Dear customer,

we would like to thank you for purchasing our product. The TSPro diagnostic device will allow you to find and identify faults of electronic systems on the majority of today´s vehicles.

Because the complexity of control systems is increasing with every new generation, a diagnostic device is becoming a necessity for anyone who wants to repair vehicles efficiently and with high quality. We highly recommend reading the user guide in detail, as it will help you understand how the device is operated.

A complete description of all diagnostic features of the TSPro device can be found in this guide. Every function is described in detail and mostly documented with figures. Connecting the TSPro to a PC is also described.

Would you have more questions regarding the operation of the device please contact your reseller, who will be happy to help you. We also welcome your suggestions of future improvements of our products.

Published by Devcom spol. s r. o.
2013, 4th edition

Safety instructions

For your as well as your coworker´s safety, please read carefully following safety instructions:

The device described in this guide should only be operated by a trained person.

- The device must be protected against falling and other mechanical shocks.
- Neither the device nor the cables should be placed in close proximity of any high voltage components of the vehicle (such as ignition circuit etc.). A failure of the device might occur due to the high voltage.
- It is forbidden to use the device if the connection cables are damaged.
- The device is not waterproof; make sure no fluid gets inside the device. If it happens, unplug power supply, remove the internal battery and let dry for several days.
- Do not expose the device to extreme temperatures. It is also not allowed to use the device in areas with high humidity.
- The device can only be cleaned using soft, dry cloth. Any solvents (paint thinners, gasoline, degreasers etc.) might damage the surface.
- The touchscreen is subject to mechanical damage. Never use sharp objects to control the TSPro device.
- Breaking the warranty seal and disassembling the device will lead to the loss of warranty. The warranty seal is located on the back of the device.

In the package:

- The TSPro diagnostic device
- Transport case (optional)
- User guide and warranty seal.
- Connection cables and software modules as ordered.
- CD with the diagnostic software for Windows PC (PCCenter)
- PC connection cable
- Power supply.

The manufacturer guarantees that all future accessories (such as connection cables or software modules) will be backward compatible with the device you have bought. Since we work every day to improve our TSPro, we suggest following our homepage (www.devcom.cz) for up-to-date offers and updates.

Table of contents

1

First steps

The basics of the TSPro diagnostic device operation will be described in the first chapter of the user guide. Controls and handling of the device will be explained and possibilities of connecting to other devices will be summarized. If you are already familiar with the TSPro device, you can skip this chapter.

Introduction

The TSPro diagnostic device is designed as a universal diagnostic tool for both personal vehicles as for trucks. It is highly customizable and allows future updating. It is meant for both serial and parallel diagnostics of vehicles equipped with with electronic control units (ECUs) of engine, ABS, airbags, transmission etc. It allows using diagnostic features provided with the ECU´s manufacturer, such as fault memory readout, fault memory clearing, actuator tests, parameter readouts and many others. The number of diagnostic options is dependent on the specific ECU and used software version.

TSPro is fully compliant with following standards: ISO9141, ISO14229, ISO14230, SAE J1850, SAE J1979, SAE J1978, SAE J1962 and SAE J2012.

The device is equipped with plenty of memory for loading all current ECUs, it is not necessary to load any new programs to the device´s memory during work.

One of the major advantages of the TSPro is that can be used without connection to a personal computer. This capability will surely find use in emergency vehicles used for roadside assistance, but also anytime operating a complicated PC is hampering quick and reliable car diagnostic.

The TSPro device is controlled by an operating systems developed by Devcom spol. s r. o. The system comprises many modules where each module represents a subprogram for a given ECU or a group of ECUs. The advantage of this design is high customizability, where the customer is not forced to pay for modules he or she does not need. New modules can be uploaded by the manufacturer or using an installation software from any PC.

Using the device

We have designed the TSPro diagnostic tool such that no special knowledge of IT is required. We have also focused to make the diagnostic process easy and not dependent on the manufacturer of the ECU. For these reasons, operating the device is simple, intuitive and effective.

All functions can be controlled either using the keyboard or the touchscreen. The basic operation of all functions is designed to be as similar as possible, allowing effective operation.

Functions of individual controls will be described in the following text. The basic operation using both hardware keys as well as the touchscreen will be shown. The differences using various diagnostic modes will be introduced later in the guide.

Controls, indicators and connectors

All control keys as well as indicators with their description are shown in following figure.

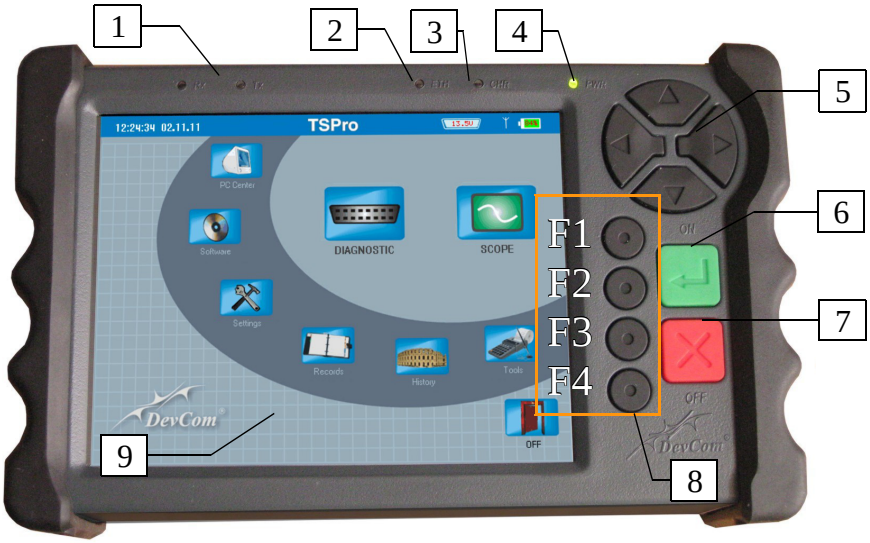


Figure 1.1

Control keys and indicators have following functions (Figure 1.1):

1. *Rx and Tx indicators of communication of the diagnostic bus*
   - RX – receiving data
   - TX – transmitting data
2. *ETH – indicates that the TSPro is connected to a LAN network*
   - LED lit : TSPro is connected to a LAN network
   - LED blinking : data is being transmitted
3. *CHR – charging indicator*
   - LED lit : the battery is being charged
4. *PWR – state indicator*
   - LED lit : the device is turned on

5. *Arrow keys* – using the arrow keys you can browse trough the menus

6. *OK (ON)*
   - confirms selection
   - turns on the device
7. *Back (OFF)*
   - return to previous menu / option
   - if pressed for more than 5 secs. the device turns off
8. *Function keys F1 – F4*
   - The function of these keys varies and depends on current menu or which operation is currently performed; it is therefore not possible to to describe the function (will be described later in the text for coresponding cases)
9. *Touchscreen* – allows operating the device without use of the keyboard

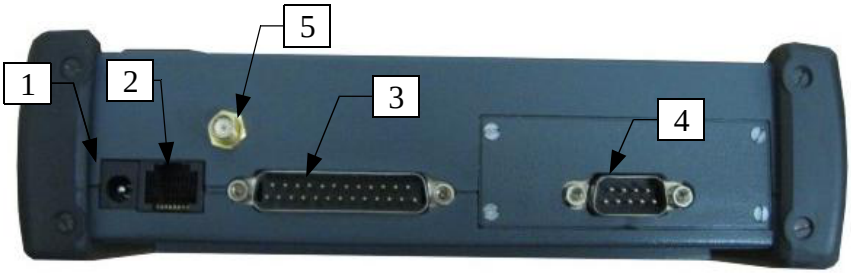


Figure 1.2

Figure 1.2 shows the rear side of the TSPro and the connectors:

1. power supply connector 12-48VDC
2. RJ45 connector to connect to a LAN network
3. a connector for connecting to diagnostic socket
4. a connector for connecting the oscilloscope probes
5. a connector for connecting the wifi antenna (must be purchased separately)

How to connect the TSPro device will be explained in following chapters.

Basic operation

On following pages we will show you how to use tde device. First using the HW keys, followed by using the touchscreen.

Selecting an item in a menu

The device is controlled via a system of menus in which individual items are selected from lists using the cursor keys. By pressing the **Up/Down** keys, the movement in the current list is performed. The currently selected item is always highlighted, as can be seen in Figure 1.3. The selection is confirmed by pressing **OK** key. This way the features such as entering new menu, starting a diagnostic test etc. are performed. By pressing the **Cancel** key, one returns to the previous menu or cancels current task.

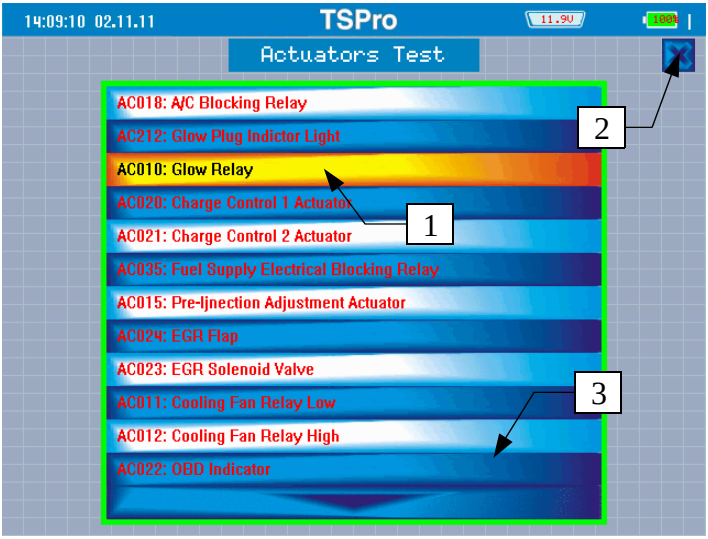


Figure 1.3

As you can see, it is very easy to work with the device using HW keys. The TSPro can, however, also be operated using the touchscreen. Would you

prefer this way, follow these steps:

• An item is selected by double pressing the corresponding line in the list on the screen. The first press selects the item (it will change color to indicate the selection), the second one confirms the selection (see Figure 1.4).

• If the list is longer that can be displayed on a single screen, an arrow will be shown to indicate that fact (see Figure 1.2)

• To return to a previous menu, press the **Back** icon in the upper right corner of the screen (figure 1.2).

Dialog screens

Dialog screens are used when user input is required to proceed further. These situations might be for example whether the fault memory should be cleared, whether new setting should be saved and so on. They are also used to inform the user about a certain detail (such as measurement results), and also warnings.

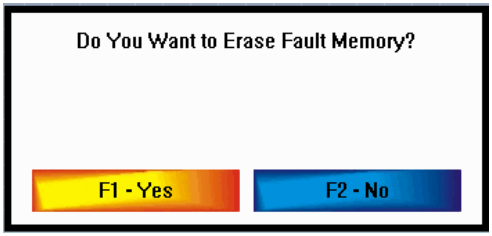


Figure 1.4

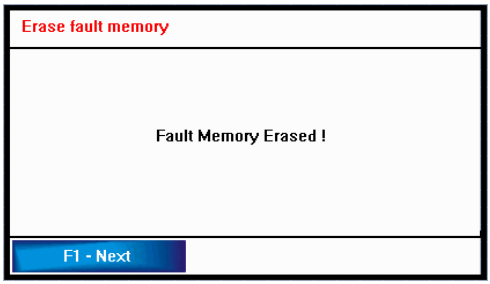


Figure 1.5

The control is generally performed with the HW function keys **F1 – F4**. Each dialog screen shows a button with a text and a number of a key that will act as that button. This can be easily understood by looking on the Yes and No icons in Figure 1.4 and Figure 1.5.

If the button is selected (such as (1) in Figure 1.3), the selection can be also confirmed by pressing the OK key on the TSPro. To switch between the buttons you can use the **Left** and **Right** arrow keys.

When using the touchscreen, the main principles of operation are similar as when choosing items in the menus lists. The only difference is that a single press on a button is sufficient to select and confirm a selection.

Entering text or numbers

When using the TSPro, it is sometimes necessary to input numbers or text, such as in Figure 1.6. The characters can be entered using either the keyboard or the touchscreen.

When using the HW keys, one has to use the arrow keys **Up/Down** and **Left/Right**. The **Left/Right** keys select a character in a string, while the **Up/Down** keys change the character then. A selected character is highlighted (1). Once you select the character to be changed its value can be changed by pressing the **Up/Down** keys. When the **Up** key is pressed, the characters change in the following sequence: 0 > 1 > 2 … > 9 > A > B … > Z >0. When the **Down** key is pressed the characters change in the opposite sequence. Al characters in a string can be set using this method.

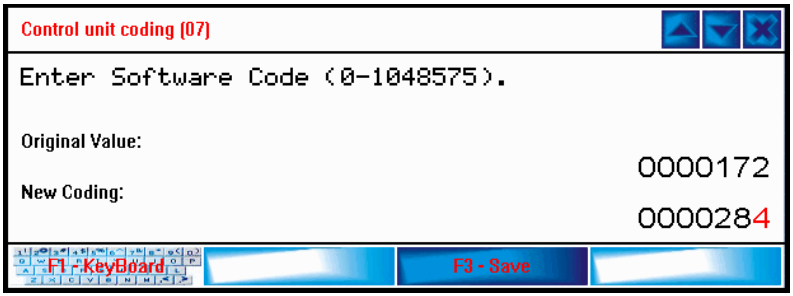


Figure 1.6

Virtual keyboard

There is a second, more convenient way of entering text on the TSPro – the virtual keyboard as shown in figure 1.7.

The characters may be entered as follows:

- a character is entered to the text box (1) by pressing a corresponding key on the virtual keyboard on the screen.
- to finish entering, press the **ENTER** key (2).
- to cancel the input and return back to previous menu, press the **Cancel** button.

The arrow keys can be used to move around on the virtual keyboard and select the desired key. The selected key will become highlighted (4) and is entered by pressing the **OK** button. To leave the virtual keyboard, navigate to the **ENTER** button (2) and confirm by pressing the **OK** key. To cancel the input, press the **Back** key.

Figure 1.7

We have introduced and explained all basic aspects of the TSPro operation in this chapter. Details about various diagnostic functions and procedures will be in detail shown in the following chapters in this user guide.

2

Operating the TSPro

All important details of the TSPro operation were introduced in the previous chapter. Information related to specific tasks will be explained in following chapters where these diagnostic tasks will be disscused. In this chapter we will focus on general tasks, such as changing system settings or browsing measurement history.

Main menu

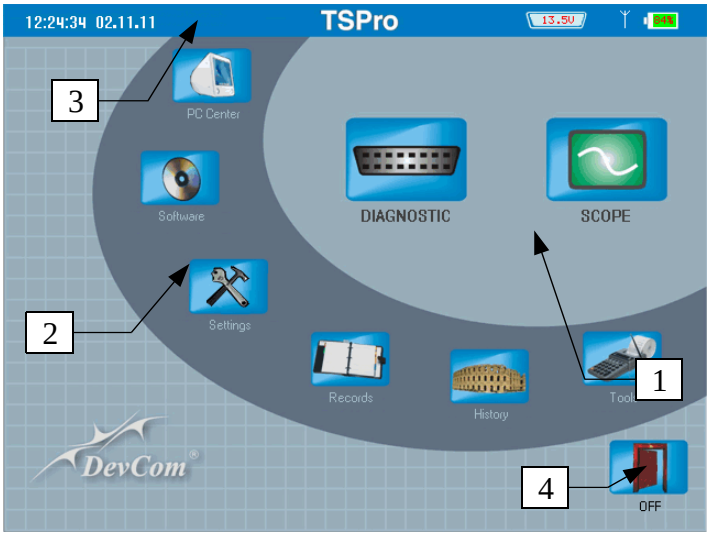


Figure 2.1

The Main menu screen will be displayed once the TSPro is turned on (Figure 2.1) this menu is also your startpoint to work with the device.

The main menu is divided into four areas. Area (1) allows you to start the main functions of the device – Diagnostic and Scope. There will be a separate chapter for both of these functions in the guide. Area (2) allows adjusting settings of the device, shows details about it and about installed software. Browsing through history of measurements is also possible by starting an application from this area. Area (3) is a so-called status bar showing current date and time, onboard voltage of a connected vehicle and status of the internal battery. Wireless network status is also indicated here, as is communication with ECU of the connected vehicle. The status bar is not shown when the Scope application is running, in all other cases it is visible. Area (4) offers the **OFF** icon for turning the device off and should be always used to power the TSPro off.

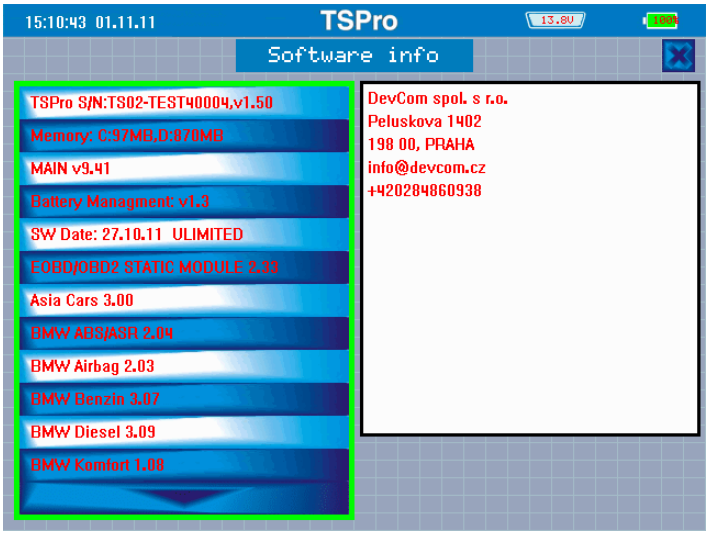


Figure 2.2

Software

You can find all details about the device in the **Software** menu. The details about installed software as well as the unit details are displayed in a list. Serial number and TSPro version are shown in the first lines, followed by the internal memory size, OS version, latest update etc. For the installed diagnostic modules, version and name is always displayed. Last but not least, owners details (if entered) are displayed (see Figure 2.2)

Settings

Various parameters can be changed in the Settings menu. The language in which the TSPro communicates, time and date, IP addresses and many other options can be changed. The Settings menu is displayed in Figure 2.3.

