Unit Injector Expert 2

User Manual

UInEx-2

Please read carefully before using the device. Ignorance of this manual may result in damage to the device or components operated by it.

DeltaTech Electronics®

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Before first use

Due to big variety of test benches along with camboxes and cams available on the market, we do not guarantee full compatibility with every specific unit available. The user should make every effort to set the device properly, paying special attention to angles described in this manual as BOI.

For proper operation of the device it is required that cambox angle between RPM synchronization sensor signal and maximum stroke of cam is between 30 and 330 degrees!

Introduction.

UInEx-2 tester was designed with the idea of combining several devices into a single measuring instrument. The process of unit injector testing requires several measurements of different electrical and mechanical properties.

Measuring unit injector delivery requires proper control signals and mounting the unit on the test bench so that fuel quantities can be measured.

Unit injector coil resistance, due to very small values in range tenths of Ohm [Ω] demands high resolution of at least 0.01 Ω.

Another typical problem when working with piezo injectors is breakdown between terminals and injector housing. Measuring resistance in range of MΩ may get good results. But when high voltage is applied it can lead to some breakdown and such measurement with ordinary resistance meter or multimeter is no longer useful. To get reliable and valuable measurement it is required to perform these tests under real operating voltage.

When it comes to unit injectors one of most important parameter is Beginning of Injection Period (BIP). Measuring this value requires precise measurement of solenoid current when control signal is applied and result is given in microseconds (µs).

UInEx-2 meets the above requirements for unit injector measurements. In addition, it allows you to set current limit for electromagnetic unit injectors. The device has memory for up to eight values of BIP and current leakage results.

Safety instructions

This chapter contains important safety instructions that must be followed when handling and storing the InEx-2. Please read the following information before any operation to ensure your safety and keep your InEx-2 in the best possible condition.

General guidelines.

- Do not place heavy objects on the device.
- Avoid impacts or rough handling, which may damage the tester.
- Do not discharge static electricity and connected components through the device.
- Use only compatible connectors and probes, not bare wires.

Cleaning the device.

- Turn off the device, disconnect the cables and plugs (measuring, control and computer communication).
- Use a soft cloth moistened with a mild solution of detergent and water. Do not spray InEx-2 with liquid.
- Do not use chemicals or cleaning products containing aggressive agents such as benzene, toluene, xylene and acetone. In case of severe dirt, you can use isopropyl alcohol (Isopropanol "IPA").

Operating environment.

- Operating temperature 5 do 40°C
- Relative humidity during operation:
  1. for temperature <30°C: <80%RH (non-condensing)
  2. for temperatures in the range of 30 - 40°C: <70%RH (non-condensing)
- Storage temperature -20 to 60°C, humidity <90%RH (non-condensing)

UInEx-2 Specifications

Unit Injector Tester UInEx-2 enables the following measurements and tests.

1. ***Resistance measurement***

Range	Resolution	Accuracy
below 5Ω	0.001Ω (1mΩ)	2% + 3 counts
5Ω to 200Ω	0.1Ω	2% + 3 counts
10kΩ to 1700kΩ	1kΩ	3% + 5 counts

2. ***Capacity measurement***

Range	Resolution	Accuracy
0.4µF to 5µF	0.001µF (1nF)	3% + 3 counts
5 to 50 µF	0.1µF (100nF)	5% + 5 counts

3. ***BIP value and dynamic response measurement***

Type	BIP[µs]	IDR	Accuracy
unit injectors (UI/EUI)	530-1400	0-1999	2% + 2 counts

4. ***Leakage current measurement***

Range	Test voltage	Resistance [MΩ]	Accuracy
1-60µA	100V or 200V	25/50	5% + 5 counts

5. ***Unit injector control***

Type	Pulse duration [µs]	Injections per minute [inj./min]	Hold current [A]
electromagnetic unit injector (UI/EUI)	200-10000 (0.2 – 20 [°])	100-1500	4-14

Type	Pulse duration [µs]	Injections per minute [inj./min]	Charge voltage	Charge rate
piezoelectric unit injector (UI/EUI)	200-10000 (0.2 – 20 [º])	100-1500	4-14	1 - 10

6. Defining three custom unit injectors parameters

Electromagnetic:

Hold current [A]
4-14

Piezoelectric:

Charge voltage [V]	Charge rate
60 - 150	1 -10

7. Result memory

Measurements of BIP, resistance, capacitance and leakage current can be performed with results memory. The user may define number of injectors up to a maximum of 8.

