Turbocharger actuator tester

VNTT-PRO

Version 4.13

User manual

Before using the device, read the operating instructions carefully. Improper use may result in damage to the device or components supported by it.

An updated version of this manual is available online:
https://dte.com.pl/download/manual/vnttpro/

DeltaTech® Electronics

Table of contents

1. Tester specifications

Supply voltage	15V DC
Current consumption	80 mA (without turbo controller)
Maximum current draw	up to 4A (fused)
Type of control / measurement	PWM, CAN, SENT, Voltage
Over-current indication threshold (ALARM)	depending on tested actuator (see section 9)

The tester is powered by the dedicated power supply attached to the electrical network. When supplying a tester from another source (e.g. power generator), remember to ground it!

2. Tester application

The VNTT-PRO device is intended for testing the operation of electronic turbocharger controllers.

With VNTT-PRO it is possible to perform the following tests:

- test of electronic controllers of turbochargers with wastegate
- test of electronic actuators of variable geometry turbochargers (VTG, VNT)
- test of dc motors from turbocharger actuators
- test of wastegate position sensors or variable geometry position sensors
- test of solenoid valves controlling turbocharging pressure, used in pneumatic systems
-

Using VNTT-PRO you can test turbo actuators from many manufacturers. A detailed list of supported actuators can be found on the product page:

https://dte.com.pl/en/p/vntt-pro-turbocharger-actuators-tester/

3. Connecting the device

Correct device test setup is shown in Figure 3.1.

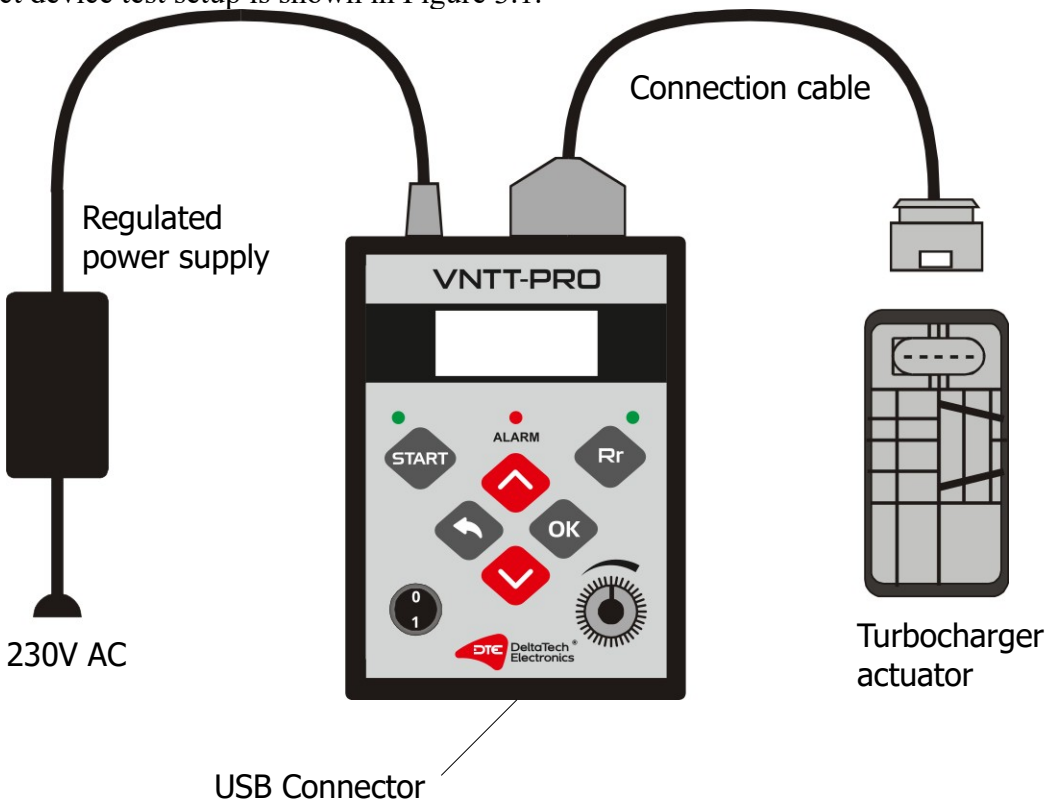


Figure 3.1

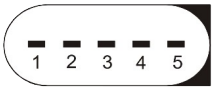
Connect the tester to included DC power supply. Turbo actuators are connected with the use of connection cable cable. There are several versions of this cable for different turbocharger types. Details are included later in this manual.

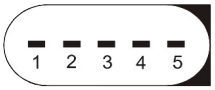
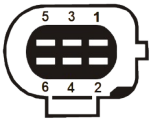
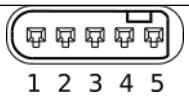
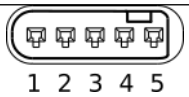
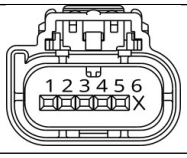
3.1 Connecting turbo actuator

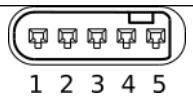
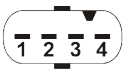
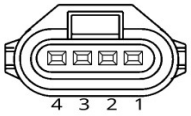
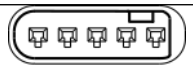
To connect turbo actuator to the VNTT-PRO device use **connection cable** (see Figure 3.1), which has different versions depending on the tested actuator or DC motor type (Table 3.1).

When connecting turbocharger actuator, pay particular attention to correct selection of **connection cable**. If the wrong cable is used, it may lead to damage to the actuator despite protection features incorporated in VNTT-PRO device.

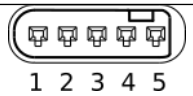
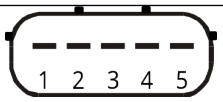
Table 3.1

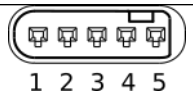
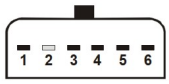
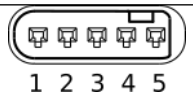
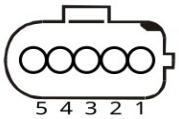
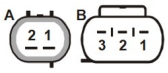
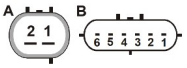
No	Actuator manufacturer	Turbine/actuator part number	Connector	**connection cable** marking	Wiring instructions
1	HELLA	6NW 008 091 6NW 008 412 6NW 009 228 6NW 009 420 6NW 009 543 6NW 009 660 6NW 010 099-01 6NW 010 099-03 6NW 010 099-04 6NW 010 099-10 6NW 010 099-16 6NW 010 099-21 6NW 010 099-24		**HE01** **(red/ blue)**	
2	HELLA	6NW 009 206 6NW 009 483 6NW 009 550 5900210-7104 5900911-9140 6NW 010 430-00 6NW 010 430-01 6NW 010 430-02 6NW 010 430-03 6NW 010 430-04 6NW 010 430-09 6NW 010 430-10 6NW 010 430-12 6NW 010 430-14 6NW 010 430-16 6NW 010 430-17 6NW 010 430-18		**HE02** **(red/ yellow)**	