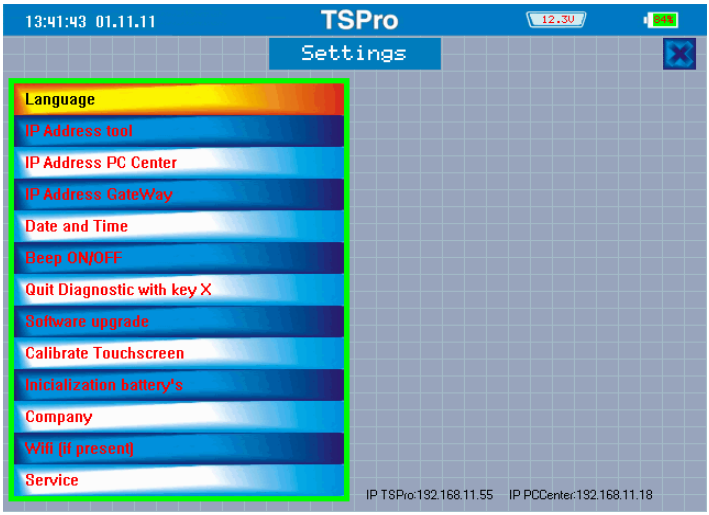


Figure 2.3

Language

In the language option you can change the language in which the TSPro communicates. Currently only Czech and English languages are available. The selected will not only be applied on the menu, but also will be used to display error messages during the diagnostic process.

IP adress

LAN interface with a UTP cable is used to communicate with personal computers. High speed and high resistance to interference are advantages of this interface. We have also introduced the wireles network adapter which is avalable for the TSPro (sold separately)

An IP adress consists of four (number) segments divided by a period - „ **.** “. It may look for example like this: 192.168.13.1. Each segment has value between 0 and 255. IP address is entered using the virtual keyboard as described earlier. While entering an IP address, make sure not to forget the periods between the segments!

The exact procedure of setting the ip address for various connection options will be described in Appendix B. Recommended IP addresses and wifi settings can be also found there.

PC Center IP address

Using the same principles as in previous option an IP address of the PC on which the PC Center software is installed can be changed in the **PC Center IP address** option. Correct setting of the IP address is essential for networkin go verthewirelessnetworks.

Gateway IP address

If the network on which the TSPro is running or the PC where the PC Center software is installed has a gateway, it´s IP address has to be set using this option. Correct setting of the IP address is essential for networking over the wireless networks.

Date and time

The date and the time can be set there. The changes are made using the arrow keys.

Beep ON/OFF

The sound of the keyboard can be turned off here. The sound played when the display is touched is also turned off. Once the change is made, it is necessary to turn the TSPro off and on again to apply the changes.

Quit diagnostic with X key

Using this function you can set whether the ECU diagnostic can or cannot be be canceled by pressing the **Back** key. If this option is not enabled, the only way to cancel the communication is using the **End diagnostic** button in the **Diagnostic** mode (this will be explained later).

Software update

After selecting this option the device switches itself to the update mode. This option is used by the manufacturer to update installed software modules.

Calibrate touchscreen

The touchscreen can be calibrated by selecting this option. You will be asked to press certain points on the display. Follow the instructions displayed on the screen to finish the process.

Battery initialization

The default values of the charging data for the inserted batteries will be loaded and charging characteristic of the batteries will be deleted after confirming this option. You should always perform the initialization after battery change to ensure the best possible charge and power on times

Company

The details of the owner of the TSPro, such as company name address, phone number, email etc. can be entered in this option. This data is shown in the **Software** option in the TSPro´s main menu.

WiFi (if present)

The wireless network can be turned on or off in this menu. Please note that the wifi module is optional and must be purchased separately.

The difference between Wifi switch ON and Wifi switch permanently is that the Wifi switches off after next turning on of the device in the first case, in the latter the Wifi remains switched on until manually turned off (Figure 2.4).

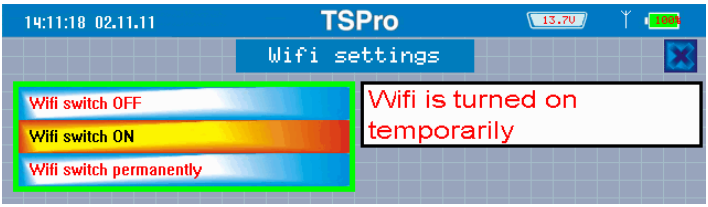


Figure 2.4

Service

This option will ask you for a password. The Service menu is designed only for purpose of unit servicing and is used only by the manufacturer.

Records

You can browse through saved records of previously performed diagnostic by selecting this function. First a list of stored records is displayed (see Figure 2.5). Details of a record is shown when the record is selected from the list (1) in the right hand side of the screen. Among the details are vehicle type and the manufacturer, which ECU was diagnosed etc.

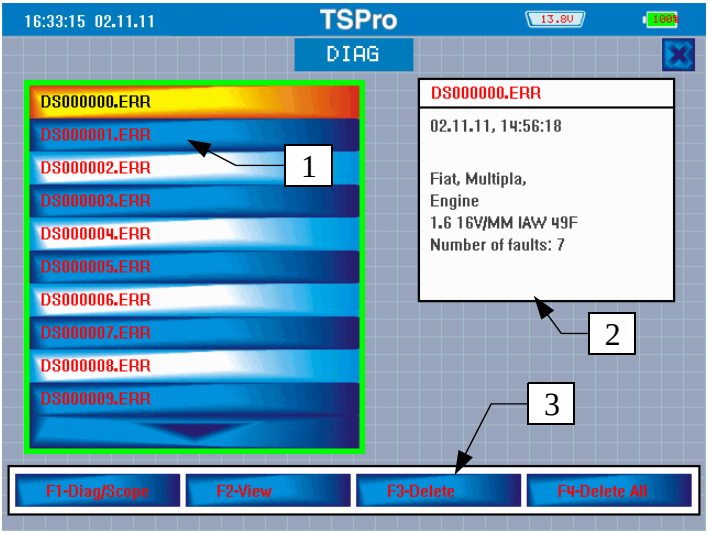


Figure 2.5

The buttons in the lower part of the screen (3) allow you to work with the records. Individual functions can be started either by the function keys F1 – F4 or by pressing the buttons on the screen.

Available functions are:

- switch between Diagnostic and Scope records ***(F1)***
- display selected record ***(F2)***
- delete selected record ***(F3)***
- delete all records at one ***(F4)***.

An example of a record stored in the Diagnostic application is shown in Figure 2.6. Using the **Up** and **Down** keys you can scroll through the records and by pressing the **Back** key you will return back to the **Records** menu.

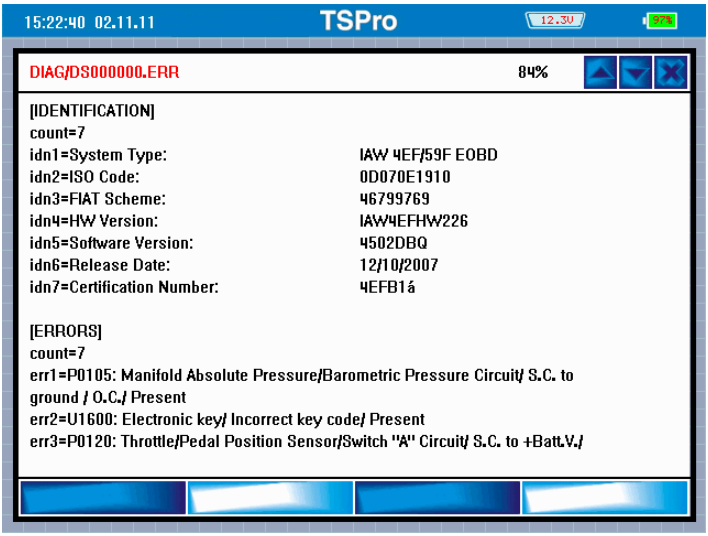


Figure 2.6

History

A list of recently diagnosed ECUs is displayed in this application. An example screenshot is shown in Figure 2.7. Using this list you can directly connect to the given ECU without going through the **Vehicle selection** menu first. A new window appears on the right hand side of the screen (2) with basic information about the ECU (vehicle manufacturer, ECU type, date and time of last connection) once an ECU is selected in the list (1). The connection can be established by pressing the **Start** button (3).

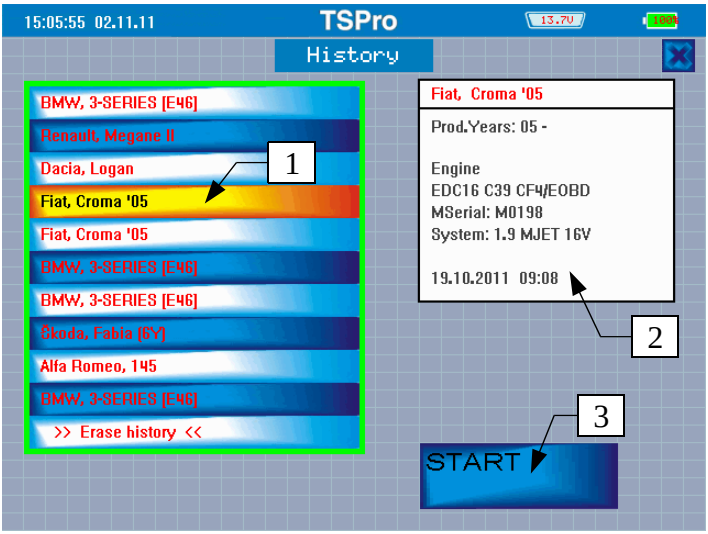


Figure 2.7

Tools

A simple calculator can be found in the **Tools** menu (Figure 2.8). It can be controlled in a manner similar to the virtual keyboard shown earlier.

3

Diagnostics

In the previous chapters we have introduced you to the basic principles of handling the TSPro diagnostic device. We will focus on describing diagnostic functions in this chapter. We will also show the correct procedures for performing diagnostic tasks of various ECUs.

Introduction

First, the principles of performing diagnostic tasks using the TSPro and its build-in programs will be shown. A separate chapter will explain how to use a PC with the TSPro PC Center program together with TSPro to evaluate conditions of car´s ECUs.

The diagnostic functions that will be described are reading and clearing fault codes, parameter readout, actuators tests and many others. Differences of diagnosing vehicles from different manufacturers will also be described. As the most significant differences are for the VW group automobiles, we will focus on those in more detail.

Car diagnostic

After turning on the device, select the **Diagnostic** icon and confirm selection. The **Manufacturer selection** menu will appear on the screen (see Figure 3.1).

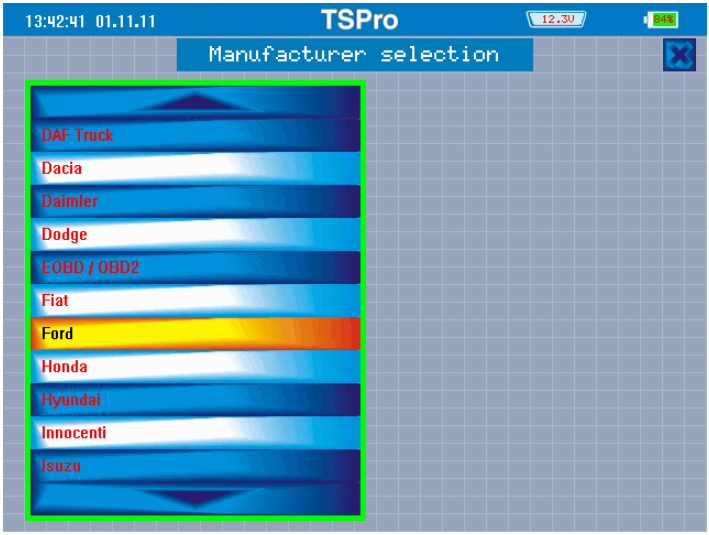


Figure 3.1

Choose the manufacturer of the vehicle to be diagnosed and confirm the selection. If the EOBD/OBD2 option is selected, you can perform basic diagnostic tasks supported by all car manufacturers. The EOBD/OBD2 is described in detail in the Appendix A.

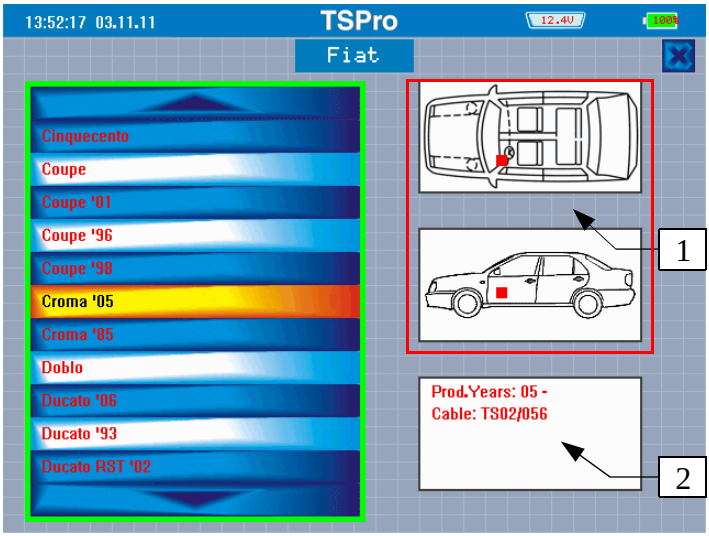


Figure 3.2

After selecting the model of the vehicle to be diagnosed, the **ECU selection** screen will appear. (Figure 3.3). First, the type of the ECU has to be set (1). Once the type of the ECU is selected, specific system of the electronic control unit must be chosen. The ECU system can be selected in the **ECU system** menu (2).

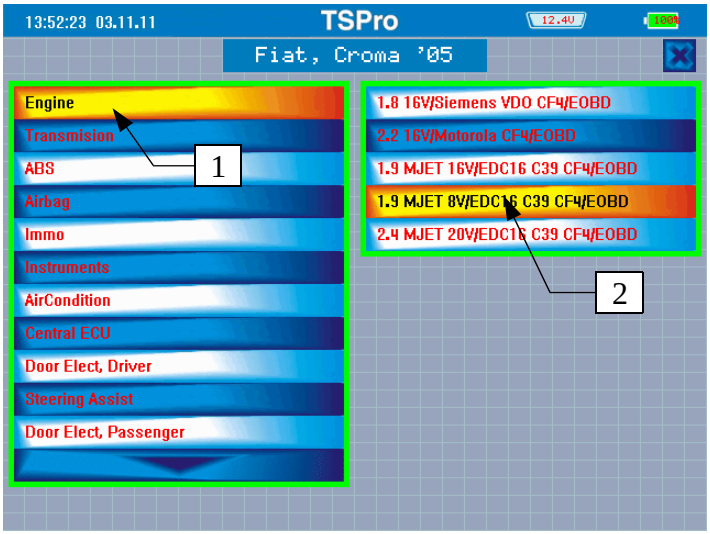


Figure 3.3

A dialog window asking you to switch the ignition on will appear after selecting and confirming both the type and the system of the ECU (Figure 3.4). In the lower part of the screen (1), details about the ECU are shown.

Once the ignition of the diagnosed vehicle is on, confirm by pressing the **Start** button on the screen (2) or by pressing **F1** key and the TSPro will connect to the control unit.

If the connection is successfully opened, the Diagnostics menu will appear on the screen (Figure 3.5)

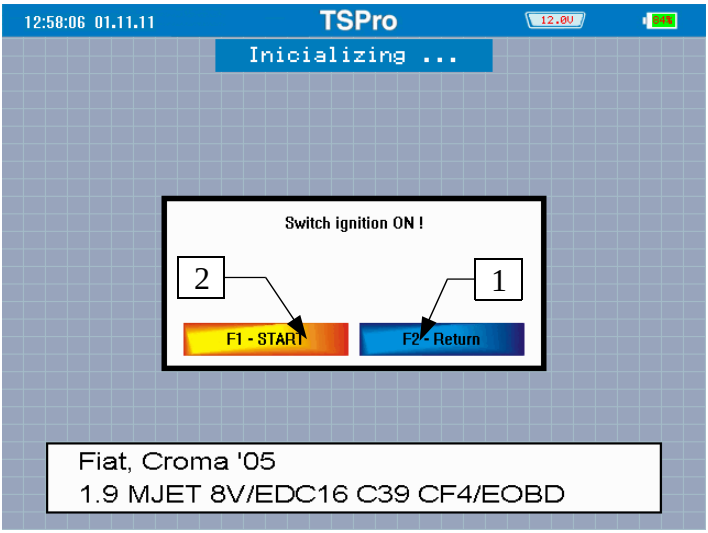


Figure 3.4

The number of items as well as the structure of available diagnostic functions may vary based on the ECU type, its manufacturer or the year it was manufactured. In the following text, individual functions that may appear in the diagnostics menu will be described in detail.