Power supply:

UInEx-2 device is powered by 13V DC power supply with minimum current rating of 12A – included power supply has current rating of 14.2A.

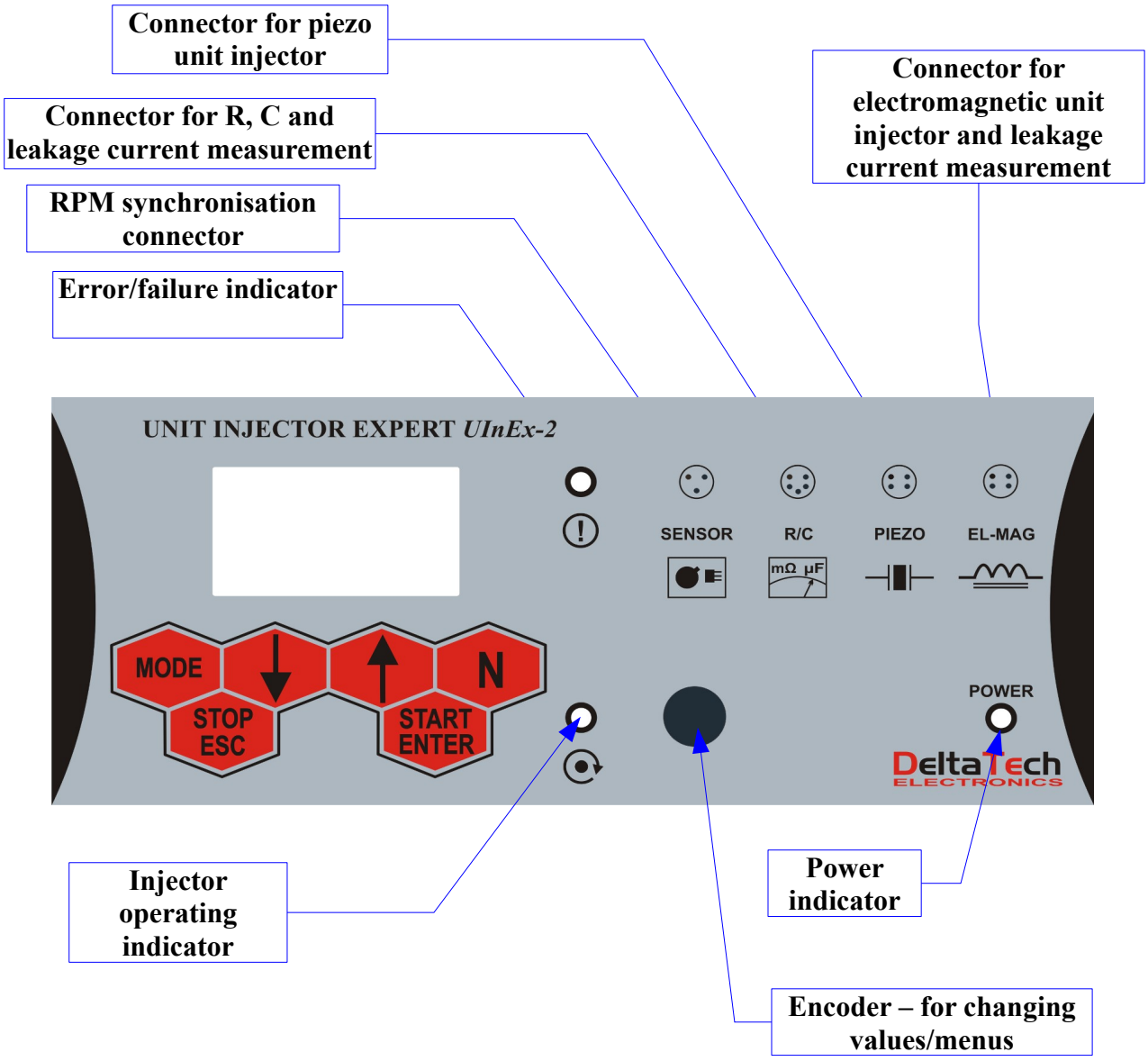
Current draw depends on performed test and can vary between 0.35 and 15.5A.