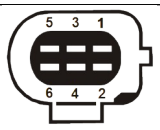
		6NW 010 430-19 6NW 010 430-22 6NW 010 430-25 6NW 010 430-26 6NW 010 430-27 6NW 010 430-28 6NW 010 430-29 6NW 010 430-30 6NW 010 430-35 6NW 010 430-38 6NW 010 430-39 6NW 010 430-42 6NW 010 430-43 6NW 010 430-71			
3	HELLA	6NW 010 099-02 6NW 010 099-05 6NW 010 099-07 6NW 010 099-08 6NW 010 099-17 6NW 010 099-18		**HE03** **(green)**	
4	HELLA	1000M-000168-087 6NW 011 132-02 6NW 011 132-04 6NW 011 132-05 6NW 012 619-22 6NW 012 619-24 6NW 011 132-34 6NW 011 132-36 6NW 015 105-06		**MA01** **(yellow/ green)**	
5	HELLA	6NW 011 132-90 6NW 010 430-64 6NW 011 934-00 6NW 011 934-02 6NW 011 934-03		**HE04** **(red/ white)**	
6	HELLA	1000M.000168-627 6NW 011 132-09 6NW 011 132-10 6NW 011 132-22 6NW 011 132-38 6NW 011 132-39 6NW 011 132-23 1000M-000168-044		**HE05** **(blue/white)**	
7	HELLA	6NW 011 132-51 6NW 011 132-99 6NW 934 803-02 6NW 934 803-05		**HE06**	

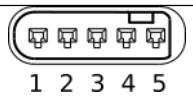
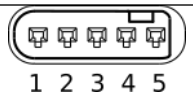
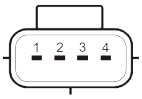
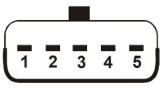
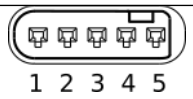
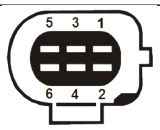
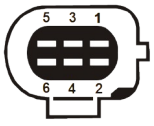
8	HELLA	6NW 010 430-36 6NW 010 430-45 6NW 010 430-46 6NW 010 430-47 6NW 010 430-60 6NW 010 430-68 6NW 012 619-20		**HE07**	
9	SIEMENS/ VDO/ CONTINENTAL (Mercedes, BMW)	-		**VD01** **(yellow)**	
10	SIEMENS/ VDO/ CONTINENTAL (VW/Audi)	-		**VD02** **(blue/** yellow)	
11	SIEMENS/ VDO/ CONTINENTAL Porsche	-		**VD03**	
12	MITSUBISHI	49135-056xx 49135-057xx 49135-058xx 49335-002xx 49335-004xx 49490-93501		**HE01** **(red/ blue)**	
13	MITSUBISHI	793486 2470360 2681209 7624535 7630462 7634486 7634487 7635804 7636784 7642469 8631700 8635804 8643129 9488206 1165 247 0360 1165 268 1209 1165 762 4535 1165 763 0462 1165 763 4486 1165 763 4487 1165 763 5804		**MT01** **(black)**	

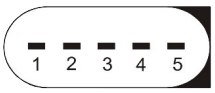
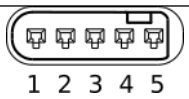
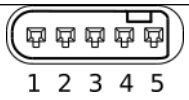
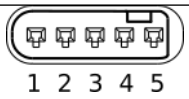
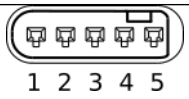
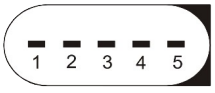
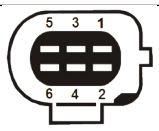
		1165 763 6784 1165 764 2469 1165 863 1700 1165 863 5804 1165 864 3129 1165 867 9021 1165 948 8206 1800 940 1722 1855 970 0024 1855 970 0030 1855 970 0041 1855 970 0043 49378-02070 49477-02010 49477-02011 49477-02012 49477-02013 49477-02020 49477-02021 49477-02022 49477-02023 49477-02024 49477-02025 49477-02026 49477-02027 49477-02028 49477-02029 49477-02030 49477-02031 49477-02032 49477-02060 49477-02061 49477-02062 49477-02063 49477-02070 49477-02071 49477-02072 49477-02104 49477-02105 49477-02106 49477-02107 49477-02108 49477-02109 49477-02120 49477-02121 49477-02122 49477-02124			

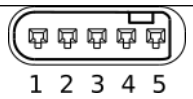
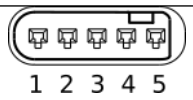
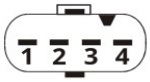
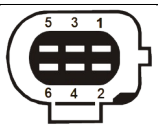
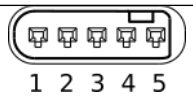
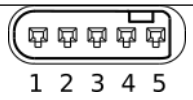
		49477-02125 49477-02126 832626-0004 832626-5004S 840069-0003 840069-0004 840069-0005 840069-0006 840069-0014 840069-0015 840069-5014S 840069-5015S 841901-0017 841902-0018			
14	MITSUBISHI	871207-0020 871207-5020S 901954-0004 0PB 145 701F 0PB 145 701G 0PB 145 702G 1855 970 0055 1855 970 0056 1855 970 0057 1855 970 0058 5304 970 0258 5304 970 0259 5304 970 0315 5304 970 0316 5304 970 0320 5304 970 0321 9V121 9V122		**MT02**	
15	MITSUBISHI Honda	1631 970 0008 1631 988 0008 18900-5AY-H012-M4 18900-5AYA-H000-W2 18900-5AYA-H022-M4 49373-07010 49373-07011 49373-07012 49373-07013 49373-07014 49373-07015 49373-07100 49373-07101		**MT03**	