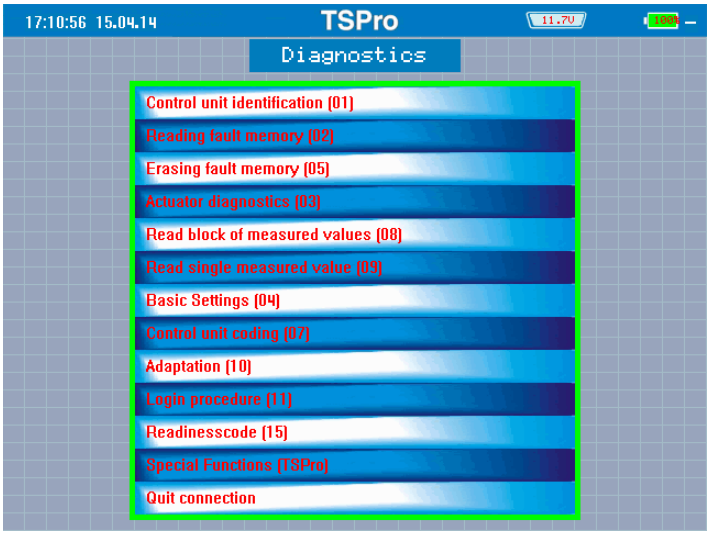


Figure 3.5

ECU identification

All basic information about the control unit, such as type, serial number, the manufacturer, software version, VIN etc. are shown in this menu (Figure 3.6). The number of details may vary based on the ECU.

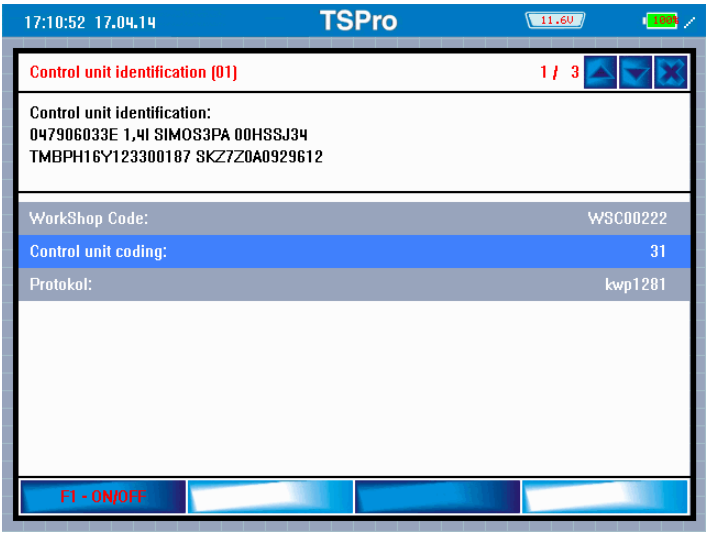


Figure 3.6

Reading fault memory

After confirming the selection, the fault memory of the ECU will be investigated and any faults found will be displayed in a list (Figure 3.7). Keep in mind that the number of the faults may vary!

Individual faults have a number / number of faults displayed (1). The fault code (2) and the text (3) is also shown Browsing through the list is similar to browsing through any other menu lists (see chapter 1).

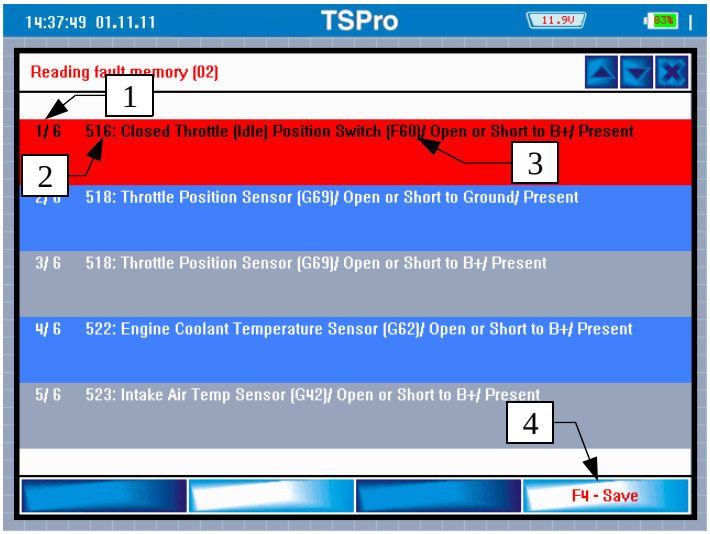


Figure 3.7

The fault list can be stored in the internal memory for later use. You can store the faults readout by pressing the **Save** button on the screen (4) or by the **F4** key on the TSPro. Stored record can be accompanied by a text to ease identification of the record (Figure 3.8) the text is entered using the virtual keyboard (2) into the text field (1). The text will be stored after pressing **Save** (3) button. If the procedure has been successful, a confirmation window **Record stored** will appear.

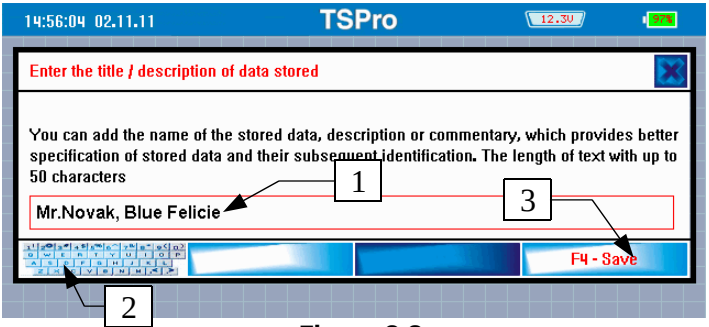


Figure 3.8

Erasing fault memory

In the previous paragraph we have shown how to read the fault memory. The procedure of fault memory clearing will be shown here. Keep in mind that the fault memory can be cleared only if it has already been loaded. After selecting the corresponding option in the **Diagnostic** menu a dialog window requesting confirmation will appear (see Figure 3.9).

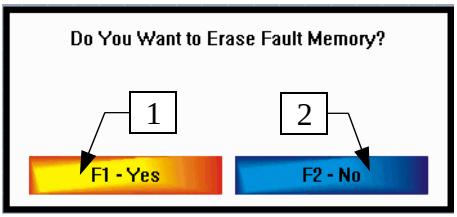


Figure 3.9

After pressing the **YES** button (1) the memory will be cleared. By pressing the **NO** button (2) you will return back to **Diagnostics** menu. The **F1** and **F2** keys on the TSPro keyboard (Figure 3.9) can also be used. If the memory is deleted successfully an information dialog will appear on the screen (Figure 3.10). Pressing the **Next** button will return you back to the **Diagnostics** menu

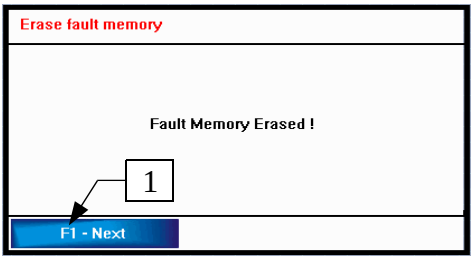


Figure 3.10

Parameters

In the Parameters menu (Figure 3.11) you can browse trhroug measured parameters of the ECU. Scrolling in the menu is similar to other menus (see Chapter 1). For the engine ECU parameters such as battery

voltage, intake air temperature, engine speed or throttle valve angle are displayed. For detailed explanation of individual items see service documentation of the vehicle or service manual of the control unit.

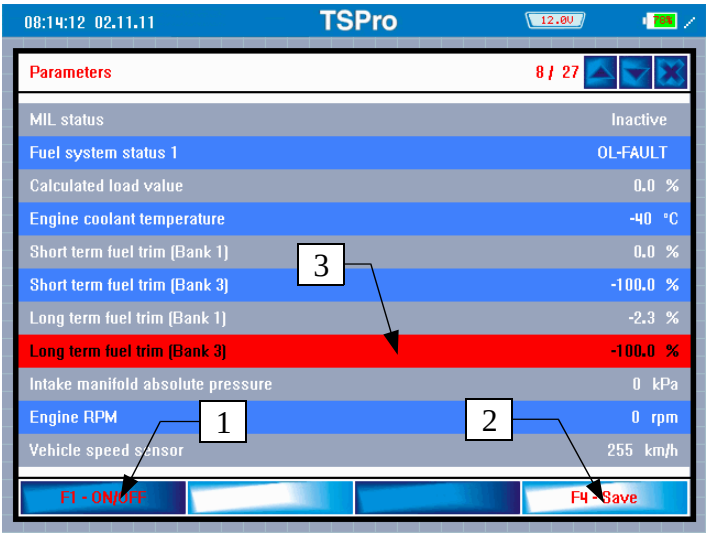


Figure 3.11

Selected parameters (2) can be enabled or disabled using the **ON/OFF** button (1), enabling you to create customized lists of parameters. Disabled parameters will be moved to the end of the list.

Displayed parameters can be stored to the internal memory by pressing the **Save** button (3). Storing the parameters is done in a similar manner as storing the fault lists, as was already described in this chapter.

Read block of measured values

This menu is similar to the previous one, as it displays measured parameters. It is, however, only available for the VW-group vehicles (i.e. Audi, Seat, Skoda and VW).

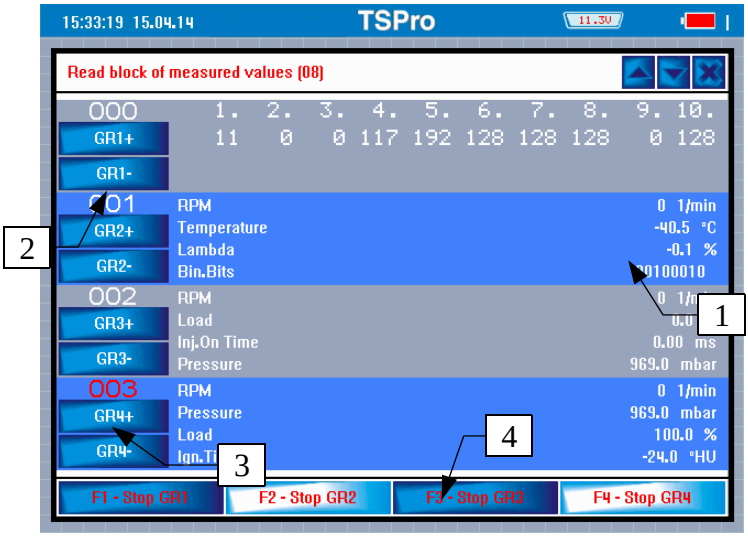


Figure 3.12

In the **Read block of measured values** menu, the screen is is split in four parts (GR1 – GR4), as can be seen in Figure 3.12 – (1). Up to four independent parameter groups can be therefore displayed on the screen simultaneously. By pressing the buttons in the bar at the bottom of the screen (2), display of parameters of a corresponding group (3) in individual blocks is done. Corresponding function keys **F1** - **F4** can also be used.

In the blocks (3) group number and displayed parameters can be changed with the **GR+/GR-** keys (2) on the touchscreen or by pressing the **Left** or **Right** keys. If you want to change the group using the **Left/Right** keys, you first have to select the block in which the group will be changed using the **Up/Down** keys. The block number is highlighted in the selected block (3).

Detailed explanation of individual items (groups) is not a part of this guide and should be looked for elsewhere.

Read single measured value

This function was supported by older control units and is not used in the current generations of ECUs. It is controlled in the same way as the Read block of measured values menu. The buttons in the lower part of the screen or corresponding function keys F1 – F4 are used to control the diagnostic function.

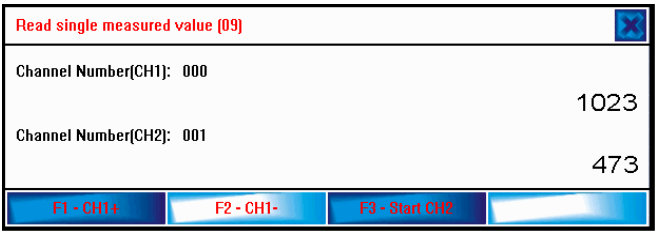


Figure 3.13

Actuator diagnostics

Another item in the Diagnostics menu is the Actuator diagnostic. Physical conditions of actuators can be tested here. For example, for the engine control unit you can test injectors, fuel pump relay, glow and MIL indicators and many others, as is documented by Figure 3.14. We have to mention that the number and type of actuators is dependent on a specific system, it´s manufacturer and the manufacture year.

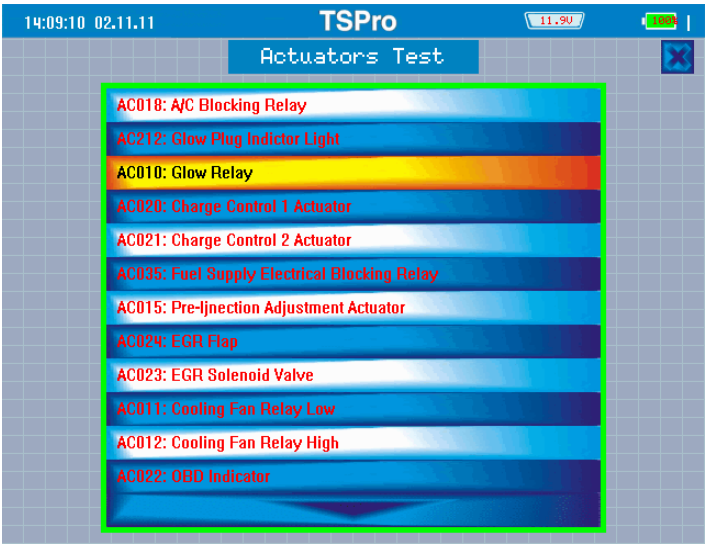


Figure 3.14

The actuator tests allows you to test the whole pathway from the control unit to the actuator i.e. output stage of the control unit, connectors and cables as well as the actuator itself.

If a test of some of the actuators is activated, a window will appear on the screen informing you about the progress (figure 3.15). During the test you can control behavior of the actuator either visually or by listening.

The actuator tests can be controlled using the keys in the lower part of the screen or by corresponding function keys *F1 - F4*.

Actuator test on the VW-group vehicles vary slightly from tests of other vehicles. If a test is selected, a list of actuators is not displayed as in the previous case in Figure 3.14, but the device will send a request to activate actuators and the control unit will activate them one after another in the order it is performed to do so. You can only control the sending request to perform next test. If a request is received and the control unit has already performed all tests, a window informing you about the end of the tests will appear on the screen.

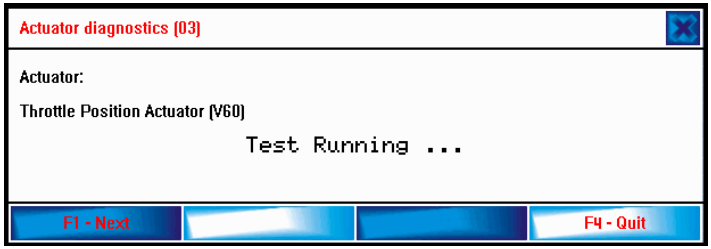


Figure 3.15

Configuration settings

This item includes all functions that are used to set various important system parameters, change system configuration and to perform initialization after component exchange. Available functions for the EDC16C39 system are shown in figure 3.16. The number and type of items in the menu is dependent on the specific system.

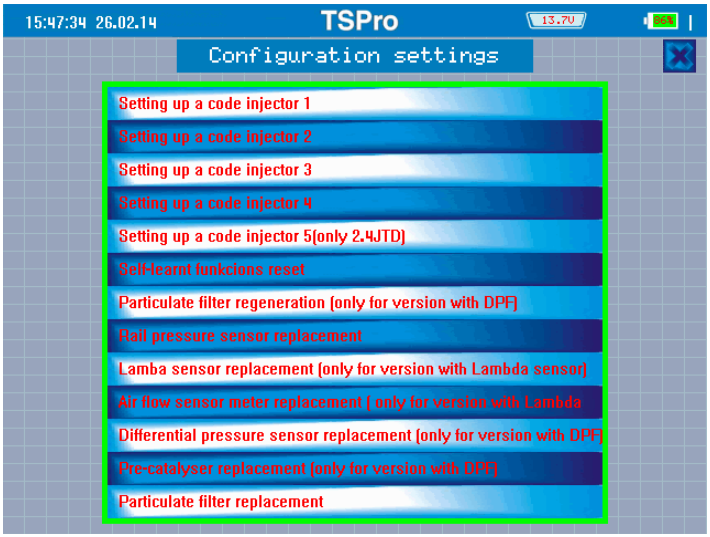


Figure 3.16

Let us now introduce some functions you can find in the menu.

Injector code setup

One of the most commonly performed tasks on the common rail diesel engines is adapting the calibration values for the injectors. The calibration constant contains mechanical parameters of the injector, so it is necessary to change it every time an injector is exchanged or repaired. The value of the calibration constant varies depending on the type and manufacturer of the injector. An example of the adaption is shown in Figure 3.17. The value modification is performed using the virtual keyboard or using the cursor keys (see Text and number input in Chapter 1).