Kit content

UInEx-2 kit contain the following items:

1) UInEx-2 device,
2) Cable for resistance, capacitance and leakage current measurement – with yellow band,
3) Universal cable for unit injector – with blue band,
4) Power supply 13V, 14.2A,
5) User manual,
6) Spare fuse 6A – 2 pcs.
7) 3-pin connector for RPM sensor
8) Grounding connector (required in certain situations described at the end of manual)

Device interface



Menu navigation / function selection

Navigating the menus is done using encoder of arrow buttons: [▲] and [▼]. To select required function or enter submenu press [**START/ENTER**] button. To exit selected function or move up in menu level press the [**STOP/ESC**] button.

List of available menus and functions:

1. **Menu**
    1. **Test injectors**
        - *1.1.* **Unit injector**
            - ➔ **Electromagnetic**
                1. **Simple mode**
                2. **Automatic mode**
                3. **Advanced mode**
                4. **BOI electromagnetic.**
            - ➔ **Piezoelectric**
                1. **Simple mode**
                2. **Automatic mode**
                3. **BOI piezo**
        - *1.2.* **BIP time**
        - *1.3.* **BIP time+RPM**
        - *1.4.* **PC Control**
    2. **Measurement R/C**
        - *2.1.* **Meas. elec. - R**
        - *2.2.* **Meas. - R**
        - *2.3.* **Meas. - C**
        - *2.4.* **Leakage current**
    3. **Info**
        - *3.1.* **Statistics**
        - *3.2.* **Tester version**
    4. **Settings**

4.1. **Custom injector EL**

4.2. **Custom injector PZ**

4.3. **Language (Język)**

4.4. **Service**

Menu – Test injectors.

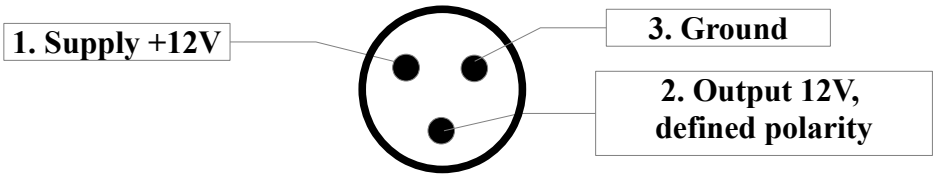
There are three tests available:

- **Unit injector**
- **BIP time** (without synchronization / off the test bench)
- **BIP time+RPM** (on the test bench)

Confirm selection by pressing [**START/ENTER**].

➢ *Unit injector → Electromagnetic – control electromagnetic unit injector.*

To control unit injector on the test bench there is RPM synchronization sensor needed. This sensor provides information on cambox position that enables driving unit injector in appropriate moment. Connect RPM sensor to 3-pin connector on the front panel of the device according to guidelines below:



RPM synchronization connector (as seen from the front).

The RPM sensor used must work with output voltage range 0 – 12V. We recommend using sensor with PNP Open Collector output (NO – Normally Open). The device can also work with sensor with NPN Open Collector output but it requires to connect additional 1k resistor between output and +12V (see Figure above).
The RPM sensor should have fast response frequency (switching frequency), minimum 1500 Hz.