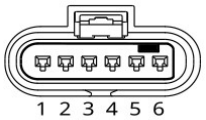
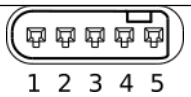
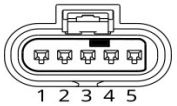
		49373-07102 49373-07103			
16	MITSUBISHI	144118020RA 144118020RD 858864-0004 858864-0008 858864-0009 858864-5004S 858864-5008S		**HE04**	
17	SONCEBOZ	5304 9xx 0065 5304 9xx 0069 5304 9xx 0073 5304 9xx 0115 5439 9xx 0061 5439 9xx 0062 5439 9xx 0063 5439 9xx 0064 5439 9xx 0110 5439 9xx 0111 5439 9xx 0112 5439 9xx 0113		**SN01** **(brown)**	
18	SONCEBOZ	1000 970 0111 1000 970 0150 1000 970 0162 1000 970 0178 1000 970 0218 1000 9xx 0331 1638 970 0015 1638 970 0021 1638 970 0022 1638 970 0041 1638 970 0071		**SN02**	
19	SONCEBOZ	1635 970 0009 1635 970 0013 1635 970 0020 1635 970 0035		**SN03**	
20	DENSO	780709-0003 780708-0002		**DE01** **(red/ black)**	
21	DENSO	17201-30100 17201-30101 17201-30110 17201-30160		**DE02** **(blue/ black)**	**[1]**

22	MAHLE	03F 145 701G 03F 145 701GV 03F 145 701GX 03F 145 701M 03F 145 701MV 03F 145 701MX 03F 145 701T 03F 145 701TV 03F 145 701TX 04E 145 713Q 04E 145 721B 04K 145 702N 06K 145 701N 06K 145 701T 06K 145 702E 06K 145 702J 06K 145 702K 06K 145 702M 06K 145 702N 06K 145 702Q 06K 145 702R 06K 145 702T 06K 145 722A 06K 145 722G 06K 145 722H 06K 145 722L 06K 145 722N 06K 145 722P 06K 145 722S 06K 145 722T 06K 145 874C 06K 145 874E 06K 145 874F 06K 145 874G 06K 145 874K 06K 145 874L 06K 145 874M 06K 145 874N 06K 145 874P 9V204 9VA04 9VA049 9VA05 IS20 05C 145 701 05C 145 704 1635 970 0047		**MA01** **(yellow/ green)**	

		1635 970 0066 1635 988 0047 1635 988 0066			
23	MAHLE	1640 970 0006		**MA02**	
24	MAHLE	40008693		**MA03**	
25	HITACHI	5304 970 0062 5304 988 0062		**HT01** **(yellow/ black(**	
26	CONTINENTAL	49477-01012, 49477-01104, 49477-01202, 49477-01203, 49477-01204		**CN01** **(brown/ black)**	
27	CONTINENTAL	1000 970 0210 1000 970 0268 1000 970 0284 1000 970 0324		**HE04** **(red/ white)**	
28	CONTINENTAL	06N 145 701D 874595-0011		**MA01** **(yellow/ green)**	
29	BORGWARNER	59001107055 59007117001		**VD02** **(blue/ yellow)**	
30	MAGNETI MARELLI	059 145 873DJ 059 145 873DL 059 145 873EG 059 145 873ER 059 145 873FE 059 145 873FQ 05E 145 701E 05L 253 019P 078087-0004 844437-0007 847009-0006 847009-5006S		**MA01** **(yellow/ green)**	

		881652-0001 896758-0001 896758-5001S			
31	MAGNETI MARELLI	838417-0002 838417-0003 838417-5002S 838417-5003S 850226-0004 850226-5004S 850840-0007 850840-5007S 856943-0006 SH18-13700-B		**HE02** **(red/ yellow)**	
32	MAGNETI MARELLI	46340583 860517-0002 860517-5002S 845780-0005		**HE04** **(red/ white)**	
33	MAGNETI MARELLI	845275-0001 845275-0002 845275-5001S 845275-5002S 845780-0003		**HE05** **(blue/ white)**	
34	MAGNETI MARELLI	835556-0139		**HE07**	
35	MAGNETI MARELLI	913630-0001		**MA02**	
36	MANDO	28235-2A600		**HE03** **(green)**	
37	KAMTEC	28231-04500 28231-2GTD0 50124-01022 839827-0001 839827-0003 839827-0005 839827-0007 839827-0008 839827-0009		**MA01** **(yellow/ green)**	
38	KAMTEC	828760		**VD02** **(blue/ yellow)**	

39	KAMTEC	9825982080 9836081180 860103-0005 870248-0002 870248-5002S 887157-0001		**HE04** **(red/ white)**	
40	KAMTEC	1637 970 0420		**BS01**	
41	KAMTEC	784111-0015		**KA01**	
42	COOPERSTANDARD	06L145614B		**MA01** **(yellow/ green)**	
43	BOSCH	50033989 1857 970 0001 K2GE-9G438-BC K2GE-9G438-BD		**HE05** **(blue/ white)**	
44	BOSCH	1638 970 0008 1638 970 0016 1638 970 0019 1638 970 0020 1638 970 0023 1800 940 1116 144106227R 144109240R 144109984R 1631 970 0017 1631 970 0018 1631 970 0052 1635 970 0025 1635 970 0099 1745 970 0002 1745 970 0006 1745 970 0007 1745 970 0009 1745 970 0010 1745 970 0011 1745 970 0013 1745 970 0015 1745 970 0017 1745 970 0018 1745 970 0019		**BS01**	

		1745 970 0020 1745 970 0026 1745 971 0026			
45	BOSCH	49F90-53920 49F90-53922		**BS02**	
46	FAIST	910058-0005		**MA02**	
47	GARRET	889551-0005		**GA01**	

[1] This actuator has two separate position sensors. connection cable for this actuator includes sensor selection switch. Testing should be done in two phases:

- phase 1 – actuator test with sensor 1 used (switch in position 0)
- phase 2 – actuator test with sensor 2 used (switch in position 1)

3.2 Connecting DC motor

To connect DC motor to VNTT-PRO tester use **connection cable DC01 (blue/green).** This cables have 5 wires but in this case only two are required. Each wire is ended with universal tip. Two tips should be connected directly to DC motor according to Table 3.2. The polarity of connection is not important as reversing polarity will only result in changing motor direction.

Table 3.2

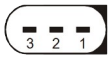
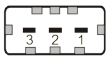
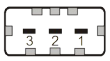
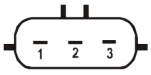
Terminal color	Description
red	motor power supply (DC+)
black	motor power supply (DC-)

3.3 Connecting variable geometry position sensor

To connect variable geometry position sensor to VNTT-PRO device use **connection cable** with appropriate marking according to the Table below.

When connecting variable geometry position sensor, pay special attention to correctness of terminal connections. Improper wiring may result in damage to the sensor.