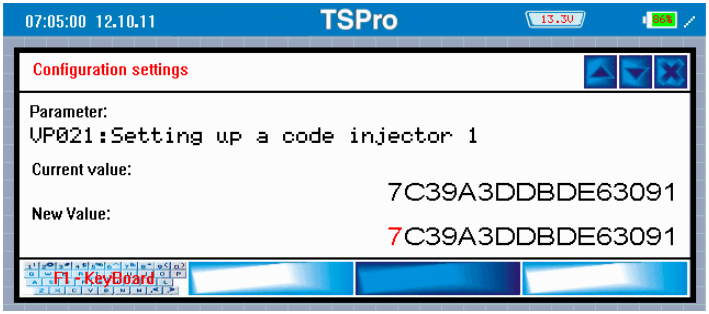


Figure 3.17

Particulate filter regeneration

Another important function for modern diesel engines is a particulate filter (DPF/FAP) regeneration. Small particles of soot accumulate in the filter while driving, which can cause the filter to clog. After selecting the option the TSPro will send a request for the DPF regeneration and if all starting conditions are met (mainly engine and exhaust pipe temperature) the regeneration sequence is initiated. The system controls the whole procedure which can last few minutes.

Steering wheel angle sensor reset / yaw rate sensor reset

For ESP equipped vehicles you can perform calibrations of steering wheel angle sensor, yaw rate sensor, or lateral acceleration sensor These calibrations should always follow replacement of the above-mentioned

sensors. Steering wheel sensor has to be calibrated also when anything is changed or adjusted on the front axle.

Airbag configuration

Airbag configuration can be modified with this function. It is possible to enable or disable certain parts of the system, such as passengers airbag, seat belt pretensioners, head or side airbags etc. An example of the configuration adjustment can be seen in Figure 3.18.

Figure 3.18

Browsing in the menu is performed in similar manner as already described (see Chapter 1). Currently selected item is highlighted (1). By pressing the Change button (2) in the lower part of the screen the selected parameter can be changed. All changed parameters are labeled with the * symbol (4). When all adjustments are done, press the **Save** button and the new values will be stored in the control unit. We highly recommend turning the ignition off and on again and check the fault memory afterwards.

Basic Settings

Function Basic Settings (Figure 3.19) enables resetting adjusted values in the electronic control unit and return it to it´s original values. This function finds use when calibrating the throttle valve, when bleeding an ABS brake system or when calibrating the xenon light level adjustment.

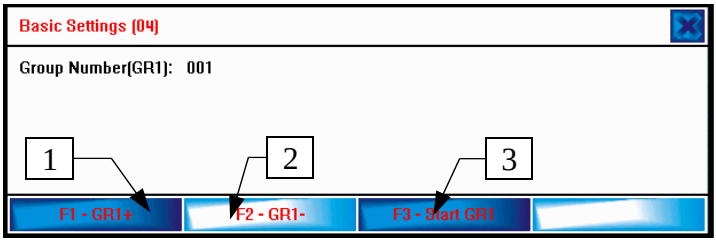


Figure 3.19

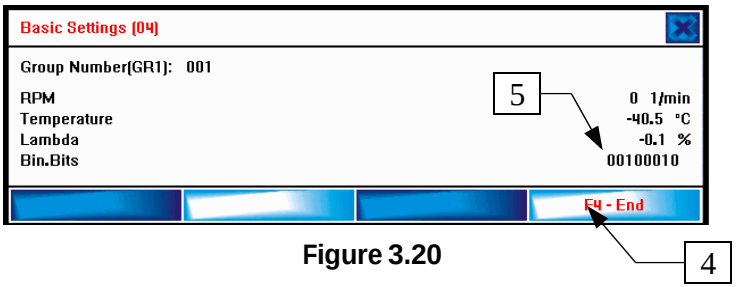


Figure 3.20

First the desired group has to be selected using the **GR+/GR-** keys, as can be seen in Figure 3.19. If the group is selected you can start the initialization procedure with the **Start GR1** button. The progress is indicated by the **Bin. bits** label in Figure 3.20. The progress is indicated by a sequence of ones and zeros or by a message **ADP running / ADP OK**. After completion, indicated by a defined 1 and 0 sequence or by displaying the **ADP OK** message on the screen you can exit the procedure by pressing the **End** button (5).

Control unit coding

With the **Control unit coding** function, 5-digit codes reflecting the configuration of the control unit for a given vehicle can be entered (Figure 3.21). For engine ECUs this configuration can for example be whether automatic or manual transmission is installed, whether ABS or air condition is installed and so on. This feature is only available in VW-group vehicles.

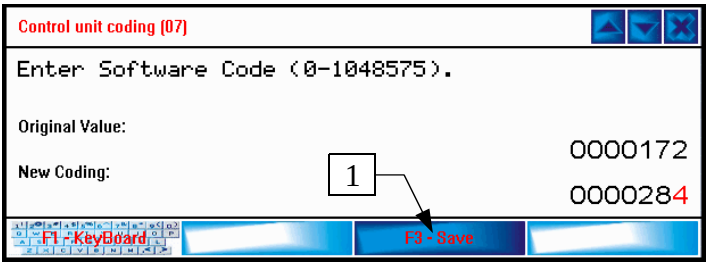


Figure 3.21

New value is stored to the ECU by pressing the Save button on the screen. After pressing the Save button you will be asked to confirm the changes (Figure 3.22) and if a positive answer is received the result of the procedure will be shown on the screen (Figure 3.23). The exact meaning of individual codes is explained in the service documentation.

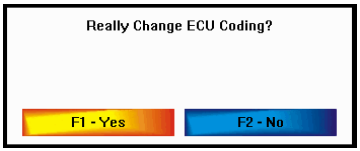


Figure 3.22

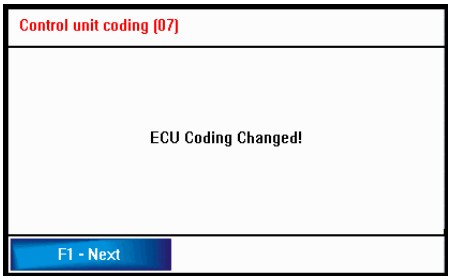


Figure 3.23

Long coding

In newer units that communicate on the CAN bus one uses the ***Long coding*** to change its configuration. Using the long coding you can for example activate daylight running lights, window comfort functions, coming home etc.

Instead of the 5-digit code a hexadecimal string is entered. The length of the string is different for different control units and is related to the size of the configuration memory; for example for the Gateway the string length is usually 7bytes, corresponding to 14 characters. The strings can have up to 128 characters.

The coding string is split into groups, each containing 10 characters. Information about the current character group is in the upper part of the screen (1) & (3). In the figure 3.23 the first screen with characters 1-10 (2) is displayed. After pressing the **Save** button a new window with characters 11-20 will appear (4) on the screen. In the case shown in Figure 3.24 only 4 characters are visible. If the **Save** button (5) is pressed again and if more characters can be coded a new screen with positions 21-30 will appear. If no more characters have to be coded the TSPro will request confirmation of the changes (Figure 3.22) and if the confirmation is received the coding operation will be confirmed.

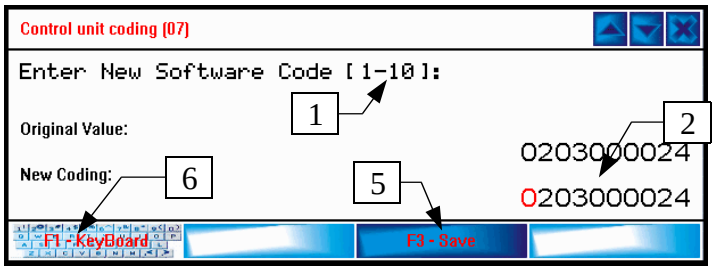


Figure 3.23

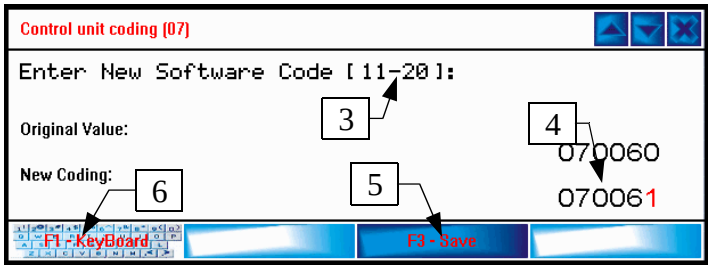


Figure 3.24

Individual characters are entered using the virtual keyboard (6) or the cursor keys – see Entering numbers and characters in Chapter 1.

Adaptation

The Adaptation function allows for changing specific settings of control units. We can set and reset service intervals, code new keys and remote controls, adjust the injection correction for TDI engines, set the idle engine speed, block airbags and many other parameters with this function.

An example of performing an adaptation on channel 10 is shown on the following figures. In figure 3.25 you can see a window for the channel number input (1). After pressing the Next button (2) a request for current channel value is sent. Then a window with original and new adaptation value (3) is visible as in Figure 3.26.

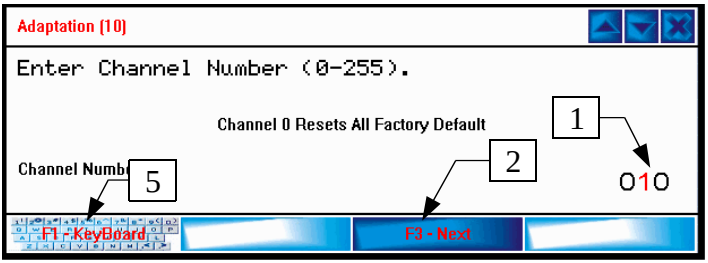


Figure 3.25

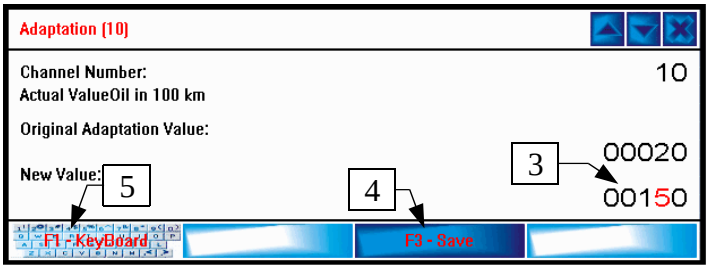


Figure 3.26

Setting the channel number or entering a new adaptation value is done using the virtual keyboard (5) or the cursor keys (see Entering text and numbers in Chapter 1)

If the desired value is entered, press the **Save** button (4). You will be asked to confirm the change (Figure 3.27). Once confirmed, the new value is stored and the result of the procedure is displayed on the screen (Figure 3.28)

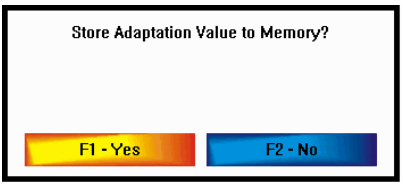


Figure 3.27

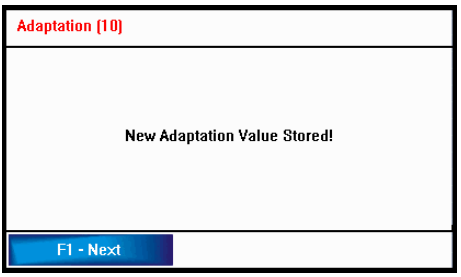


Figure 3.28

Login

For some control units it is necessary to perform a so called **Login** before performing maintenance tasks (such as adding new keys or programming). Login means that a specific code / password has to be entered to unlock the control unit. For this purpose the Login function has to be used (Figure 3.29).

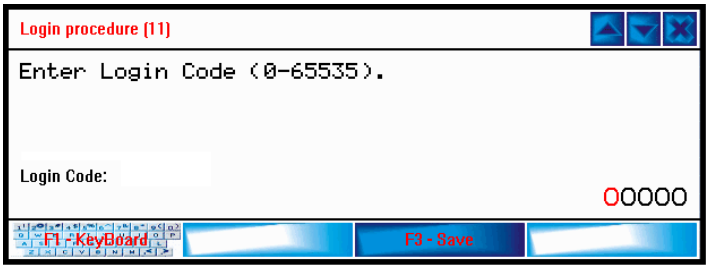


Figure 3.29

The TSPro will require confirmation for the ECU unlock after entering the password (Figure 3.30).
If confirmed, a dialog window informing about the result of the login procedure appears on the screen (Figure 3.31).

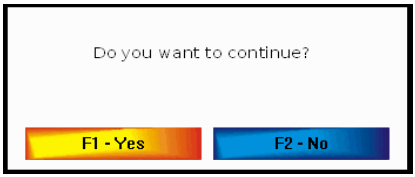


Figure 3.30

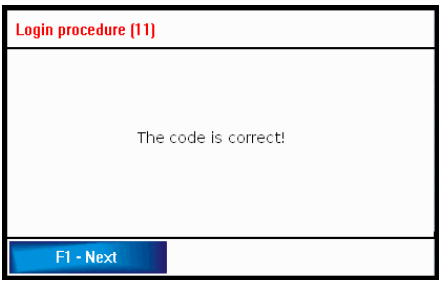


Figure 3.31

Readiness code

Readiness code appears in the vehicles since 1996 (in those supporting OBD-II) and is related to catalytic convertor and lambda sensors. You can find a detailed description of the code in Appendix A of this guide.

TSPro Special functions

The **Special function** menu contains a group of predefined functions that enables you to perform complicated coding tasks without any detailed knowledge of the procedure and without the coding values. Supported functions are (among others): throttle valve adjustment, injected fuel mass adaptation, DPF regeneration, brake caliper position reset, enabling or disabling daylight running lights, steering wheel angle sensor reset etc. The special function menu primarily focuses on electronic control units of VW-group vehicles. The number of available options of course depends on the current ECU. Available functions for the engine ECU can be seen in Figure 3.32.

Figure 3.32

TSPro service functions

This menu makes settings of service functions very simple. Functions, such as service interval reset, engine oil change interval, brake pad change interval and others are supported. These functions are either available as a function for a specific control unit or as an individual unit in the Control Unit menu , always as the last item in the list.

Disconnect

Once done with the diagnostic tasks, it is important to correctly disconnect the TSPro from the vehicle. This can be done by pressing the **Back** key in the **Diagnostics** menu or by pressing the **Disconnect** button on the screen. You will be asked to switch the ignition off (Figure 3.33). Once confirmed, the screen of the TSPro will display the control unit selection screen (Figure 3.3).

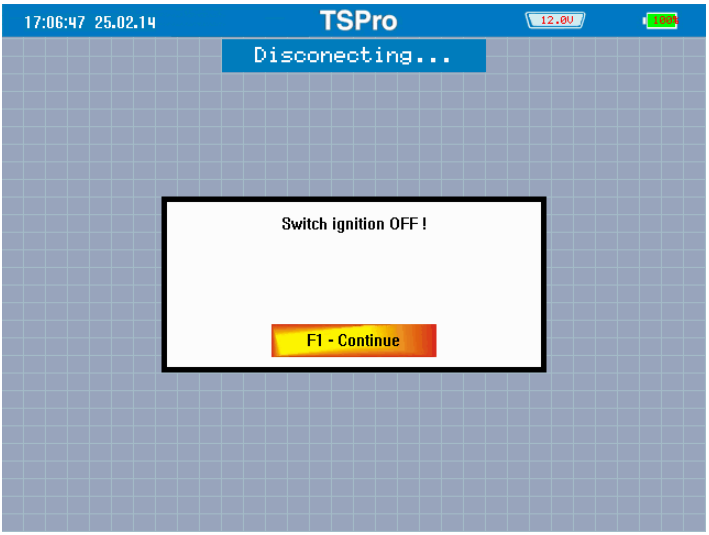


Figure 3.33

4

Oscilloscope

The oscilloscope is an essential waveform diagnostic tool for every mechanican. It brings big benefits compared to a voltmeter or an amperemeter - it can display the waveform over the time. The signal is displayed on a screen ,where the vertical axis (Y) is voltage and the horizontal axis (X) is time. This mode is often called the T-X Mode and is implemented in the TSPro. Using this mode we can see the waveform in time, count it´s frequency, detect interference or count a DC shift.

One channel is used to display each signal. Your TSPro can measure and display 8 different channels at once.

Diagnosing using the oscilloscope is irreplaceable in practice, therefore we will show you in detail how to work with TSPro integrated oscilloscope. At the end of this chapter you can find Section Glossary, where you can find an explanation of the terms frequently used in diagnosing.

Introduction

To run the oscilloscope select the **Scope** (1) (see Figure 4.1) option in the main menu and confirm it. When it loads you will see the it´s workspace (see Figure 4.3) where the signals are displayed and where you can do the application´s settings.

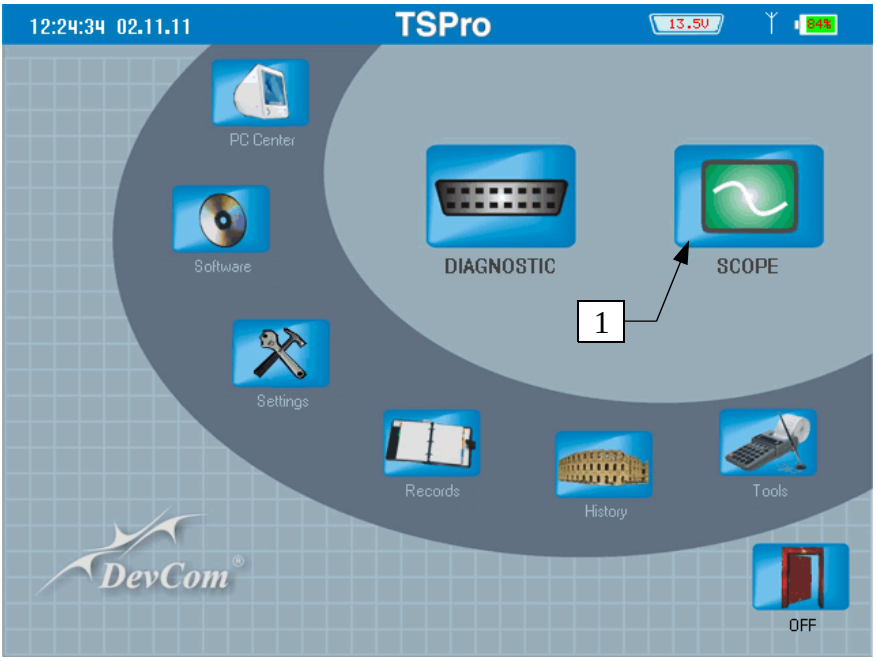


Figure 4.1

Caution! The oscilloscope application Is an optional accessory and does not have to be installed in your device. If your TSPro does not contain the oscilloscope you will see a warning message (see Figure 4.2).