The most commonly used set of wire colors is defined below:

1. brown (supply)
2. black (output)
3. blue (ground)

****

Terms used in the description:
gross time – total control signal duration
net time – injector opening duration (from the moment BIP time was measured)
net time = gross time – BIP

In all modes, control signal generation is indicated by the symbol in the lower right part of display:
■ - indicates disabled control (**STOP**)
► - indicates enabled control (**OPERATION**)
❚❚ - indicates temporarily disabled control (**PAUSE**)

WARNING: Changing of DURATION and NUMBER parameters is not taken into account in OPERATION or PAUSE state. The new settings take effect only when changing from STOP to OPERATION.

Unit injector control is possible in two modes::

- **Simple mode**
- **Automatic mode**

Simple mode

enables activation of unit injector after specified angle (from the moment RPM sensor detects reference position). The pulse time can be given in unit of time or angle.

Before starting the test the user may change type of unit injector and define the following parameters:

- **Duration**
- **Count**
- **BOI angle** (starting value are taken from BOI value stored in configuration)
- **N** (number of performed control cycles – reset only)

Use arrow buttons ([▲] and [▼]) to select required parameter (Duration, Number, BOI angle, N) and use encoder knob to adjust value selected.

➔ **Unit injector type**

Upper line of display indicates type of unit injector. There are seven predefined ones: **I.PUMP(E) 1** … **I.PUMP(E) 7**. Additionally the user can define three custom types (**UI(E)-DEF1**, **UI(E)-DEF2** and **UI(E)-DEF3**) that can configured in **MENU-> Settings-> Custom injector.** Use encoder knob to select type of unit injector. Confirm selection by [**START/ENTER**].

➔ **Duration**

This defines total pulse duration – gross time. This value can be adjusted in range: 200 –

10000 [µs]. By pressing [**N**] the user may change switch between step sizes of 100µs, 25µs and 10µs. Pressing [**MODE]** will switch do degrees and enables adjustments in range of 0,2 – 20[º] in steps of 1.00, 0.25, 0.1, 0.02, switched by pressing [**N**]. When the user defines pulse duration in angle units, real gross time depends on cambox speed.

➔ **Number**

This field shows two values: Number: ---% -----[n]. The first one shows the percentage of control cycles performed out of defined Number. The second shows actual number of cycles to be performed. Use encoder knob to select required number, by pressing **[N]** select step size of 100, 25 or 10 if required. When no value is selected '-----' the device controls unit injector in continuous mode, and this is default when selecting 'Simple mode'.

➔ **BOI angle**

Acceptable range is 10 – 350[º], initial value is taken from BOI1 parameter defined in device configuration in **Menu->Settings->Set BOI**. This value can be changed using encoder knob. If the value is different from the BOI1, there is indicator after ' º ' symbol showing greater (**!>**) or lower (**!<**). If the value is the same, an '**!=**' symbol appears.
This angle corresponds to cambox rotation from the moment of reference position sensor signal till the moment of unit injector control pulse.

The bottom line indicates two values. '**RPM:**' shows current cambox speed as detected by RPM synchronization sensor. The '**N**' shows number of control cycles performed. Use [**N**] to reset this value only if this field is highlighted.

To start injector test press [**START/ENTER**] – the device is in OPERATION mode. Single press of [**STOP/ESC**] makes device go into PAUSE, the second STOP. Pressing [**STOP/ESC**] again exits current menu.

Automatic mode

enables selecting type of unit injector and a set of parameters as in 'Simple mode':

- **Duration**
- **Number**

along with additional test parameter:

- **BIP T** (BIP time measured in RPM synchronized mode)

> **To be able to use 'Automatic mode' the user must first define two angles described as BOI** that correspond to maximum delivery of unit injector. This procedure is described in 'BOI angle setting' section.