Table 3.3

No	Make	Connector type	**connection cable** marking	Wiring instructions
1	VW/Audi		**SE01 (blue)**	
2	VW/Audi		**SE05 (green/black)**	
3	Opel, Alfa Romeo, Fiat		**SE02 (blue/brown)**	
4	Opel 1.6		**SE06 (red/brown)**	
5	Ford		**SE03 (green/brown)**	
6	Citroen, Peugeot, Opel, Ford 1.6 HDI		**SE07 (red/green)**	
7	Citroen, Peugeot		**SE04 (yellow/brown)**	
8	2.0 HDI		**SE08 (black/white)**	
9	(SENT)		**SE09**	

3.4. Connecting boost control solenoid valve

To connect valve to VNTT-PRO tester use **connection cable** with **DC01** (**blue/green)** marking. This cable has 5 terminals but only two are used. Each of terminals is ended with universal tip. Connect directly to valve terminals according to Table 3.4. Polarity does not matter.

Table 3.4

connection cable terminal color	Valve terminal
red	1
black	2

4. Tester operation

The device is operated with the panel shown in Figure 4.1.

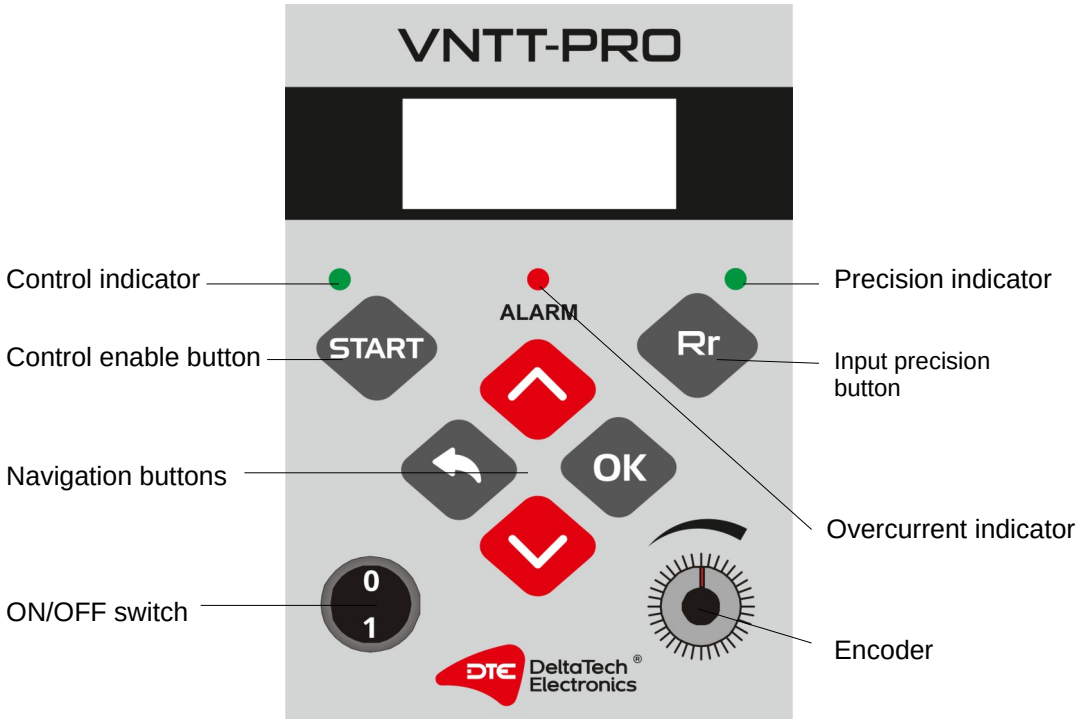


Figure 4.1

Display – provides information necessary to work with device along with tester status messages.

Control enabled indicator - it lights up when the selected task is performed

Control enable button – starts and stops selected task.

Navigation buttons – used to select and confirm desired action:

- **Right arrow** – confirm selection.
- **Left arrow** – return from menu.
- **Up/down arrow** – menu navigation, changing subsequent screens

ON/OFF switch – it turns device ON and OFF.

Input potentiometer - used to change the set values. Depending on selected accuracy, changing the position of the control knob may cause small or large increases in the controlled value. The accuracy of adjustment changes is determined using the button. The knob is also used to select a character when entering a device name. You can also navigate through the menus using the knob.

Input potentiometer – adjusts selected parameter. Depending on the input precision selected (coarse/fine) the changes are performed in big/small steps. To change input adjustment precision use the 

button.

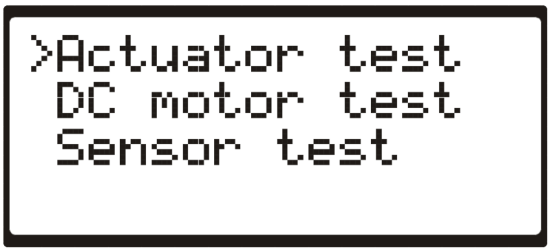
Overcurrent indicator – lights up when the load (turbo actuator or DC motor) current exceeds 2A. The warning signal sounds when this state is indicated.

Input precision button – (coarse/fine) toggles on and off precise parameter adjustment.

Precision indicator – lights up when precise (fine) adjustment is made.

After connecting the device to power source and switching it ON (see Fig. 4.1) the device starts with its splash screen.

After 3 seconds the device goes to test selection screen



To select required action use arrow buttons  . Current choice is indicated with the symbol on the left. The following items are available.

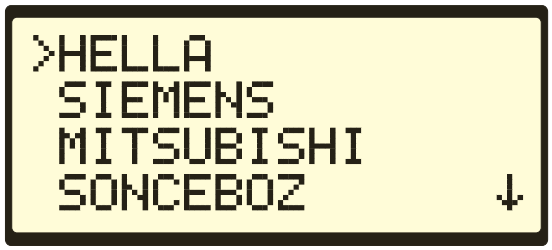
1. **Actuator test** – allows for performing a turbocharger actuator test.

2. **DC motor test** – runs DC motor test. These are used to move the variable geometry lever or to actuate wastegate valve.
3. **Sensor test** – enables to test variable geometry or wastegate position sensor. Wastegate position sensors are found in turbines that use pneumatic valve to control boost pressure.
4. **Valve test** – allow for diagnosing boost control solenoid valve that is used in pneumatic systems.

To confirm selection use the right arrow button .

4.1 Actuator test

After selecting actuator test the device will display a list of supported actuator manufacturers.



Use buttons  to navigate to required item pointed by the symbol .
Use right arrow button to confirm the selection.
Use the left arrow button to return to test selection screen.