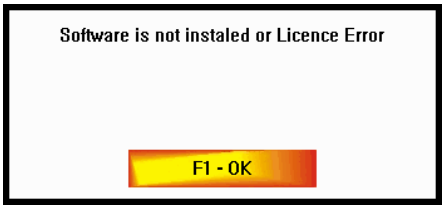


Figure 4.2

The workspace is divided into several areas for displaying and setting the data needed to use the oscilloscope.

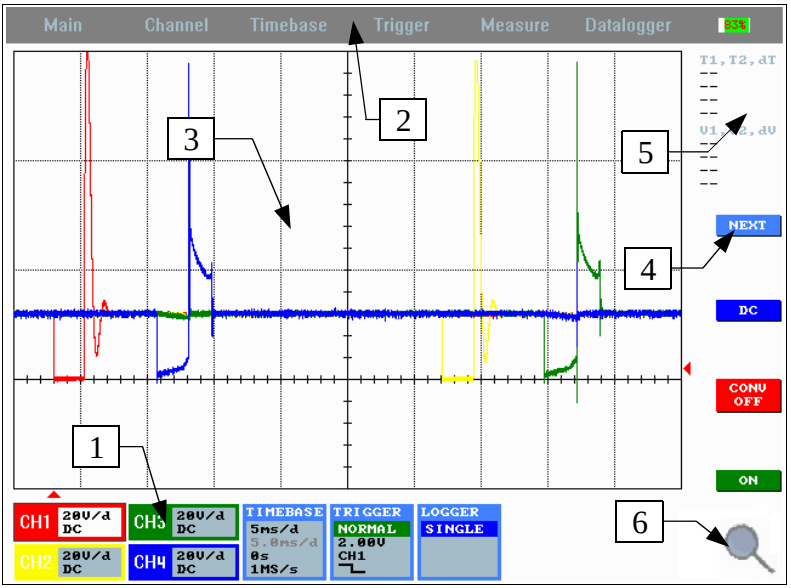


Figure 4.3

1. Shows selected parameters of each one channel, time base and trigger
2. Menu bar
3. The main window displaying measured waveforms
4. Fast selected function parameters settings
5. Shows the measured values of voltage and time using measuring cursors
6. Magnifying glass (making displayed waveforms bigger)

The control principle is the same for all available variants (e. g. 2,4 or 8 channels), in the following text we will focus on describing the operation of the 4 channel one.
Before we´ll proceed to describing the individual functions, we´ll describe the control principles. Control of the oscilloscope was designed so that all parameter settings can be done as fast as possible and so that both the keyboard and the touchscreen can be used. Now we will show performing the setting on examples.

Choose the desired function

The easiest way to choose a function is to press the F1 button or to click the NEXT icon on the touchscreen next to the F1 button. By pressing the button/icon each oscilloscope function is activated in the following order: *setting the parameters of channels 1, 2, 3, 4, setting the time base, setting triggering parameters, measurement cursors, data logging, saving pictures; and then the individual items in the menu bar toggle: File →Channel → Measurement →Logging .... After the last menu item is activated then setting the parameters of channel 1 activates again*

The second way to choose the function is using the touchscreen, when the function is activated by a single click on it´s icon.

Example: Clicking the channel 4´s icon activates setting the parameters of channel 4. (Fig. 4.4) Activation of the function is indicated by changing the highlighting color to white.

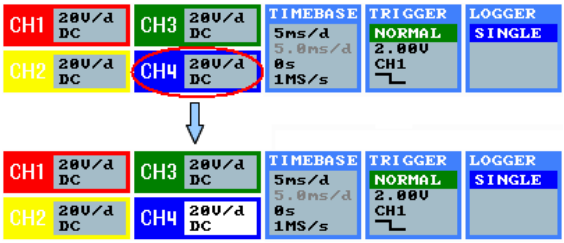


Figure 4.4

Setting the parameter

- **hotkeys**: You can use the F2, F3 and F4 keys or the icons next to these buttons for fast setting of the most used parameters. The type of the parameter which is currently being set depends of the previously chosen function. Figure 4.5 shows some examples of the icons for fast setting (A: choosing of the measuring channel´s parameter, B: setting the time base, C: setting of the starting, D: setting of the measuring cursors)

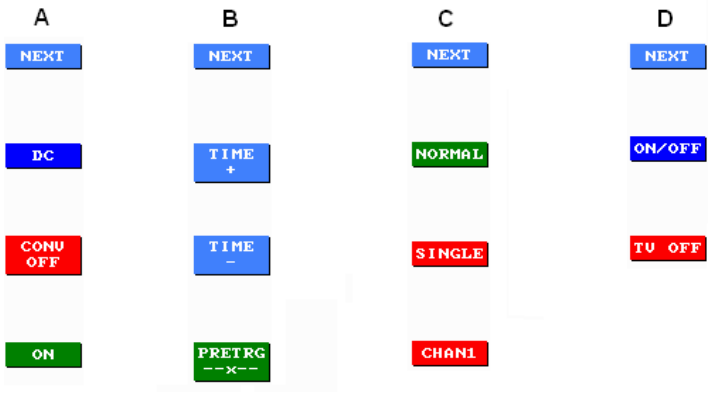


Figure 4.5

- **Cursor keys**: parameters which are set using the cursor keys also change depending on the chosen function
    - **Up/down** arrows are used to make the voltage range, time resolution or setting the starting level bigger or smaller, to move the measuring cursors etc.
    - **Left/right** arrows are used to set the pretrigger, the starting channel / trig, to move the measuring time cursors etc.

- *Menu bar:* here you can set all the oscilloscope parameters and activate all the available functions. Selecting from the menu is done by cursor keys or by touching the icon directly on the touchscreen. An example of the menu can be seen on the Figure 4.6.

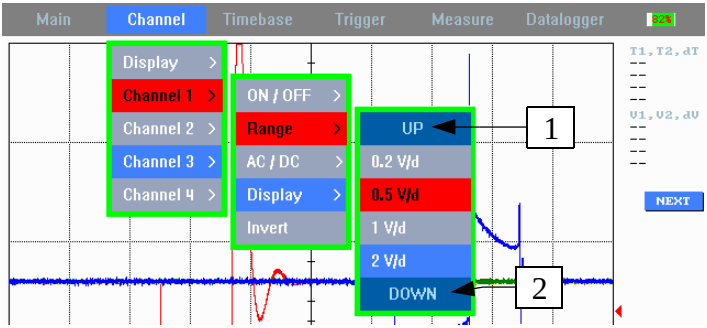


Figure 4.6

If the list is long an item (UP(1) / DOWN(2)) appears on the list; if pressed, the list shifts up or down respectively.

- **keys Confirm (ON)/ Back (OFF)**: You can turn on or off measuring on all the channels simultaneously by pressing these keys. If the measuring is turned off the last measured value is shown in window 3 figure 4.3. The waveform stays displayed also after disconnecting the measured signals. The state of measuring is displayed in the Trigger icon (Figure 4.7).

Figure 4.7

On the following pages we will guide you trough the individual settings of the application. Only part of the screen is shown in some pictures for better understanding.

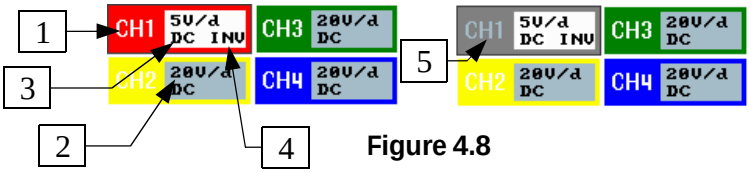


Figure 4.8

Setting parameters of measuring channels

In this paragraph you will see how to change various oscilloscope settings, e.g. voltage range and type, signal inverting, selecting the measuring probe etc. The parameters are set individually and every channel can be set differently.
The actual parameter setting of the individual channels can be seen in the down left corner of the screen. (Figure 4.3 - 1) The way to change the settings is the same for all the channels, so we will show them on the channel 1. (CH1)
Let´s describe the individual settings following the Figure 4.8.

Channel number (1)
Here you can see which channel is this one. Color of the icon matches the color of the waveform in the main window (Figure 4.3 - 3).

Voltage range (2)
Here you can see the voltage range which is currently set for the individual channel. You can change it using either the cursor keys Up and Down or by selecting the desired range in the menu bar in the range from 50mV/square to 100V/square. (Figure 4.9). On the Figure 4.10 you can see an example of the same signal in various ranges.

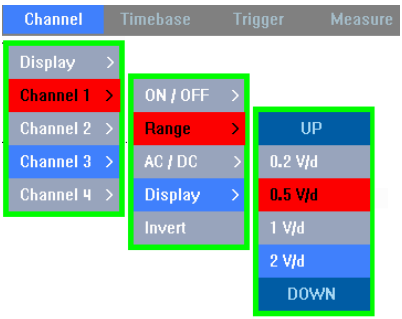


Figure 4.9

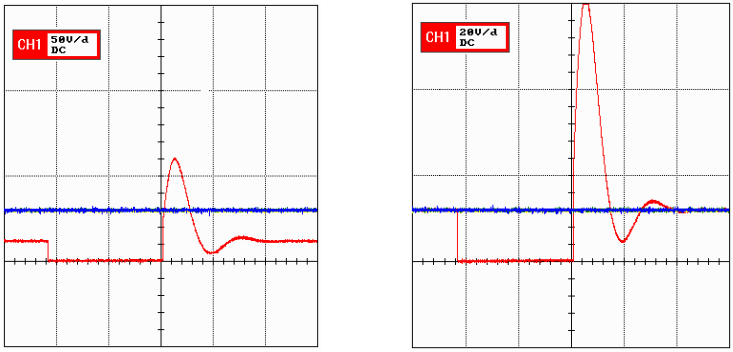


Figure 4.10

Coupling type (3)
There are two types of coupling - AC and DC. The difference between them can be seen on the figure 4.11 for DC and 4.12 for AC. You can find a detailed description of the individual bonding types in the Glossary.

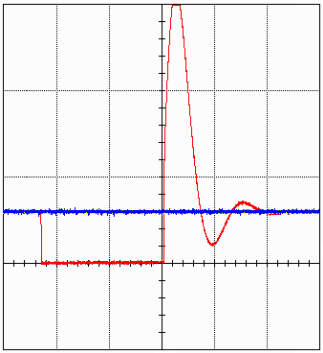


Figure 4. 11

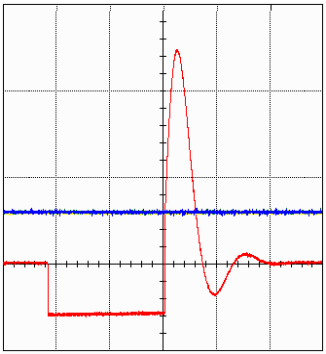


Figure 4.12

You can set the bonding type using either the F2 key, the icon next to it on the touchscreen (Figure 4.13), or by selecting the desired bonding type in the menu bar (Figure 4.14).

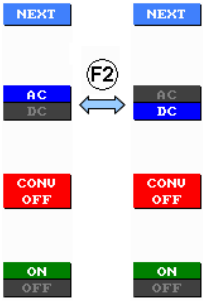


Figure 4.14

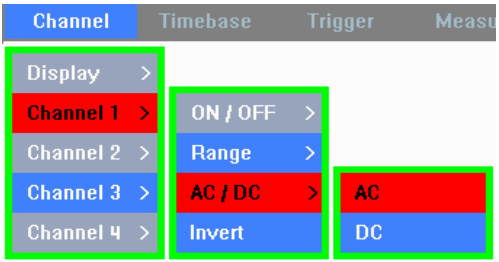


Figure 4.13

Signal inverting (4)

A sign **INV** indicates that the signal inverting is enabled on the channel. The figure 4.15 shows an not-inverted waveform and the figure 4.16 shows an inverted waveform. You can turn this function on or off only by selecting the Invert/Not-invert item in the menu bar (Figure 4.17).

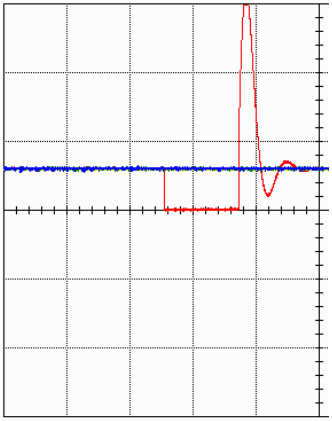


Figure 4.15

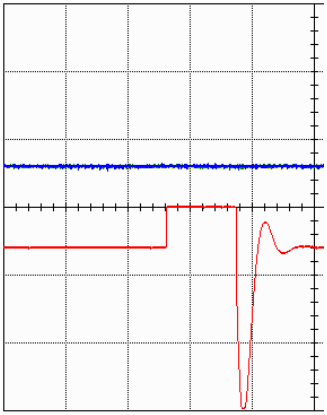


Figure 4.16

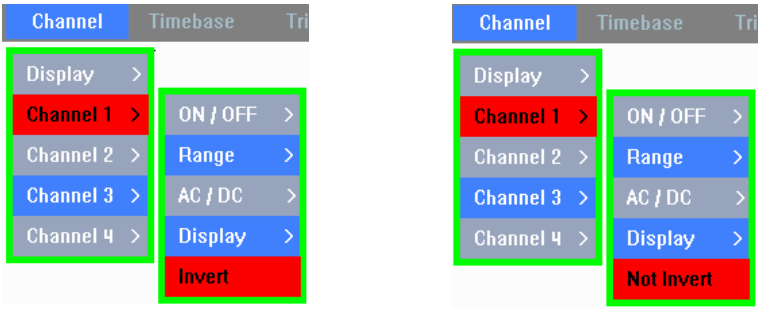


Figure 4.17

ON/OFF measurement (5)

During the measuring you can turn on or off displaying any of the measured channels. If the channel is turned off, the channel´s icon turns gray (Figure 4.18). You can turn the waveforms on or off either by pressing the hotkey F4, the icon next to it or by pressing the corresponding item in the menu bar (Figure 4.19).

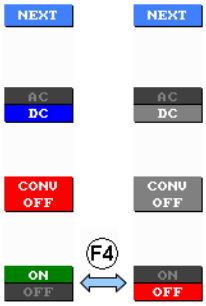


Figure 4.18

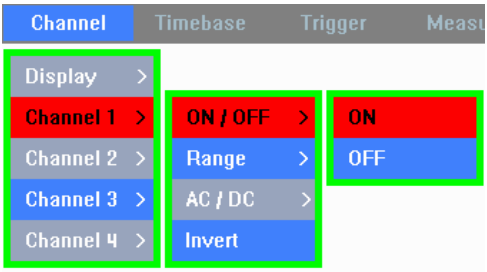


Figure 4.19

Signal conversion (Measuring probes)

The waveforms in the main window (Figure 4.3 - 3) are usually displayed as graphs of voltage in time. You have to use special probes to

display other values. The device can switch it´s operation to several pre-defined modes enabling input signal conversion. The system is calibrated for use with the probes provided by the manufacturer.

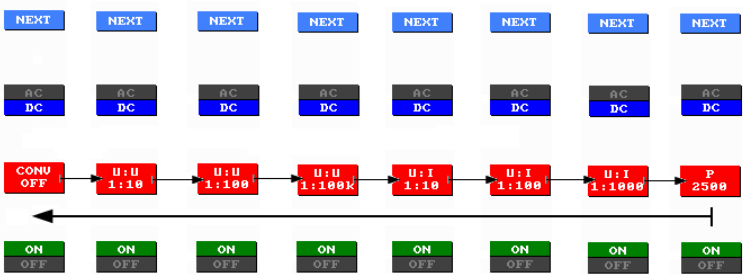


Figure 4.20

You can switch any measuring channel to the conversion mode independently; it can be done by pressing the F3 key or the icon next to it on the touchscreen. By pressing the F3 key or the icon you can change the modes (Figure 4.20).

For example you can see a graph of pressure in time if you use a 

pressure probe P 2500 supplied by the manufacturer.
Information about the chosen mode are displayed in the signal´s info window. An example of a mode for voltage/current conversion is on the Figure 4.21.

If there is an icon 

next to the F3 key signal conversion is turned off for the selected channel.

Figure 4.21

Timebase setting

In this paragraph you will see how to set oscilloscope´s time range, e.g. the amount of time displayed in the main window (Figure 4.3). This parameter is the same for all the channels. On Figure 4.22 a window with actual timebase settings is displayed.

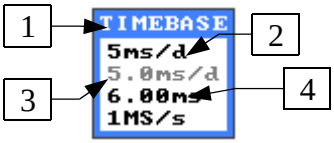


Figure 4.22

Time resolution (1)

Here you can see the oscilloscope´s currently set time resolution value. You can change it by pressing up or down keys, F2/F3 hotkeys (Figure 4.23), the icons next to them on the touchscreen, or by selecting the desired value in the menu bar in range from 1µs/square to 5s/square.