Having these two angles specified, the device can automatically adjusts unit injector timing in optimal way. Duration adjusted is net time (if BIP was measured or specified) or gross time of **BIP T** is marked with '----' (BIP = 0 µs – default value after turning on the device).

BIP T stores value of measured BIP. To make BIP measurement, press the [**MODE**] while this field is highlighted. The device will display information as in BIP measurement mode – along

with current RPM and **T** line with BIP, IDR and ERROR. BIP measurement will start after pressing [**START/ENTER**]. Pulse duration gross time is about 3000 µs. Pressing [**STOP/ESC**] stops BIP measurement and reset this value to 0. To leave measurement mode (after the BIP was measured) press [**STOP/ESC**]. If BIP was not measured, the field indicates '----' and that means BIP = 0 µs. Stored result can be changed in range from 500 – 1700 [µs]. If the value was entered manually or it differs from real BIP measurement, additionally there is '!' indicator between 'BIP' and 'T'.

Advanced mode

enables to select unit injector type and define parameters as in simple mode:

- **Duration**
- **Number**
  and the additional parameters:
- **BIP T** (BIP measured with RPM synchronization)
- **BIP α** (parameter used by BOSCH test benches)

This mode is intended for users that want to use BOSCH test plans.

BIP time

Measurement of Beginning of Injection Period

This test is intended for unit injectors - **UI 12V** means 'Unit Injector – 12V. To change number of tested units press [**N**]. This also clears any results stored earlier (if any).

In this test there is a series of pulses for each measurement (without RPM synchronization). Results are displayed as shown below:

N	BIP-µs	IDR	ERR
1	-----	----	----

- ➔ **N** – number of tested injector (memory location)
- ➔ **BIP-µs** – **average beginning of injection** – the most important parameter shown in [µs]
- ➔ **IDR** – injector dynamic response – parameter correlated to injector coil inductance. This is dimensionless value intended for comparative assessment.
- ➔ **ERR** - parameter used to estimate BIP measurement credibility/correctness. It shows how the series of measurement differ from average. The whole bar corresponds to 2% variability. Indications of more than ¾ bar length **may indicate** mechanical problems of injector. The shorter bar, the more stable/reliable is the measurement. **WARNING**: Full bar length may appear when testing the injector for the first time as a result of setting it in motion.

To start measurement press **[START/ENTER]**. In the bottom of display there is a test status:

'**Injector N Measure**' means ongoing test while '**Injector N Complete**' states for completed test. N indicates current injector number. To scroll results (for more than 2 injectors) use arrow buttons ([▲] i [▼]).

BIP Time+RPM

Measurement of Beginning of Injection Period with RPM synchronization.

In this test there is a series of control pulses for each measurement (synchronized with RPM sensor). Result display and settings are the same as int **BIP Time** mode.
During BIP evaluation pulse time is about 3000µs. To be able to make measurements, it is needed to obtain two BOI angles as in **automatic mode**.

To start measurement press **[START/ENTER],** to stop use [**STOP/ESC**]. In the bottom of display there is a test status: '**Injector N Measure**' means ongoing test while '**Injector N Complete**' states for completed test. **N** indicates current injector number. To scroll results (for more than 2 injectors) use arrow buttons ([▲] i [▼]).

PC Control

This menu is for UInEx-2 connection with PC computer. It is automatically selected when establishing connection with the device using DeltaTech Electronics dedicated software. It is required to connect device to DTE-BUS network.

➢ *Unit injector → Piezoelectric – control piezoelectric unit injector*

For piezoelectric unit injector there are two modes available: simple and automatic.

Simple mode

This mode is mostly the same as when working with electromagnetic injectors. The difference is that different parameters are set when selecting unit injectors. Controlled injector should be connected to „**PIEZO**" output.

➔ **Unit injector type**

Upper line of display indicates type of unit injector. There are seven predefined ones: **I.PUMP(P) 1** … **I.PUMP(P) 7**. Additionally the user can define three custom types **UI(P)-DEF1** … **UI(P)-DEF1** that can configured in **MENU-> Settings-> Custom injector.** Use encoder knob to select type of unit injector. Confirm selection by [**START/ENTER**].

