/min	ml/min	ml/min	ml/min
PRESSURE	INJECT. TIME	SPEED																								
<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>																								
bar	µs	rpm																								
Delivery		Back leak																								
Minimum	Maximum	Minimum	Maximum																							
<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>																							
ml/min	ml/min	ml/min	ml/min																							
<input type="button" value="OK"/> <input type="button" value="Cancel"/>																										

This mode allows to perform a series of measurements for a set of injectors. The test may be performed according to a pre-defined test plan (*Diagnostic path*) or a single set of test data (*Custom*). The user can measure both injector output and back leak at the same time or alternatively two injector outputs at once when only fuel output is available.

A) Custom

After selecting *Custom* measurement please specify test conditions: *Pressure*, *Injection time*, *Speed* along with reference values for *Delivery* (Minimum and Maximum) and *Back leak* (Minimum and Maximum). All data entered will be visible on printouts. Click *OK*.



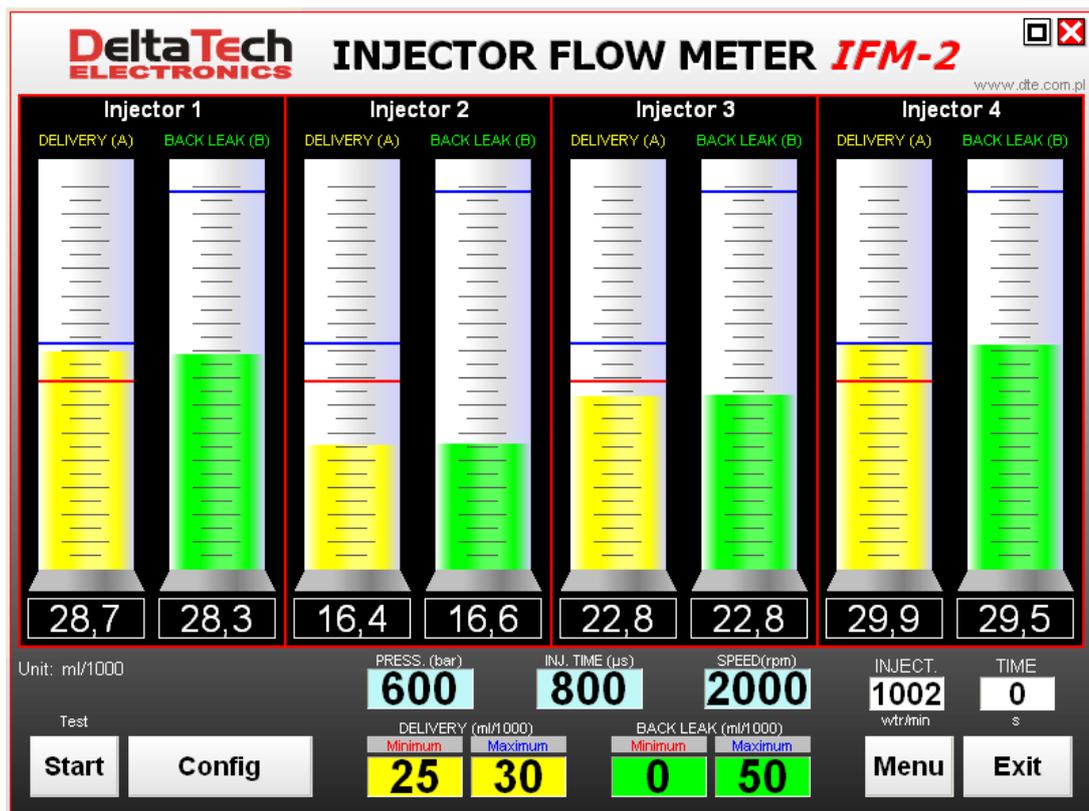
Click *Start* button to begin test procedure. Now first injector is highlighted. Connect first of tested injectors to device inputs and run injector tester with given parameters. Wait for flow rates to stabilize (a measuring cylinders with flash during preview). After pressing the start button, the device will perform 15 second measurement of flow rates.

When complete, the second injector is automatically selected. Then the user should stop injector tester, disconnect first injector from flow meter and connect second one.

Restart injector tester with the same parameters and wait for flow rates to stabilize. After that click *Run* to make measurements for second injector.

Repeat procedure for each of the tested injectors. This way, a set results for whole set of injectors and given test parameters can be obtained.