Figure 4.23 **Figure 4.24**

Time resolution in the magnifying glass mode (2)

If the magnifying glass mode is activated, you can see here the the time resolution for current enlargement. This will be described more in the Magnifying glass paragraph.

On the Figure 4.25 you can see the same signal in various time resolution.

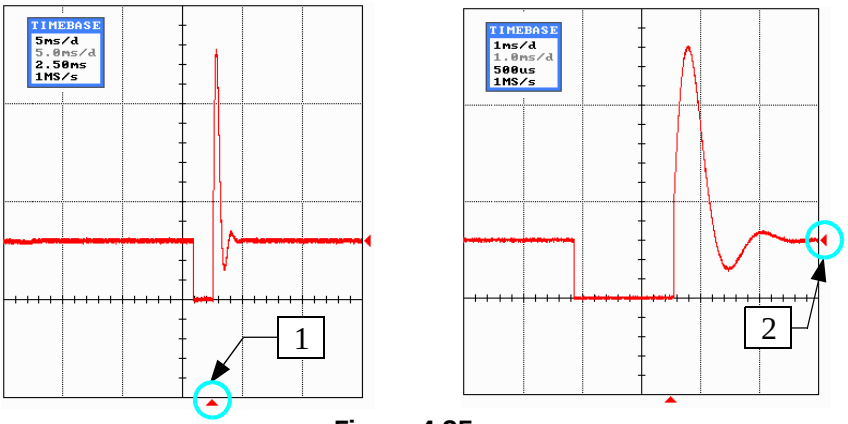


Figure 4.25

Pretrigger (3)

Actual pretrigger value, e.g. signal display length before the starting condition (see Appendix B) is displayed here. You can set the pretrigger using either the left/right keys or by moving your finger on the touchscreen left or right. The current pretrigger setting is marked by an arrow on the bottom of the screen (Figure 4.25 - 1). You can set the pretrigger in the central (zero) position by pressing F4 key (Figure 4.26).*Sampling frequency (4)*

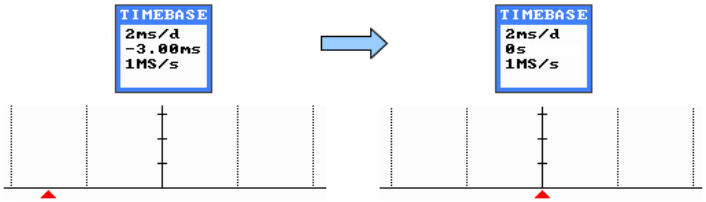


Figure 4.26

This value is only informative and depends on timebase setting.

Trigger setting

On Figure 4.27 you can see a window informing about individual settings of the Trigger setting. This setting is shared between all channels.

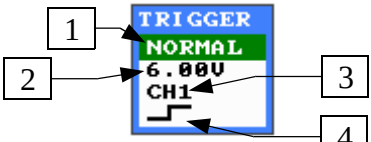


Figure 4.27

Trigger modes(1)

Here you can see the current trigger setting. You can choose from four modes: AUTO, NORMAL, SINGLE and FREE (Figure 4.29). These modes can be chosen by pressing F2 and F3 keys, the icons next to them on the touschscreen or in the menu bar (Figure 4.28). The FREE mode is special - it is set automatically if the time resolution is set to 100ms/square or higher and only in this mode you can record the signal; see paragraph Signal recording

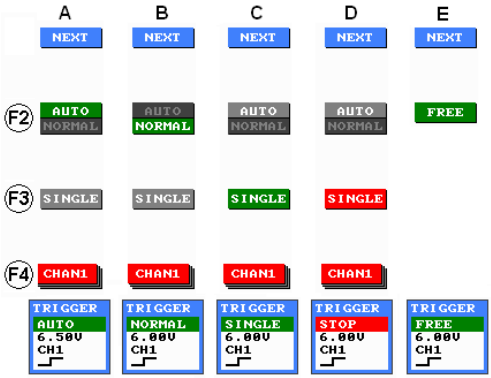


Figure 4.28

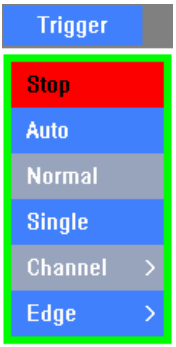


Figure 4.29

Figure 4.30

Displaying of the waveform starts only if the starting conditions are met in the NORMAL and SINGLE modes. If the condition is not met there is a sign "waiting for trig" in the upper right corner of the main window (Figure 4.30). When the condition is met displaying of the waveform starts immediately in the NORMAL mode. In the SINGLE mode the measurement will be displayed just once when the condition is met and then the measuring stops. To run the measuring again, e.g. to wait again for the starting condition press the F3 key or the Enter(ON) key. The influence of the trigger mode on the displayed waveform is described in the Glossary.

Signal triggering level (2)

Here you can see the current trigger value, e.g. the value which the signal has to exceed for the measuring to start. You can set this value using the up/down keys oe by swipying your finger up or down on the screen. The current trigger value is also displayed graphically by an arrow on the right side of the screen (Figure 4.25). It is important to set this value properly for the measuring to start in the modes NORMAL and SINGLE!

Triggering channel (3)

The number of the channel which is used for triggering is displayed here. You can change it by pressing the Left key (Figure 4.32), by the hotkey F4 or by selecting the desired item in the menu bar (Figure 4.31). The color of the trigger and pretrigger arrows match the color of the chosen channel.

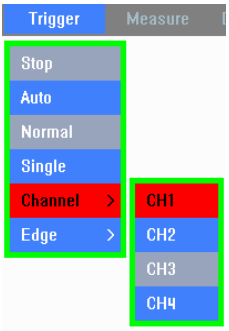


Figure 4.31

Figure 4.32

Trigger edge setting (4)

Here you can see the currently set type of the trigger edge, which can be either falling or rising. You can choose which one starts the measuring by pressing the Right key or by selecting a corresponding item in the menu bar (Figure 4.33). The Figure 4.34 shows triggering by a rising edge and the Figure 4.35 shows triggering by falling edge.

Figure 4.33

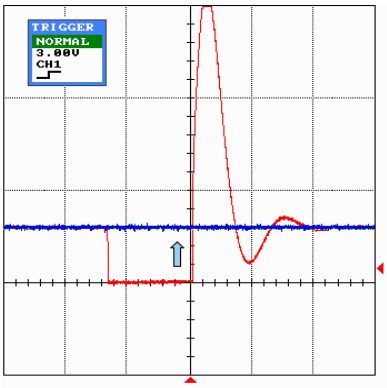


Figure 4.34

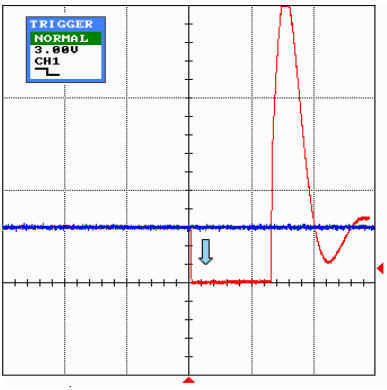


Figure 4.35

Main window for displaying waveforms

This paragraph describes the main window´s properties (Figure 4.3 - 3). We will show you some waveform display options and functions, e.g. time and voltage measurement and a magnifying glass.

You can change the display mode in the menu bar (Channel -> Display; Figure 4.36) by selecting the desired item.

Now we will show you the individual displaying options using examples.

Figure 4.36

- *1 grid:* All the waveforms are displayed in one window (Figure 4.37). This mode is set as default.

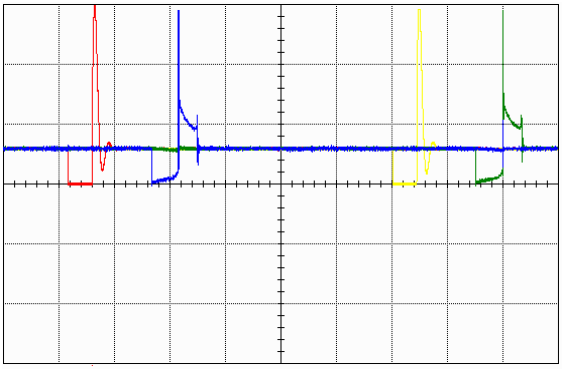


Figure 4.37

- *2 grids (1-2 3-4):* The main window is divided into two halves, where there are two waveforms displayed in each of them. In the first window there are waveforms 1 and 2 and in the second one 3 and 4. (Figure 4.38)

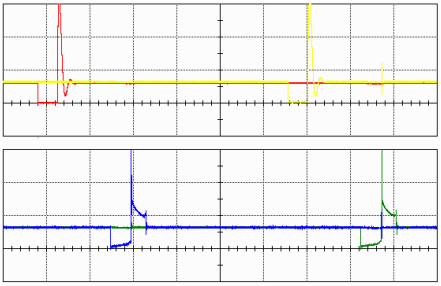


Figure 4.38

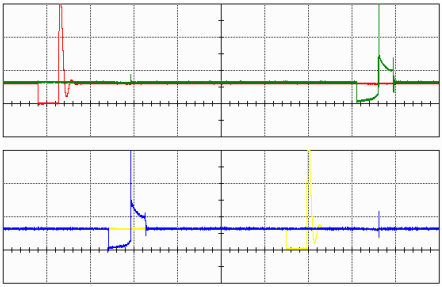


Figure 4.39

- *2 grids (1-3 2-4)* : This mode is the same as above, but in the first window you can see channels 1 and 3 and in the second one channels 2 and 4 (Figure 4.39)
- ***4 grids***: Every channel is displayed in it´s own window (Figure 4.40).

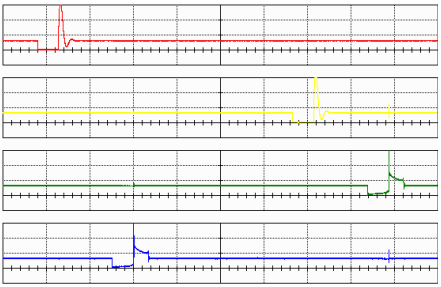


Figure 4.40

- ***Full grid***: The area for displaying positive and negative parts of the signal is the same. The zero axis is in the middle of the screen (Figure 4.41). This mode is set as default and is common for all windows.

- ***Half grid***: This mode is suited for a more precise analysis of positive signals as it has it´s positive part doubled and the negative part not visible (Figure 4.42). If there is more than one window displayed this mode is common for all windows.

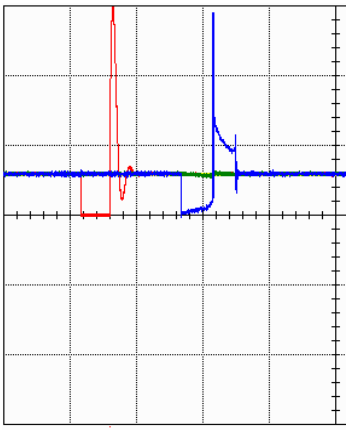


Figure 4.41

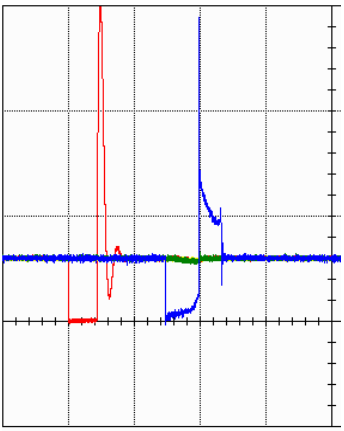


Figure 4.42

- ***Color scheme***: Here you can change between 3 available oscilloscope background colors (Figure 4.43).

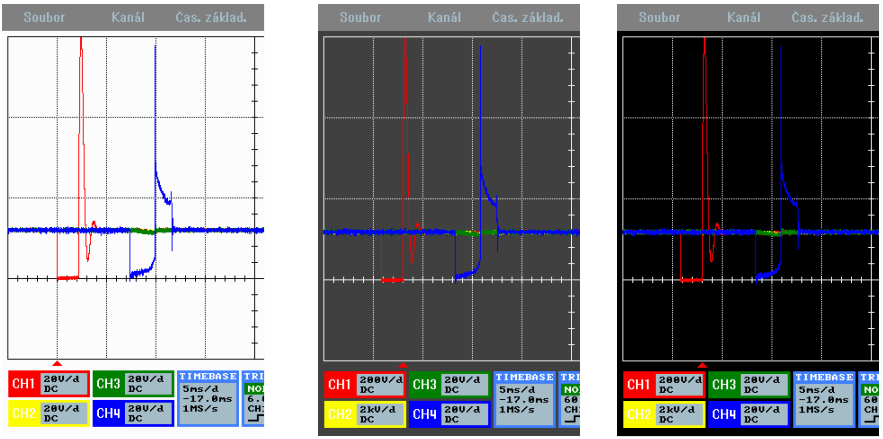


Figure 4.43

Measuring cursors

You can use measuring cursors to measure time periods or voltage levels on the displayed waveform. To turn on this function either find the

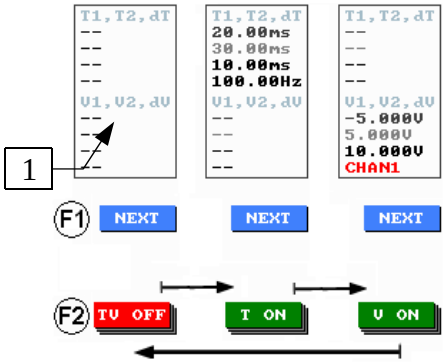


Figure 4.44

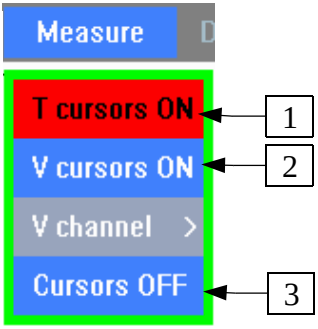


Figure 4.45

corresponding item in the menu bar (Fig. 4.45 - 1 or 2) or press the section one (Fig. 4.44) and then press the F2 key. You can turn the cursors off by pressing the F2 key or the button next to it on the screen multiple times and selecting the option TV OFF (Fig. 4.44) or in the menu bar by selecting Measuring -> Cursors OFF (Figure 4.45 - 3). If the cursors are turned off displaying of measured values of time and voltage is also disabled (Figure 4.44 – 1).

Time measurement – Time cursors

You can turn this function on by pressing the corresponding item in the menu bar (Fig. 4.45 - 1) or by pressing the section A (Fig. 4.44) and then press the F2 key or the button next to it. After activating you can see two vertical lines (Fig. 4.46) which represent the time cursors. You can move them on the screen and measure desired time periods of the displayed waveform. Measured values are displayed in the upper right corner of the screen (Fig 4.47 - 1). The first displayed value represents the T1 cursor, the second one represents the T2 cursor, the third one is the difference between T1 and T2 and the last one is

the difference converted to frequency.
The cursors can be moved either by the left/right arrow keys or by moving your finger on the screen. You can choose which of the cursors move by pressing the F2 key or by clicking the icon next to it (Fig. 4.47)

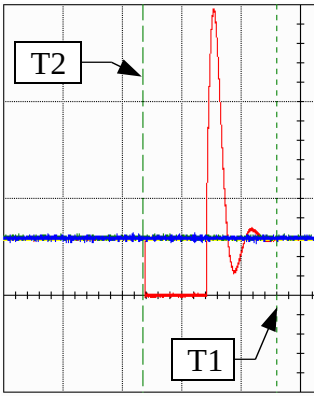


Figure 4.46

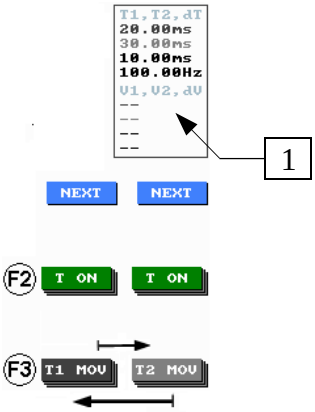


Figure 4.47

Voltage measurement – voltage cursors

If the voltage measurement function is activated, you can see two horizontal lines in the main window (Fig. 4.49) representing the voltage cursors. You can move them on the screen and measure desired voltage levels or differences. Unlike the time cursors the voltage cursors are set for only one channel, because every channel can have different voltage range. Measured values can be found in the upper right corner of the window (Fig. 4.50 - 1). The first value corresponds to the V1 cursor, the second on to the V2 cursor, the third one is the

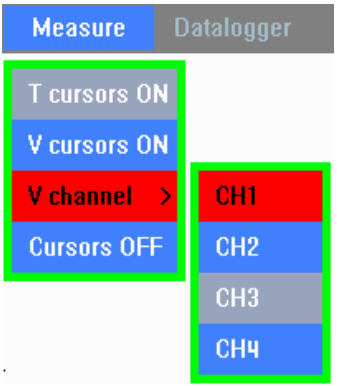


Figure 4.48

difference between them and the last one shows to which channel the cursors correspond. You can move individual cursors by pressing the up/right keys or by moving your finger on the screen up/down. You can select the cursor which you want to move by pressing the F3 key repeatedly or by touching the button next to it (Figure 4.50). You can select the channel which you want to measure by pressing the F3 and F4 key; select the cursor to be set by pressing the F3 key or by touching the button next to it and then select the channel by pressing the F4 key, or by selecting the corresponding channel number in the menu bar: Measuring -> V channel (Fig. 4.48 - 1).