Automatic mode

This mode is mostly the same as when working with electromagnetic injectors. The difference is that different parameters are set when selecting unit injectors. Controlled injector

should be connected to „**PIEZO**” output.

In piezoelectric mode, BOI angles are treated as a separate pair of values. To set BOI angles perform procedure described in 'Setting BOI angles for electromagnetic and piezoelectric injectors'.

Menu – R/C Measurements (resistance and capacitance measurement mode).

By measuring resistance and capacitance of a set unit injectors both in car and dismounted from car the user can quickly evaluate state of coils and piezo stacks. By comparing results of resistance or piezo stack capacitance between individual injectors any abnormal value can indicate possibly faulty unit. When performing such measurements, make all measurements at the time when all injectors are in similar temperature. This comparative method is based on the assumption that it is unlikely that all 4 or more injectors have faulty coil or piezo stack.

Coil resistance is usually less that 1Ω. For passenger vehicles the value is usually 0,2 – 0,4Ω, for trucks about 0,5 – 0,6Ω. Piezo stack have capacitance of 2 – 10 µF, usually about 3 µF, while piezo stack resistance is usually between 150 – 1100 kΩ. Piezo stack resistance below 10k indicate possible failure.

➔ **Meas. elec. – R**

Resistance measurement for electromagnetic injectors. Measurement range is 0 to 200Ω. For values < 5Ω resolution is 0.001 Ω, for greater than 0.5Ω resolution is 0.1Ω.. Exceeding range is indicated by the appropriate message. [**N**] defines number of injectors to be tested. To start the test press [**START/ENTER**]. Scrolling results (for N > 2) can be done using arrow buttons [▲] and [▼].

➔ **Meas. – R**

Continuous resistance measurement. Two ranges are available:

- **0 – 200Ω**
- **10kΩ – 1700kΩ**

Measurement starts on entering this function. To change range press the [**N**] button. Exceeding range is indicated by the appropriate message:

1) **>200Ω**
2) **<10kΩ**
3) **>1700kΩ**

Range **0-200Ω** has two resolutions:

<5Ω	0,001Ω (1mΩ)
>5Ω	0,1Ω

Range **10kΩ -1700kΩ** has resolution of 0.1kΩ.

Due to result averaging, immediately after connecting to a circuit, extreme values can appear. After approximate 2 seconds there should be stable and accurate results displayed.

➔ **Meas. – C**

Continuous capacitance measurement. Range is from 0.4µF to 50µF. Values greater than 5 µF are displayed with 0.1 µF (100 nF) resolution, lower with 0.001 µF (1 nF).

➔ **Meas. – leakage**

This function measures leakage current between to terminals, for example between injector coil/piezo stack and injector housing. For this measurement the user should connect tested device to two UInEx 2 connectors: **EL-MAG** and **R/C.** using included cables. Connect red terminal of injector cable to tested element (typically one of injector terminals), black terminal should be left not connected. The second cable, connected to **R/C** connector has among others, black alligator clip. Other tips should remain unconnected. Connect this alligator clip to second terminal of tested element (typically injector housing). The measurement is performed with test voltage selected by user (100V or 200V).

Results are shown as below:

N	Leakage µA	MΩ	State
1	----	---	---

N – tested injector

[**N**] determines number of elements to be tested. Press [**START/ENTER**] button to begin measurement**.** Exceeding range is indicated by the appropriate message: **<1µA** or **>60µA [<1,5(2,7) MΩ** or **> 25 (50)MΩ]**. Values in brackets refer to 200V. Scrolling results (for N > 2) can be done using arrow buttons [▲] and [▼]..