After selecting a manufacturer, a list of supported part numbers may appear on device display. As the number of supported actuators cannot be displayed at once, several selection screens are available. Arrow symbols indicate that the next/previous screen is available.

symbol ↑ – means that the previous screen is available. To go to the previous screen move the pointer > to the first line and press the button  . No up arrow symbol visible means that the beginning of the list has been reached.

symbol ↓ – means that the next screen is available. To go to the next screen move the pointer > to bottom of the screen and press the button  . No down arrow symbol visible means that the end of the list has been reached.

Use buttons  to move the pointer  to required actuator number and confirm selection by pressing the button  . Then, the following menu should appear.

To select desired action move the pointer  to required action and confirm selection by pressing the button  .

Pressing the left button  makes the tester go back to the manufacturer selection menu.

4.2 DC motor test

If DC motor test is selected the VNTT-PRO will display test parameters.

This test description can be found in 'Tester functions' part of this manual.

Use left arrow button  to return to test selection screen.

4.3 Variable geometry position sensor test

After selecting position sensor test, the device will display position sensor output (feedback signal) value.

Detailed description of this test is available in 'Tester functions' part of this manual

Use left arrow button  to return to test selection screen.

4.4. Boost control valve solenoid test

If DC valve test is selected the VNTT-PRO will display test parameters.

Detailed description of this test is available in section 5 of this manual.

Use left arrow button  to return to test selection screen.

5. Tester functions

VNTT-PRO tester has four main functions. Two of them: *Control* and *Range test* apply to whole turbo actuator unit. The other: *DC motor test, Sensor test* and *Valve test* apply only to the DC motor, geometry position sensor or solenoid boost control valve respectively.

5.1 *Control* function

This function applies to turbo actuator and enables to:

- set variable geometry lever to any position from available range of movement and to hold in this position for a testing time;
- determine the cause of mechanical failure inducing partial or total lack of VTG lever movement (jammed lever, damaged gear, etc.);
- measure actuator current consumption during manual change of lever position;
- measure actuator internal temperature (available only for certain Hella actuators).

When this function is active the device displays the following parameters.

Pos - position setpoint, changed by user. This is VTG lever position expressed as a percentage of the full range of lever movement. The user may change this value using input potentiometer. Acceptable values depend on actuator selected. Input precision can be set to 1.0[%] or 0.1[%].

Ret - position feedback, value returned by actuator. It specifies current position of the VTG lever expressed as a percentage of the full range of lever movement. If a "---" is displayed instead of numerical value, this indicates that the actuator does not provide lever position measurement.

I - momentary value of current draw by the actuator.

Imax - maximum value of current draw by the actuator during the test (since enabling control)

Temp - actuator unit internal temperature expressed in degrees Celsius. Value read from internal temperature sensor. This is only available in Hella actuators found in Ford 1.8 and 2.0 TDCI 130hp. If the data shows '---' that means the actuator does not provide information on internal temperature.

To enable lever control press the start button 

. Enabled control is signaled by an indicator. (see Fig. 4.1).
Use input potentiometer to change required lever position. Changes can be made in steps of 1.0[%] or, after pressing the input precision button 

, in steps of 0.1[%] which gives a more accurate lever movement. Current input precision is indicated by an indicator (see Fig. 4.1). The indicator lights up when adjustment is performed in steps of 0.1[%].

All parameters are displayed on the two screens. Arrow symbols on the right indicate availability of another screen:

– means that after pressing the button  the device will display first screen showing **Pos**, ***Ret, I, Imax;***

– means that after pressing the button  the device will display second screen showing ***Temp***.

An important parameter for actuator diagnosis is unit current consumption during the test. Acceptable values are given in Table 5.1. Values outside given range may indicate a mechanical failure (excessive gear friction, etc.) or electric failure most often associated with the DC motor (worn out brushes, faulty commutator, etc.).

Table 5.1

Actuator manufacturer	**Cable**	**Acceptable current *Imax***
HELLA	HE01 (red/blue) HE03 (green)	< 0.5 A
HELLA	HE02 (red/yellow) MA01 (yellow/green) HE04 (red/white) HE05 (blue/white) HE06 HE07	< 0.25 A
SIEMENS/VDO/ CONTINENTAL	-	< 0.7 A
MITSUBISHI	-	< 0.25 A
GARRET	-	< 0.3 A
SONCEBOZ	-	< 0.25 A
DENSO	-	< 1.2 A
MAHLE	-	< 1.2 A
HITACHI	-	< 1.5 A
CONTINENTAL	CN01 (brown/black)	< 1.2 A
CONTINENTAL	HE04 (red/white)	< 0.3 A
BORGWARNER	-	< 0.7 A
MAGNETI MARELLI	-	< 0.3 A
MANDO	-	< 0.7 A
KAMTEC	MA01 (yellow/green) HE04 (red/white)	< 0.3 A
KAMTEC	VD02 (blue/yellow)	< 0.7 A

COOPERSTANDARD	-	< 0.5 A
BOSCH	-	< 0.3 A
FAIST	-	< 0.4 A

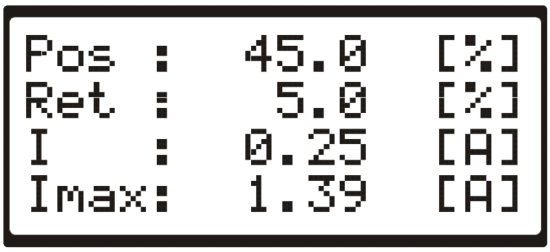
The values in Table 5.1 were based on number of tests conducted by DeltaTech Electronics, however, these are only illustrative values that may be useful in diagnosis and repair of turbo actuators.

5.2 *Range of movement* test

This function applies to turbo actuator and and enables to:

- check lever movement uniformity,
- detect irregularities in positioning caused by mechanical wear,
- measure current drawn by actuator during the test.
- moving back and forth between extreme positions.

To perform this test press the START button. When the control is enabled, the control indicator lights up (see Fig. 4.1).



If this function is selected the VNTT-PRO will display the following parameters:

Pos - position setpoint, changed automatically by the user. Exact values depend on actuaator selected.

Ret - position feedback, value returned by actuator position sensor. It shows position of the VTG lever expressed as a percentage of the full range of movement. If a "---" is displayed instead of numerical value, this indicates that the actuator does not provide lever position measurement.

I - momentary value of current drawn by the actuator.

Imax - maximum value of current drawn by the actuator during the test (since enabling control)

Temp - actuator unit internal temperature expressed in degrees Celsius. Value read from internal temperature sensor. This is only available in Hella actuators found in Ford 1.8 and 2.0 TDCI 130hp. If the data shows '---' that means the actuator does not provide information on internal temperature.