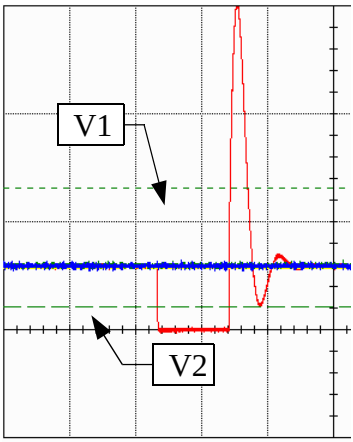


Figure 4.49

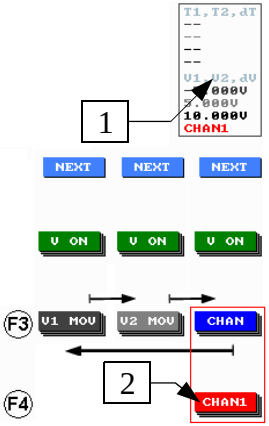


Figure 4.50

Magnifier (zoom)

Magnifier (or zoom) is one of the most used functions for waveform viewing. You can enlarge the waveform only if the measurement is stopped either by pressing the **Back (off)** button or by clicking the **Stop** icon in the **Starting** menu.

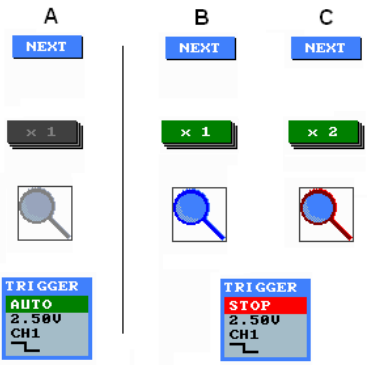


Figure 4.51

When measurement is running the magnifier function is disabled (Fig. 4.51 - A); if you turn the measurement off, the magnifier function is enabled and you can enlarge the waveform (Fig. 4.51 - B, C). If you turn on the magnifier you can enlarge the displayed waveform by pressing the F2 key or the icon next to it. Current magnifying ratio is indicated by a sign on the icon next to the F2 key (Fig. 4.52). If the zoom is more than 2x, a scrollbar, indicating which part of the screen is currently shown, appears on the bottom of the screen. You can move around the zoomed waveform either by moving your finger on the screen or by pressing the arrow keys right/left.

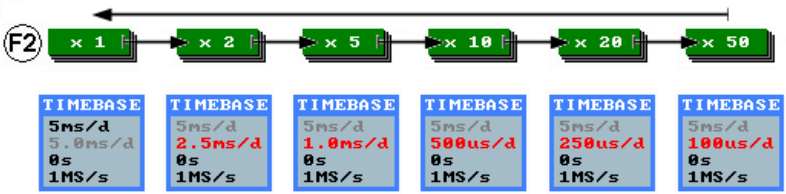


Figure 4.52

On Figure 4.53 you can see a waveform in two different enlargements - 2x on the left and 5x on the right.
The Magnifier function is deactivated by starting measurement again. After you turn it off the displayed waveform returns into it´s original position.

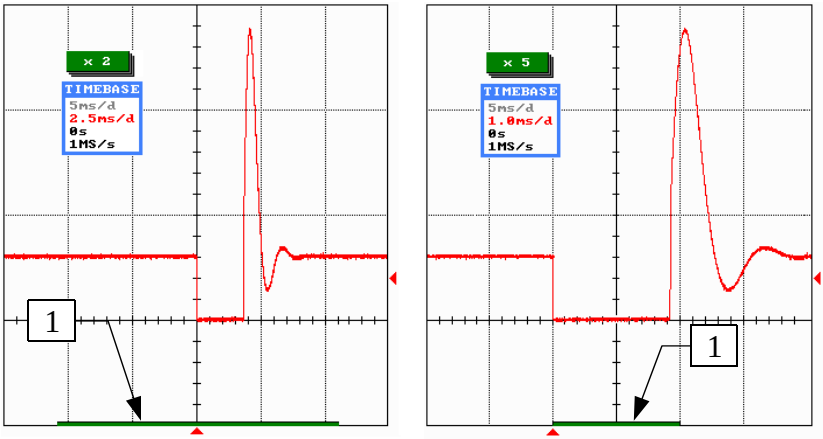


Figure 4.53

Datalogger (Data recording)

Figure 4.54

An another very useful function of the TSPro´s oscilloscope is **Logger** (data recording). With this function you can record and browse through logged waveforms of all active channels.

You can select the logging function either by finding the corresponding item in the menu bar (Logging -> Logging, Fig. 4.54 - 1) or by pressing the F1 key or the icon next to it multiple times (Fig. 4.55 - A or B).

*The program **Oscilloscope** provides two different methods of saving measured waveforms:*

Screenshot

If this type of measurement recording is used to record the parts of waveforms that are currently displayed. The current settings of timebase and other options is also stored for each channel. You can save the measurement this way while using any channel settings or timebase settings. The procedure is following: after pressing the SingleLog icon or the F3 key or the icon next to it the currently displayed waveforms save into a file. This type of record is used mostly for saving the detail of waveforms of individual sensors or actuators; rpm sensors, phase sensor or injection valves.

Long record

You can use the Long record mode to save longer waveforms of all channels than it is possible for the Screenshot in the longest timebase setting available (5s/square). You can even record for tens of minutes; maximum length of the record is limited by the free memory available (about 1 GB).
To save records in this mode, the oscilloscope must be in the Free mode (timebase 100 ms or more). If the oscilloscope is in an other mode, the icon will not be shown (4.55 - A).

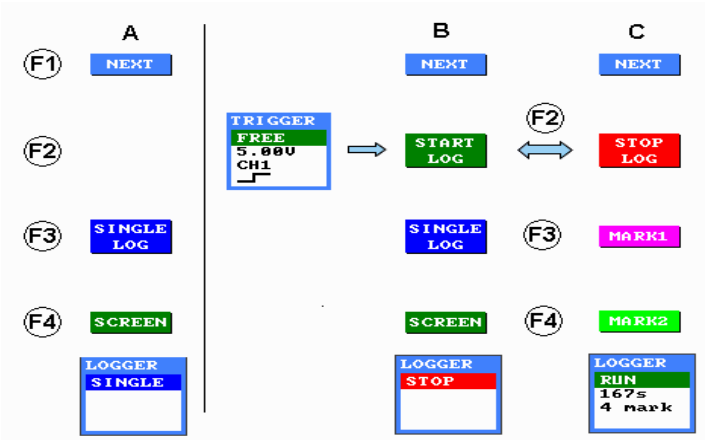


Figure 4.55

During recording you can insert marks (for example when you see a signal error). You can insert these marks by pressing the F3 or F4 key or clicking the icon next to it. The number of these marks is unlimited. You can stop logging any time by pressing the F2 key or by clicking the STOP LOG icon. The Long record function is useful especially when you have to find a fault caused by a random dysfunction of some sensor of actuator.
All information about current state of the Logging function, e.g. record type, record state, record length, number of inserted marks etc. are shown in the Logger window (Fig. 4.55 - A/B/C)

Let´s now focus on viewing saved data.

Viewing records

Selecting the desired record which we want to view is done in the menu bar by selecting Logging -> Show log (Fig. 4.56). In this section you can see a list of all saved logs. Every record contains date and time of creation.

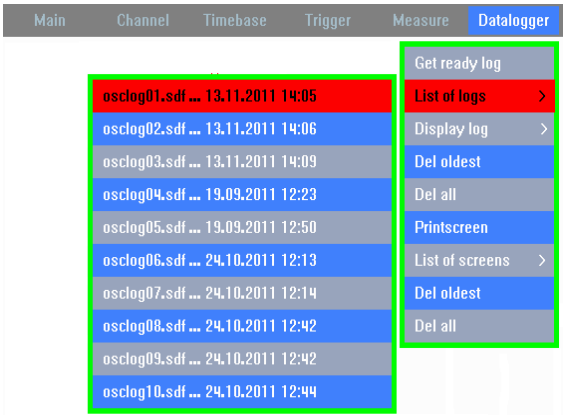


Figure 4.56

After you select the desired log using either the touchscreen or cursor keys up/down and confirming, you can see the waveform in the main window (Fig. 4.57).

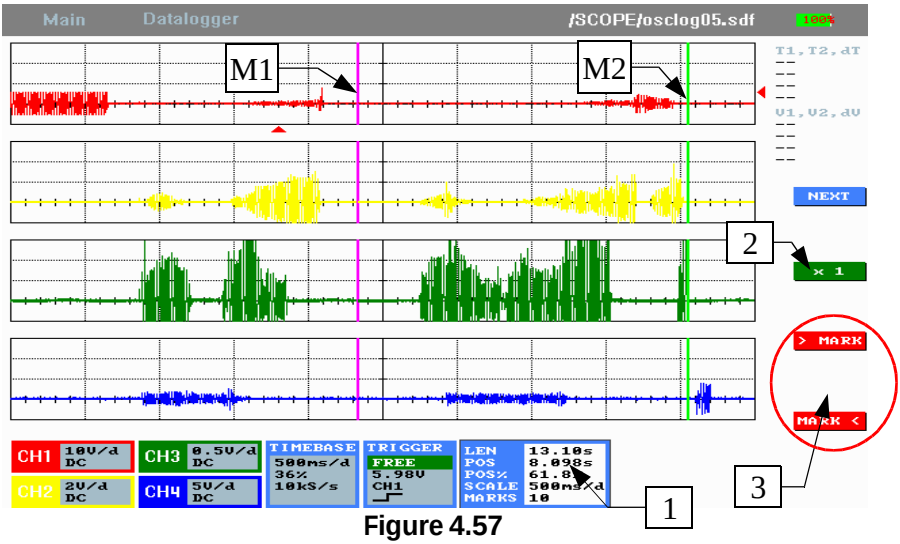


Figure 4.57

A new window with information about the record appears at the bottom of the screen (Fig. 4.57 - 1). The information in order from the top are: total record length, current position in the record in seconds, current position in the record in percents, current time resolution and the number of time marks. You can move in the record by pressing arrow keys or by moving your finger on the touchscreen left/right. Moving between time marks is done by pressing F3 and F4 keys or by pressing icons (Fig. 4.57 -3). An example of a waveform with marks M1 and M2 can be found in the same figure.

You can display the waveforms in one, two or four grids or in a half grid, as was already described. Changing the viewing options is done in the menu bar in Datalogger -> Displaying (Fig. 4.58).

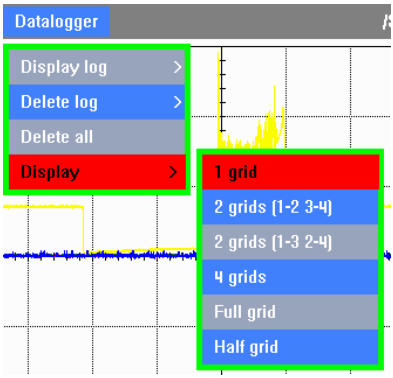


Figure 4.58

In the window with the record you can use some useful functions - the abovementioned measuring cursors or magnifier functions. Using them in the viewing record mode is the same as described above. In Figure 4.59 you can see information about the current zoom level.

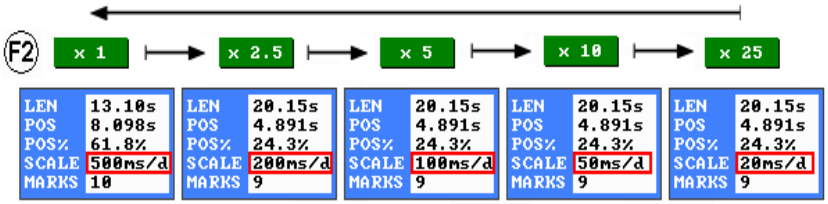


Figure 4.59

You can end viewing of a record by selecting File -> Oscilloscope (Fig. 4.60) in the menu bar; it will close log section and return to current waveforms or by selecting the File -> Close which closes whole oscilloscope application.

Deleting saved data

If you want to delete some records from your TSPro´s memory you have two opinions: you can either delete some of them by selecting Datalogger -> Delete log (1) or delete all of them by pressing Datalogger -> Delete all (2) (Fig. 4.61)

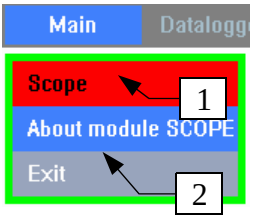


Figure 4.60

Printscreen

Another way to save currently measured waveforms is a so-called Printscreen. You can save a picture of the TSPro´s screen to a .bmp file using this function This function can be used any time regardless of the timebase setting etc. It is mainly used for saving details of actuator waveforms or sensors.

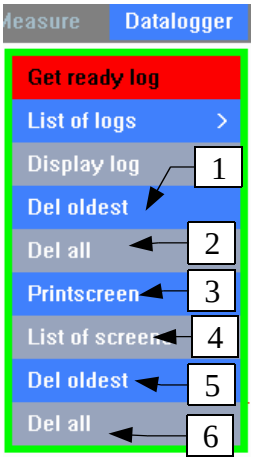


Figure 4.61

Figure 4.62

You can activate this function using either by pressing Datalogger - Printscreen (Figure 4.61 - 3), or you can press the **F1** key or the button next to it on the screen until a **SCREEN** icon appears next to the **F4** key (Figure 4.62) - then a picture of the screen is saved every time you press the F4 key or the button next to it on the screen.

Viewing saved pictures

You can browse trough pictures saved in the TSPro´s memory by choosing Logging - Show screen. Then a menu with saved pictures appears (Figure 4.56). Every picture is labeled with date and time of creation.

The picture appears after you select the desired one using either the touchscreen or **up/down** keys (Figure 4.63). The displayed picture is framed in red and in the upper left corner you can see a sign **BACK** = close (Figure 4.63 - 1). You can end viewing this picture by pressing the **Back** key.

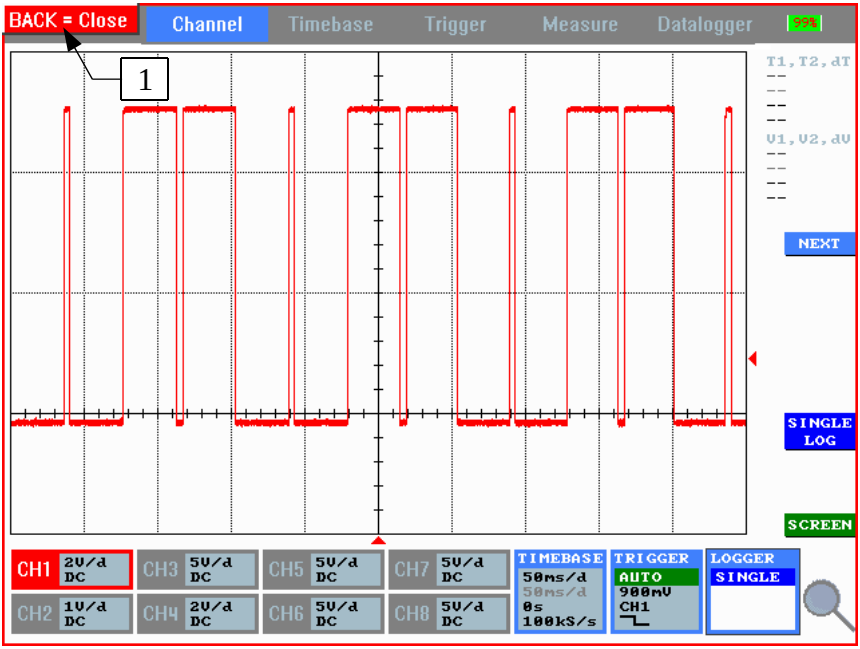


Figure 4.63

Deleting saved pictures

If you want to delete saved pictures you have two opinions: you can either delete all of them by pressing **Datalogger - Delete all** (6) in the menu bar, or if you want to delete only one, press **Datalogger - delete screen** (5) (Figure 4.61).

Warning:

The device´s memory is limited and is not primarily designed for archiving data. The maximal number of stored items of each type is ten, and, of course, it is limited by device´s free memory. If the maximal number of items is exceeded or if there is no free memory left, the oldest item is deleted and the new record is stored in this freed memory. If you want to archive the stored items, transfer them to your PC using PCCenter Archive (will be described in following chapters).

Voltmeter

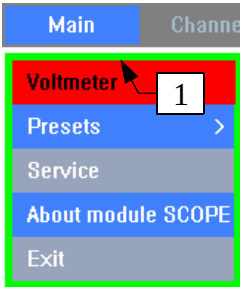


Figure 4.64

An another Scope application´s mode is the Voltmeter. It is used to measure voltage between each channel and the ground (frame) or to measure differences between any two channels. You can start this mode by choosing Main - Voltmeter in the menu bar (Figure 4.64 - 1). When it is started you can see a desktop (Figure 4.64 - 1) where the measured values are displayed and all the application´s parameters are set.