'Stan' indicates result meaning, three indications are possible: OK, Bad and OK?. **OK** – means good value, **Bad** – out of specified range (leakage current too high), **OK?** indicates uncertainty (e.g. result is near OK/Bad threshold).

Resistance given in MΩ is estimated from current measurement and it is given for informational purposes only.

Exceeding resistance range [>25(50) MΩ] is correct value for piezo stacks. Values of leakage 1-20 µA will not indicate damage in most cases. Usually 30 µA leakage current indicates possible stack breakdown. Very useful is comparison between results from other units. Exceeding lower resistance limit (R<1,5 MΩ or leakage >60 µA) indicates poor insulation and possible breakdown.

During leakage measurements the tested injector should be disconnected from test bench ground. Practically, the injector should be placed on insulating material. When measurement is made while injector is mounted in the car, the readings may be unstable especially on low leakage (high resistance) indication.

WARNING: During measurement a voltage of 100V or 200V is applied between red terminal and black alligator clip. The maximum testing current is <1 mA. Current between black wire (or device ground) and red terminal can be as high as few Amps and voltage as set (for less than 0,5s).

Menu – Info

➔ **Statistics**

In this menu device statistics can be seen – number of power cycles.

➔ **Tester version**

This contains information on software and hardware versions along with serial number

Menu – Settings

➔ **Custom injector – EL**

This menu enables defining custom electromagnetic unit injector type that can be chosen in 'Test injectors' menu. Three types can be defined **UI(E)-DEF1, UI(E)-DEF2, UI(E)-DEF3**. Press [**N**] to change the number.

Current specifies unit injector holding current. Allowable values are 4.0A to 14.0A in steps of 0.5A.

WARNING: Exiting the custom injector menu by pressing [**STOP/ESC**] will not make changes to injector parameters. **To save parameters press** [**START/ENTER**].

➔ **Custom injector – PZ**

This menu enables defining custom piezoelectric unit injector type that can be chosen in 'Test injectors' menu. Three types can be defined **UI(P)-DEF1, UI(P)-DEF2, UI(P)-DEF3**. Press

[**N**] to change the number.

- Voltage defines charging voltage of piezo stack. Setting range is 60V to 150V in steps of 5V.
- **dV** refers to charge speed of piezo stack, setting range is 1 to 10, the greater the value, the higher charging rate.

WARNING: Exiting the custom injector menu by pressing [**STOP/ESC**] will not make changes to injector parameters. **To save parameters press** [**START/ENTER**].

➔ **Language (Język)**

This menu allows to change device language. To switch between available languages use arrow buttons [▲] and [▼] or encoder knob.

WARNING: Exiting the language menu by pressing [**STOP/ESC**] will change language only to the next startup. **To save language setting press** [**START/ENTER**].

➔ **Service**

Service menu for manufacturer use only.

BOI evaluation for electromagnetic and piezoelectric injectors

This menu enables evaluation and setting of two BOI angles that are characteristic for given cambox and specific cam. Allowable range is from 30 – 330[º]. To change value use encoder knob after highlighting this field. Adjustment steps can be switched between 5.0, 1.0 or 0.1 [º]. by pressing [**N**]
'**Sensor**' defines type of RPM sensor used: **PNP** corresponds to positive signal transition and it is indicated by arrow up symbol. **NPN** means negative transition is detected and it is indicated by an arrow pointing down. To save setting press [**MODE**].
When saving BOI angles determine BOI1 and BOI2 separately. BOI2 must be greater than BOI1. To switch between BOI1 and BOI2 use **[N]**.
[**START/ENTER**] enables control signal for unit injector connected to **EL-MAG** with parameters specified on the device screen. Press [**STOP/ESC**] to disable control signals. BOI adjustments can be make when injector control is active – there is no needed to stop and start control again.

BOI angles evaluation

After entering **Injector test → Unit injector** and selecting electromagnetic or piezoelectric type, at

the end of menu there is **BOI angle elect.** or **BOI angle piezo.** Evaluating BOI values is necessary for automatic mode of unit injector driving.