All parameters are displayed on the two screens. Arrow symbols on the right indicate availability of another screen:

† – means that after pressing the button  the device will display first screen showing **Pos**, ***Ret, I, Imax;***

↓ – means that after pressing the button  the device will display second screen showing ***Temp***.

During the test it is possible to change lever speed. To change between preset values use the 

button. Current speed is indicated by input precision indicator (see Fig. 4.1). When this indicator is off, maximum speed is selected.
Changing actuator speed is possible when testing the following actuators:

- HELLA: 6NW008091, 6NW008412, 6NW009228, 6NW009420, 6NW009543, 6NW009660, 6NW010099-xx
- SIEMENS
- MITSUBISHI: 49335-002xx, 49335-004xx, 49135-056xx, 49135-057xx, 49135-058xx, 49490-93501
- HITACHI: 5304 9xx 0062, 5304 9xx 0066

As in the case of *Control* function, an important parameter in this test is actuator current consumption during the test. Acceptable values are given in Table 5.2. Values outside given range may indicate a mechanical failure (excessive gear friction, etc.) or electric failure most often associated with the DC motor (worn out brushes, faulty commutator, etc.).

Table 5.2

Actuator manufacturer	**Cable**	**Acceptable current draw Imax**
HELLA	HE01 (red/blue) HE03 (green)	< 1.6 A
HELLA	HE02 (red/yellow) MA01 (yellow/green) HE04 (red/white) HE05 (blue/white) HE06 HE07	< 0.25 A
SIEMENS/VDO/ CONTINENTAL	-	< 1.6 A
MITSUBISHI	-	< 0.4 A
GARRET	-	< 0.5 A
SONCEBOZ	-	< 0.25 A

DENSO	-	< 0.8 A
MAHLE	-	< 1.5 A
HITACHI	-	< 2 A
CONTINENTAL	CN01 (brown/black)	< 1 A
CONTINENTAL	HE04 (red/white)	< 0.3 A
BORGWARNER	-	< 1.6 A
MAGNETI MARELLI	-	< 0.3 A
MANDO	-	< 1.6 A
KAMTEC	MA01 (yellow/green) HE04 (red/white)	< 0.3 A
KAMTEC	VD02 (blue/yellow)	< 1.6 A
COOPERSTANDARD	-	< 0.8 A
BOSCH	-	< 0.3 A
FAIST	-	< 0.4 A

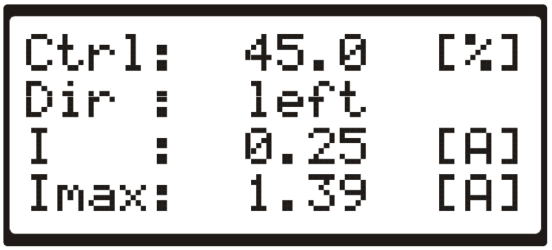
The values in Table 5.2 were based on number of tests conducted by DeltaTech Electronics, however, these are only illustrative values that may be useful in diagnosis and repair of turbo actuators.

5.3 Checking compatible cables

To check which cable is intended for the selected controller, select *Cable* from the menu available after selecting the actuator.

5.3 *DC motor test* function

This test enables the user to test DC motor used in turbo actuators. During the test it is possible to change motor current and direction.



During the test the following parameters are displayed:

Ctrl - DC motor control value as a percentage [%]. Use input potentiometer to adjust this value in range 0.0[%]...100.0[%]. Adjustment can be made in steps of 1.0[%] or 0.1[%].

Dir - contractual motor direction. Use arrow buttons  to reverse the direction.

I - momentary motor current draw

Imax - maximum value of current draw by DC motor during the test (since enabling control).

To enable motor control signal press the button  . Active control is signaled by an indicator light (see Fig. 4.1).

One of the most common turbo actuator malfunctions is the failure of electric motor. This problem is difficult to diagnose because the actuator performs well during the testing, moving the VTG lever along whole range of movement. The same unit placed in car often causes the 'check engine' indicator to light up and the turbine to be disabled.

To detect this type of fault during the testing procedures, the user should pay attention to actuator current draw. In case of malfunction this value can exceed normal operating value by several times (see section 5.1 and 5.2).

After diagnosing the DC motor failure, it should be removed from the actuator unit and tested using *DC motor test* function. Two parameters should be evaluated:

- current draw at maximum control value
- control value at which the motor starts to rotate

To determine current draw at maximum control value:

1. Use  button to disable motor control (if it is enabled)
2. Set control value to 0.0[%] using input potentiometer.
3. Press  to enable motor control.
4. Increase control value to 100.0[%] by turning the input potentiometer.
5. Read ***Imax*** parameter and compare it with the range given in Table 9.3.

To get minimum control value at which the motor begins to rotate:

- Press  to disable motor control (if it is enabled).
- Set control value to 0.0[%] using input potentiometer.
- Press  to enable motor control.
- Using input potentiometer slowly increases control value until the motor starts to rotate steadily.

- Read ***Ctrl*** value and compare it with the range given in Table 7.3.

If the measured values exceed the values in Table 5.3 it indicates DC motor failure. I.

Table 5.3

Current draw at maximum control value 100 [%]	***Imax*** < 0.30 [A]
The minimum control value at which motor starts to rotate	***Ctrl*** < 18 [%]

The values in Table 5.3 were based on number of tests conducted by DeltaTech Electronics, however, these are only illustrative values that may be useful in diagnosis and repair of turbo actuators.

5.4 *Position sensor* test

This test enables checking voltage output of variable geometry position sensor. Tested position sensor should be connected according to section 3 of this manual.

When using this mode the following parameters are displayed on the screen:

Pos - position sensor output value

Checking position sensor consists of changing geometry lever position and observing sensor output (feedback signal).

Manufacturers of pneumatic actuators recommend using pressure/vacuum generating devices to change lever position. It is not recommended to change lever position by applying external force as this may cause damage to actuator.

Output signal should change evenly with uniform lever movement. The maximum and minimum value observed depends essentially on the sensor type and actuator design.

Achieving minimum or maximum value during lever movement as well as extended range of minimum or maximum value indicates sensor failure.

5.5 *Valve test* function

This test can be used to diagnose boost control valve (solenoid) used in pneumatic systems. This valve is used to control pneumatic actuator moving variable geometry or opening exhaust vent.

If this function is selected the VNTT-PRO will display the following parameters:

Ctrl - Valve control expressed as a percentage of maximum [%]. Adjustment can be made using input potentiometer in range of 0.0[%]...100.0[%]. Adjustment resolution is i 1.0[%] or 0.1[%].