After completing all steps, the message *Test complete* will pop up. The results can be printed.



B) Diagnostic path

If *Diagnostic path* was selected the window will appear:

Diagnostic path

Select injector

Nr	Designation	Type	Manufacturer Id	Engine	Make
1	0445110190	CR/IPS16/ZEREA10S	DB 611 070 16 87	OM611-971	Bosch

Test plan for selected injector

Nr	Pressure (bar)	Injection time (µs)	Speed (rpm)	Delivery MIN (ml/1000)	Delivery MAX (ml/1000)	Back leak MIN (ml/1000)
1	250	700	400	13	14	
2	1350	900	1500	72	77	

Diagnostic path window consist of two parts: injector list and test plan list for selected injector. By clicking *New*, *Edit*, *Delete* the user may create new injector, edit existing injector parameters or remove injector from database.

Create new injector

Designation

Type

Manufacturer Id

Engine

Make

New, Edit and Delete buttons in lower part of the window refer to adding, modifying or removing test plan.

Create new test plan

injector 0445110190

Pressure (bar)	<input type="text" value="250"/>
Injection time (µs)	<input type="text" value="700"/>
Speed (rpm)	<input type="text" value="400"/>

reference

Delivery MIN (ml/1000)	<input type="text" value="13"/>
Delivery MAX (ml/1000)	<input type="text" value="14"/>
Back leak MIN (ml/1000)	<input type="text"/>
Back leak MAX (ml/1000)	<input type="text" value="30"/>

In *Diagnostic path* window select specific injector and test plan item and click **OK**. Then click Start to begin test procedure. Test procedure is the same as in Custom (see A) except that reference values are taken from test plan database.

8. Troubleshooting

<i>Problem</i>	<i>Suggested actions</i>
Device does not work. Display back-light and indicators are off.	<ul style="list-style-type: none"> - Make sure that power supply is connected properly. - Check power supply unit with a voltmeter – it should indicate 12V DC Voltage.
Device does not work. Back light is on, but no messages appear on the screen.	<ul style="list-style-type: none"> - Disconnect the device from power supply. - Check power supply unit with a voltmeter – it should indicate 12V DC Voltage. - Wait a while and try reconnect the device.
Device displays 'Internal error' and shows specific number.	<ul style="list-style-type: none"> - Write down number displayed. - Make sure that ambient and fuel temperatures are within limit. - Wait a while and try turning device on again. If the problem persists contact manufacturer. Include information about displayed number.
Readings are inaccurate. Problem intensifies with flow increase.	<ul style="list-style-type: none"> - Make sure that fuel is properly cooled before it enters flow meter (Use cooler even if oil temperature at the moment of measurement is below 40°C).
Readings are highly variable despite constant fuel delivery of injector.	<ul style="list-style-type: none"> - Probably an air enters measuring circuit. Make sure that no air can enter flow meter during the measurement and all connections are tight.

Indications on device LCD differs from the ones shown in PC software	- This is usually normal occurrence caused by independent way of result display – see section 5.4.1.
Measured injection rate is incorrect (or value is multiplied)	- Check connection of injection signal detector: it should be connected in parallel with the tested injector.
PC Software does not detect connected device	- Ensure proper driver installation (see section 5).
PC and device connection is unreliable – it is frequently disrupted during measurement	<ul style="list-style-type: none"> - Make sure that USB cable goes as far away as possible from drive elements such as FVD inverter, motor and power cables. - Connect flow meter housing to test bench ground using short cable with a tip to place under one of housing screws. - The test bench should be properly grounded, and the wires leading to AC motor should be as short as possible and properly shielded. - Check USB cable: in case of any problems, we recommend using possibly short cable of a good quality. The cable should be connected directly to the computer USB port. - If you use a laptop, check the behavior of the system without laptop AC power supply connected (battery operation).

Warning !!!

The device is covered by 24 month limited warranty. The warranty do not cover any damage caused by incorrect use.

DeltaTech Electronics company is liable up to the amount paid for the device and is not responsible for any damage and consequences of misuse.

In case of device failure please contact manufacturer. Do not try to modify or repair the device by yourself as this will void the warranty. If returning the product for warranty repairs please include purchasing document (or copy) and device accessories, such as power supply, cables, etc.

DeltaTech Electronics Company has do their most in order to write this manual properly, but can not guarantee that it does not contain any errors. During any workshop activities please always refer to vehicle service manuals, local regulations and laws, workplace and fire safety rules.