BOI angles evaluations should be performed at about 350 RPM and using fully functional unit injector.

BOI angles corresponds to a range of maximum unit injector delivery. These angles are constant for specific cambox and cam and are saved in device non-volatile memory. **When cambox or cam is replaced the user must perform BOI evaluation procedure again**.

BOI evaluation procedure

1. Make delivery measurement of good unit injector beginning from angle about 10 degrees less that angle between RPM sensor reference position and maximum cambox stroke.
2. Increase angle by 1 degrees and write down delivery results.
3. Deliveries should increase along with angle, than should remain almost constant for few degrees (maximum delivery range), and then it should gradually decrease.
4. Range of angles of maximum delivery defines BOI 1 and BOI 2.
5. BOI 1 defines low limit of maximum delivery range, BOI 2 upper limit of maximum delivery range.
6. Initial BOI1 value can be lower that given in 1. and it depends on cam profile and cambox design.
7. If the difference between BOI 2 and BOI 1 is less than 5 degrees, it is recommended to specify angles with resolution of 0,5 º or finer.

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.

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.

Appendix A – BIP reference table

Number	Heating up	Idling
0414720002	925	915
0414720003	925	915
0414720005	925	915
0414720007	925	915
0414720008	925	895
0414720009	925	900
0414720013	925	910
0414720014	925	895
0414720015	925	900
0414720016	925	900
0414720018	925	920
0414720028	925	910
0414720029	925	920
0414720030	925	900
0414720033	925	900
0414720034	925	900
0414720035	925	915
0414720036	925	895
0414720037	925	930
0414720038	925	920
0414720039	925	910
0414720201	980	950
0414720204	980	950
0414720206	980	980
0414720208	980	980
0414720209	980	950
0414720210	980	950
0414720213	980	980
0414720214	980	950

During heating up BIP tolerances 100µs, for idle speed 70µs. Cambox speed for heating up should be 1100 rpm (2 minutes), for idling 350 rpm (1.5 minute). BIP value measured without mechanical drive (out of test bench) is about 80 – 90µs less than BIP value for idling.

0414720215	980	980
0414720216	980	950
0414720217	980	950
0414720220	980	960
0414720221	980	965
0414720222	980	950
0414720223	980	980
0414720224	980	970
0414720225	1000	970
0414720226	980	985
0414720227	980	975
0414720228	1000	970
0414720229	980	985
0414720230	980	985
0414720231	980	950
0414720232	980	970
0414720301	970	900
0414720302	980	925
0414720303	980	925
0414720304	980	910
0414720305	970	900
0414720306	980	925
0414720307	980	925
0414720308	980	910
0414720309	980	910
0414720310	980	925
0414720311	970	900
0414720312	980	925
0414720313	980	925
0414720314	980	910

Troubleshooting

Symptom	Solutions/Suggestions
Tester skips cycles or triggers at wrong position at higher speeds when triggering from RPM sensor.	The sensor improperly installed. During bench operation, vibrations make RPM sensor indications unstable. *1.* Reduce the distance to the sensor face to minimum safe value. *2.* Check fastening of RPM sensor in cambox housing.
Unstable RPM detection across entire RPM range.	Excessive interference caused by nearby devices. *1.* Ensure good test bench grounding. *2.* Ground the housing of UInEx-2 to the bench ground (equalize potentials).
Irregular beep sound when triggering from RPM sensor.	See suggestions above
Different leakage indications for the same item	Mains interference is too high. Repeat measurements of the parts placed on non-conductive surface.
High error rate when measuring BIP	Possible bad connection at injector terminal.
Unstable resistance readings at the range of miliohms.	Because of the method of low resistance measurement do not modify or repair the cable intended for this measurement. In the case of worn terminals, the can be replaced with the similar but maintaining the same wire colors. Any extension of measurement cable will lead to possibly wrong results in 5Ω range as the extension cable resistance will be added to result.