Mode - specifies mode of operation. Two values are possible:
'ctrl' – means manual control, the valve control is continuous and defined by control value ***Ctrl***.
'test' – means cyclic switching on and off control value defined in ***Ctrl*** every 1.5 seconds.

To change mode of operation use up and down buttons  .

I - momentary value of valve current draw

Imax - maximum value of valve current during the test (from enabling control signal).

In '***ctrl'*** operating mode it is possible to set control valve in any position. With the manometer and the source of pressure/vacuum (e.g. hand pump) the user may test valve permeability and operation.

When using '***test'*** mode, the device turns control signal (defined by ***Ctrl***) on and off periodically.

To test boost control valve perform the following steps:

- Use input potentiometer to set ***Ctrl*** to 100%
- Use up button  to change operating mode to 'test'.
- Press Start  to enable valve control.
- During the test clicking sound of the valve should be heard.
- Wait a few seconds and read the *Imax* value.

Measured *Imax* current should not exceed value given in Table 5.5.

Table 5.5

Current at control value 100 [%]	**Imax** < 0.90 [A]

6. Device protection

VNTT-PRO tester incorporates several protection features:

- During test procedures the current is monitored. If the current exceeded the limit (individual for each actuator manufacturer) the *ALARM* indicator will light up and

the warning sound is emitted. If the overcurrent situation persists for more than 5 seconds ,the tester automatically disables control signal (control indicator will go out) preventing damage to the tester or to the tested actuator.

- 4A fuse.
- Supply overvoltage protection (maximum supply voltage is 15V DC).

Turbo actuators also incorporate their own protection mechanisms to avoid damage due to electrical or mechanical failure. Similar to VNTT-PRO the actuators continuously monitor current draw. When the current exceeds manufacturer limit, the actuator disables control signal and after a short while makes a try to reach given position. If actuator fails to respond, the control signal is shut off.
If this situation happens during testing with VNTT-PRO the actuator will fail to respond to control signals. To regain control of actuator perform steps described in Table 6.1.

Table 6.1

Actuator	Re-enabling control procedure
Hella	No special actions are required.
Siemens	Use START button to disable the control and then use it again to re-enable the actuator.
Mitsubishi	Use START button to disable the control, switch to function selection using the button  . Finally select required function and enable the control.
Sonceboz	No special actions are required.
Denso	No special actions are required.
Mahle	No special actions are required.
Hitachi	No special actions are required.

7. Tester display messages

The table below lists display messages with their detailed description.

Message	Description
CAN bus error	This means internal tester error. Contact with the tester manufacturer.
Position sensor, no signal	The tester does not receive the lever position signal. This may be caused either by actuator malfunction or by using wrong **TC** connection cable (see section 5.1).
Lever blocked	The tester has detected no lever movement despite applying alternate control values. This may indicate mechanical lock of the VTG lever.
Incorrect actuator type	The tester detected different turbo actuator from selected one. Please check part number of connected actuator.
Not recognized actuator type	Type of actuator was not recognized. This applies to HELLA (except 6NW009206, 6NW009483, 6NW009483, 6NW010430-01, 6NW010430-03, 6NW010430-04) and SIEMENS units. The cause

	may be damage, mechanical failure of the actuator or wrong connection.
Position sensor, incorrect signal	The device does not receive a valid lever position signal. This may be caused by actuator failure or by using wrong **TC** connection cable (see section 5.1).
Reading lever position, please wait…	The tester reads VTG lever position on the basis of received signal.
Checking control type, please wait...	The device determines type of control for specific actuator. This applies to HELLA actuators

8. Tester update.

VNTT-PRO allows for remote firmware update. Simply connect the device to PC computer using USB cable provided and run software update. The computer must have Internet access. Update software can downloaded here:

https://dte.com.pl/download/software/updater/

Software update procedure consist of two stages:
Stage 1. USB driver installation (performed only during first update).
Stage 2. Verification and device programming using Updater tool.

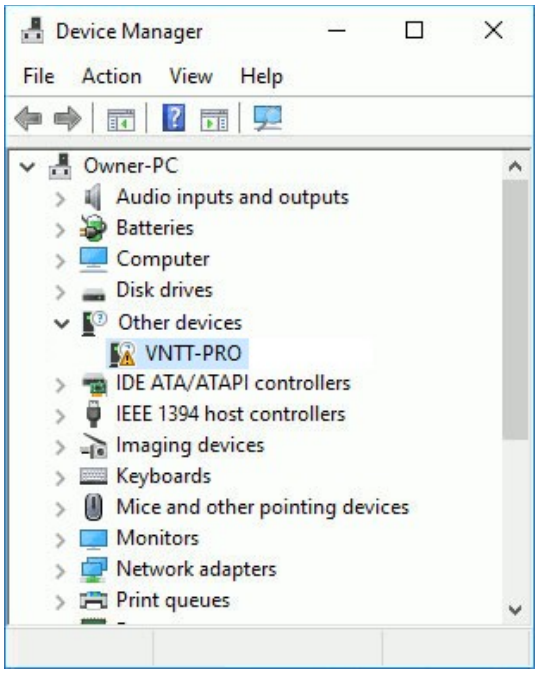
8.1 Driver installation (Windows 8/10/11)

To install driver properly in Windows 8/10/11, it is necessary to start the computer in special mode (64-bit versions).
Perform the following steps:

1. Display power options:
   - Windows 8/8.1: Move cursor over the top or bottom right corer of the screen and the Charm Bar will appear. Click *Settings* (gear icon) and then click *Power*.
   - Windows 10/11: 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.

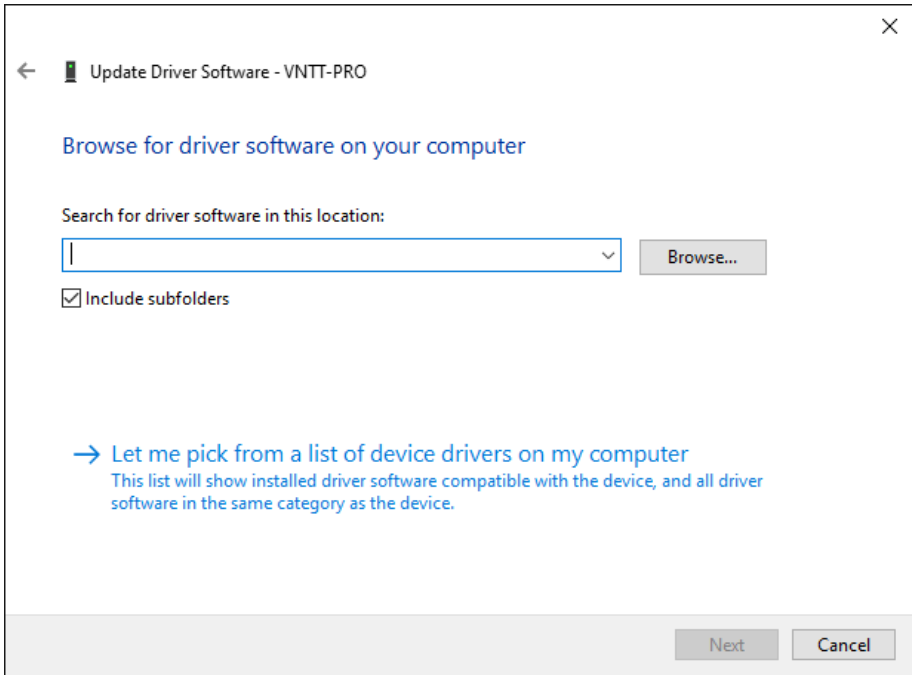
After performing all the steps connect the device to the computer using included USB cable.

Run *Device manager.* The fastest way to do this is to press *WinKey + X* on the keyboard and select *Device manager*. Alternatively, you can search for Device Manager in start menu.



Right-click on the *VNTT-PRO* item and then select the *Update driver* option.

Select the second option displayed - *Browse my computer for driver software*.



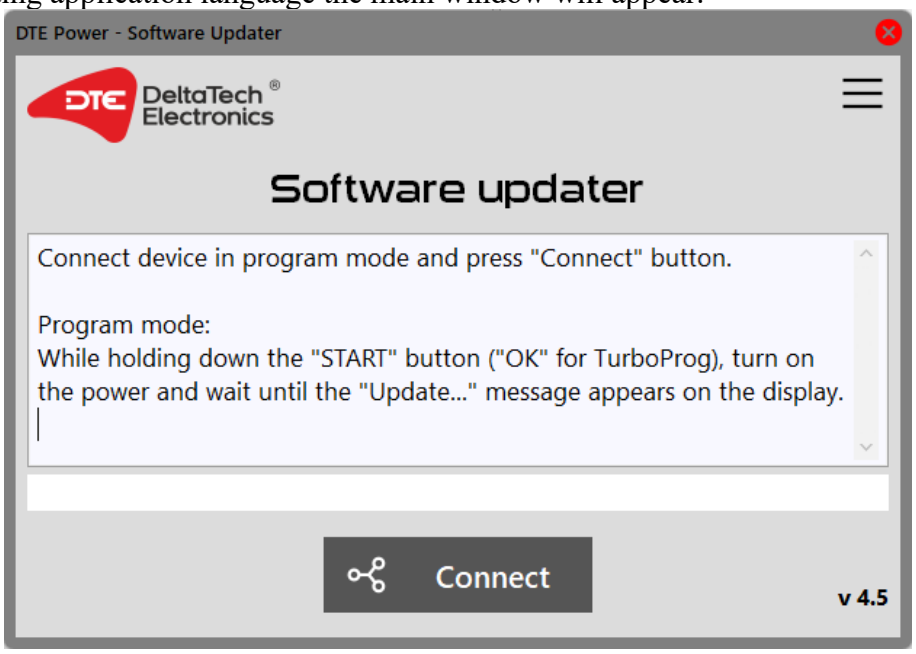
Click *Browse* and then select the folder where the drivers are located - this will be the folder with the content of the downloaded software to be updated. Confirm by clicking Next.

In the next step, Windows will display a warning that the driver vendor cannot be verified. To install the driver, click Install driver software anyway. After a while, the installation should be completed.

8.2 Software updater

This application is intended to update firmware of DeltaTech Electronics tester devices.
To perform firmware upgrade connect device to USB port and use update tool to update device.
During first run of *Updater* the language selection prompt will display.

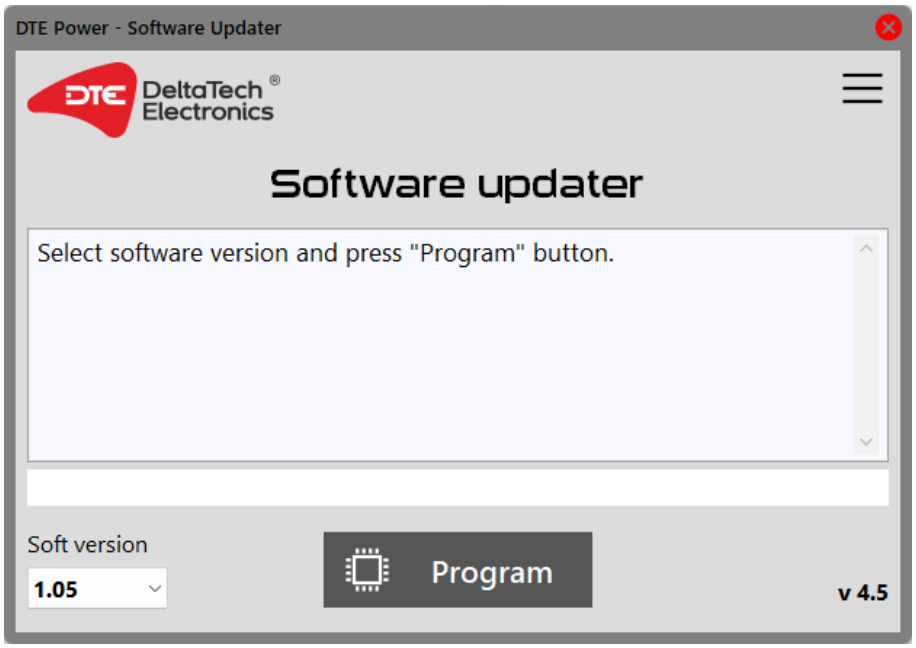
After selecting application language the main window will appear.



In the next step run the tester device in update mode. To enable program mode perform the following steps:
- Turn off the tester;
- Press ***START*** button;
- While holding ***START***, turn on the tester;
- After 3 seconds of start-up screen, the device will display *Update...*;
- Now release ***START*** button.

After these steps click ***Connect.*** A window will appear requesting the password.

Password information is included as a separate page in this manual.
After typing the password click ***OK***.



After successfully connecting to the device, you can click ***Program*** to update to the newest available version. There is possibility to downgrade by selecting older version that is currently installed.

The software updater will ask the user to confirm firmware update.
After selecting ***Yes*** the update will begin. Update process may take several minutes to complete.

After the update the user may close the application.

Warning !!!

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, applicable workplace and fire safety rules.