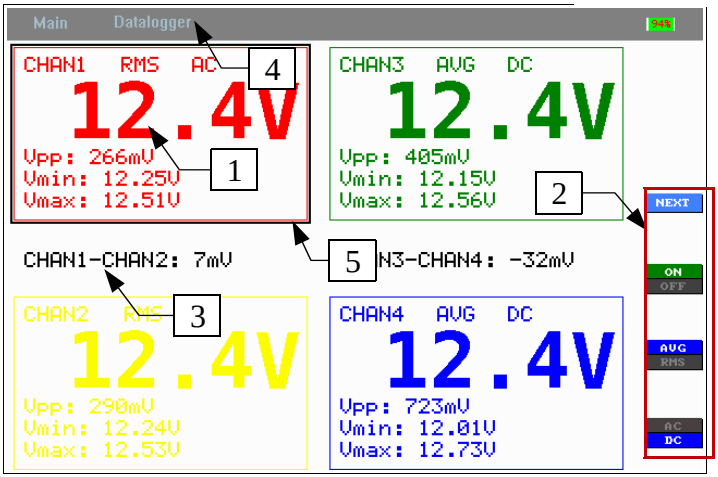


Figure 4.65

1. A window for displaying measured values and each channel´s settings
2. Fast setting of each channel´s parameters
3. Shows the difference between channels
4. Menu bar
5. Marking desired channel

Measured values window

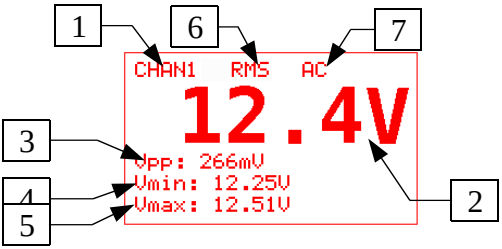


Figure 4.66

Channel number (1)

- *Here you can see the number of the channel to which this window refers. Color of the window and the text matches channel´s color.*

Voltage value(2)

- Currently measured voltage value is shown here.

Peak-to-peak voltage (3)

- Difference between maximal and minimal measured voltage.

Minimal voltage (4)

- Minimal voltage measured during one delivery

Maximal voltage (5)

- Maximal voltage measured during one delivery

Effective/ average value (6)

- This symbol shows whether an average (AVG) or effective (RMS) value is measured.

Signal type (7)

- Here you can see whether direct current (DC) or alternating current (AC) is measured.

Measuring parameter settings

You can set measuring parameters using **F1 - F4** keys or the buttons next to it (Figure 4.67), but only on one selected channel (the framed one, as on Figure 4.65 - 5). The desired channel is selected by clicking on it on the touchscreen or by pressing the F1 key repeatedly.

Figure 4.67

F2: Turn measuring on/off

F3: Switching between average (AVG) or effective (RMS) value

F4: Switching between direct (DC) or alternating (AC) current

Range of measurement is set automatically according to input voltage. After turning on or disconnecting measured voltage the maximal range (300 V) is set.

Printscreen

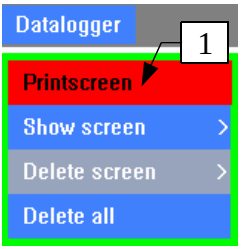


Figure 4.68

You can save measured values within the Voltmeter application using Printscreen. It is used the same way as mentioned above; press **Datalogger - Printscreen** in the menu bar and a picture of what is currently on the screen saves in the TSPro´s memory.

Exit

You can exit the Voltmeter application by pressing Main - Oscilloscope (Figure 4.69) in the menu bar and continue viewing waveforms or by pressing Main - Exit to exit the whole Oscilloscope application.

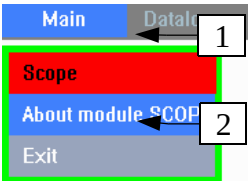


Figure 4.69

Quick oscilloscope mode presets

This function contains two mostly used types of setting that can be changed quickly. One for fast signals (injectors, ignition etc.) and one for slow signals (MAF sensors, lambda probes etc.). It can be changed by pressing Main - presets – Fast signals / Slow signals. When one of them is used all oscilloscope parameters change according to it.

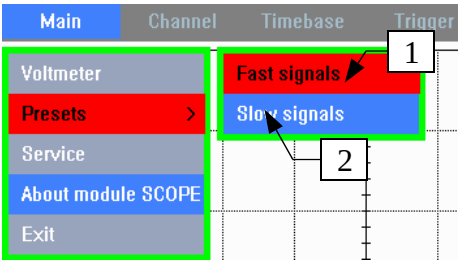


Figure 4.70

FAST:

1 grid, whole grid, 5ms/sq, 5V/sq, DC coupling on all channels, AUTO mode

SLOW:

4 grids, half grids, 1s/sq, 5V/sq, DC coupling on all channels, FREE mode

Exit

You can exit the Oscilloscope application by pressing Main - Exit (Figure 4.71). Current measurement setting, e.g. timebase, type and number of grids, colour scheme etc. is saved. When you run the Oscilloscope again, the same setting is used.

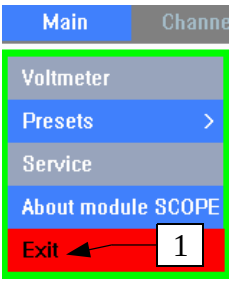


Figure 4.71

5

PC Center

This chapter describes the TSPro PC Center programe for MS Windows operating system. This program is a part of the TSPro diagnostic device. It allows you to perform Serial and parallel diagnosis with all the comfort a personal computer provides; great graphic display, memory for saving more data, printing graphs and protocols, data archiving and using service manuals.

MainBar

The PC Center program consists of 3 applications: TSdiag for serial diagnostics, TSScope for paralell diagnostics and TSarchive for managing saved serial or oscilloscope measurements. All these applications can be started easily using an application bar called MainBar (Figure 5.1) which is displayed after starting the TSPro PC Center program. You can run desired application by clicking on it ´s icon: TSDiag - 1, TSScope - 2, TSArchive - 3. Following paragraphs describe these applications in detail.

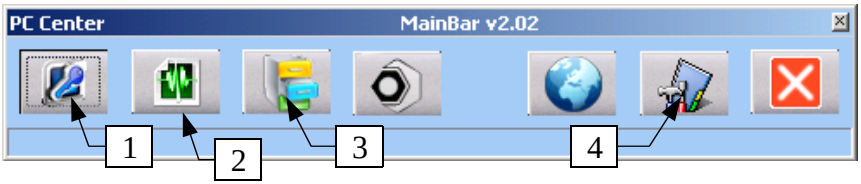


Figure 5.1

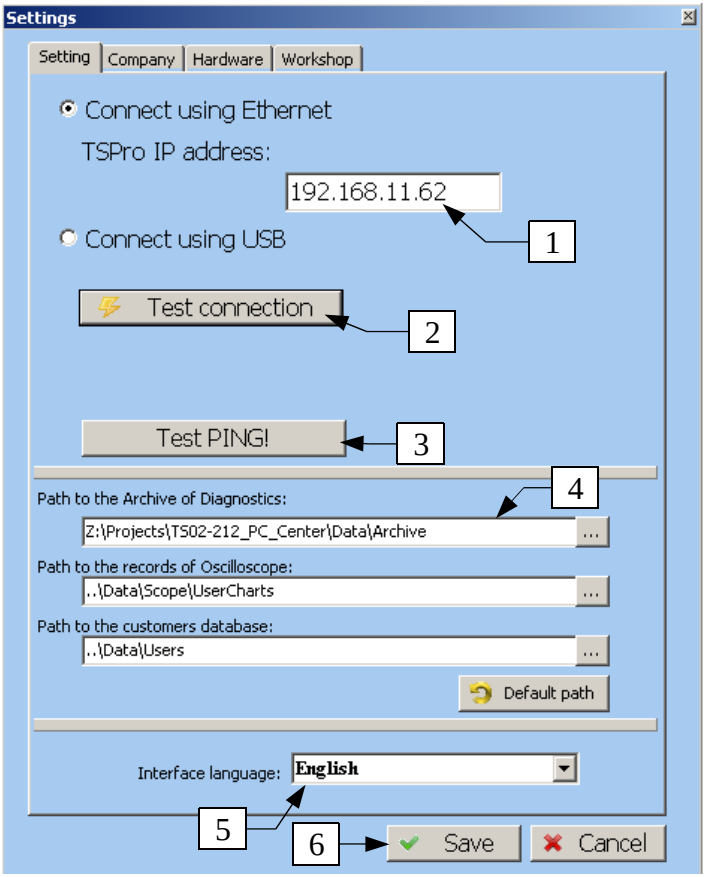


Figure 5.2

TsPro Pc Center Setting

The MainBar is used not only for starting desired application, but also for overall setting. By clicking on the Settings (4) icon a window (Figure 5.2), where all the important settings are done, appears. In the first tab you can set the device´s IP address, perform a connection test, change the language and more. The second one allows you to change the user´s initials; a short company info is printed in the heading of every protocol.

The most important item of the settings is the device´s IP address (Figure 5.2). You must set the same address which is already set in the device in Settings - device´s IP address (Figure 5.3).

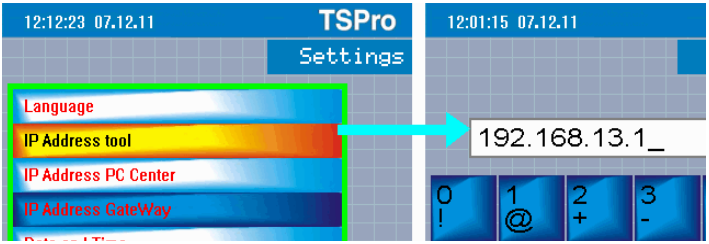


Figure 5.3

If the IP address is set and the TSPro device is connected to the PC, we have to test the connection. Click on the corresponding icon: the result can be either **Connection OK** (Figure 5.4) or **Connection error** (Figure 5.5); if so, you should check the IP addresses, network adapter in your PC and also physical connection (cables, ports).

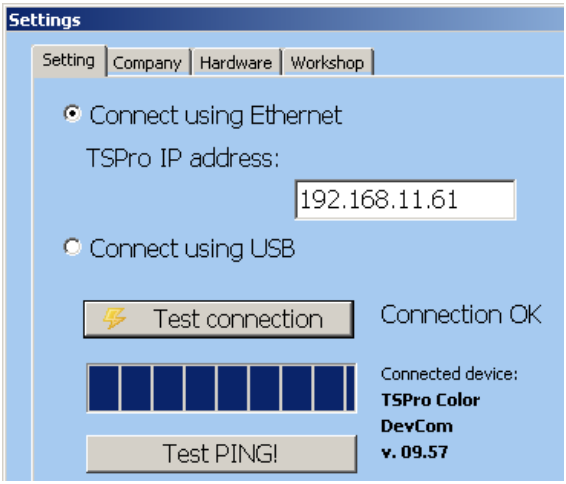


Figure 5.4

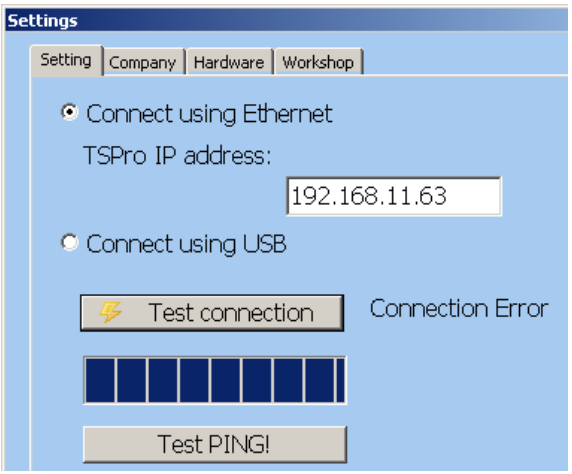


Figure 5.5

Perform the checks of device and PC connection following the instructions in Appendix B Connection to the Internet and LAN, Ip address setting.

Another parameter to set is location of directories where diagnostic reports are stored. There are three directories for diagnosis reports, oscilloscope measurements and customers database. It is used by the **Archive** application, which is designed for storing records. By default these directories are in the same directory where the PCCenter is installed. If you want to change it, you can do it by clicking the icon next to the text field and by setting new place for the folder (4).
You can also change the language here (5). This applies for all apps and all texts, help etc.

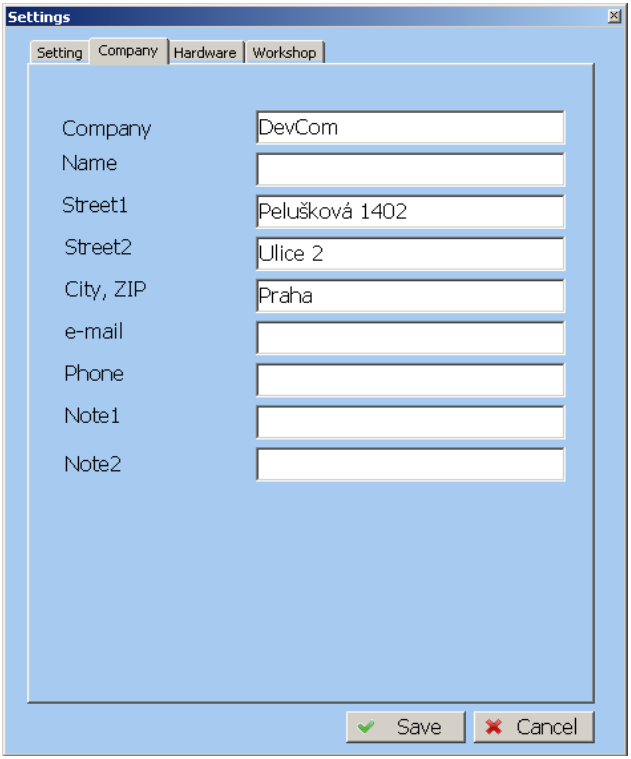


Figure 5.6

You can also set the Company info (Figure 5.6). This info is printed in heading of diagnostic protocols.
In the hardware panel (Figure 5.7) you can load or set important parameters of the TSPro device. These are network parameters, loaded SW licence status, time and date settings and so on.

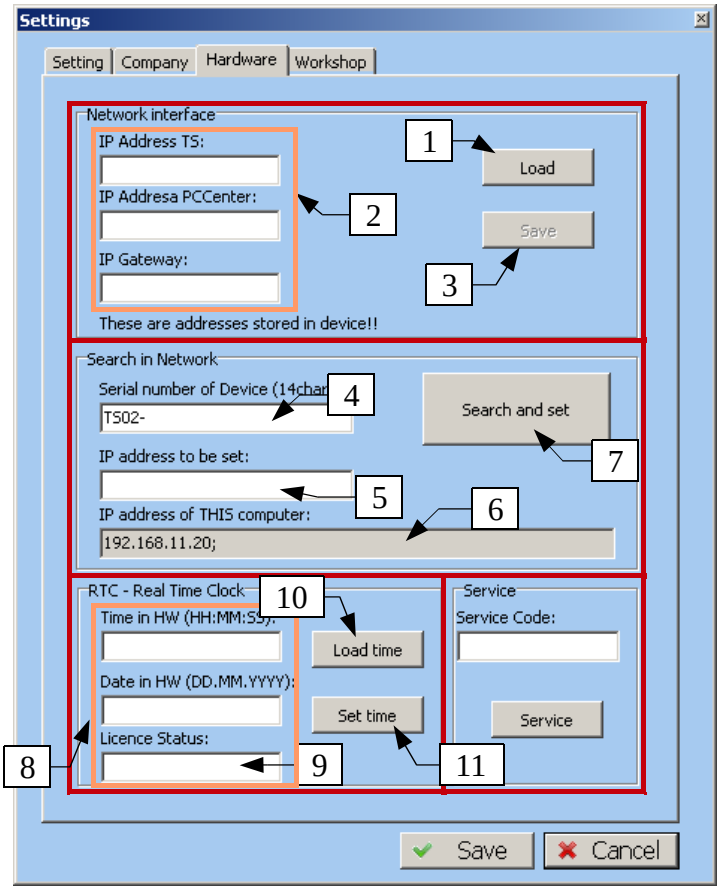


Figure 5.7

The panel is divided into several sections:

- ***Network interface:*** here you can load or change networking parameters of the device. If the device is connected to your computer correctly (Appendix F), you can load (1) and check all network parameters saved in the device. Loaded data will appear in textboxes (2). If you change them, you can load them in the device by clicking the Save button (3). The setting is applied after restart of the device.

WARNING! Incorrect setting can cause loss of connection!

- ***Search in network:*** You can use this function to find a TSPro device in your network and set it´s IP adress to work properly. Fill the TSPro´s serial number in the textbox (4) and the desired IP adress of in the textbox (5). The IP adress of your computer can be found in textbox (6).
- ***RTC – Real Time Clock:*** using this item you can set the time and date in the device. After clicking the Load time button (10) you can see and change the values in the area (8). You can load them into the device by clicking the Set time button (11). Also, if you load the time and date, you check your device´s licence remaining time (9). And again, this can be done only if the device is connected to your computer properly.
- ***Service:*** this item is intended to be used by the manufacturer only.

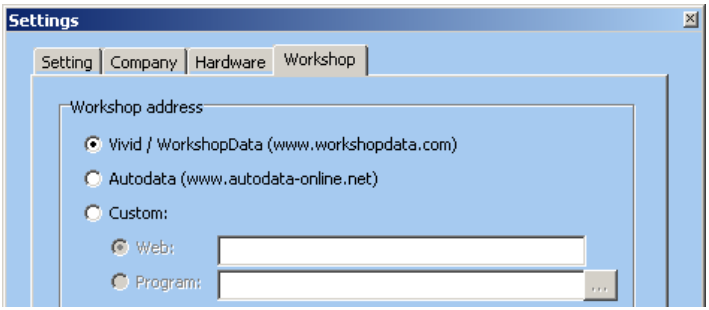


Figure 5.8

The Workshop panel (Figure 5.8) is used for workshop manuals easy access setting. The user can choose between two preset web addresses - www.workshopdata.com and www.autodata-online.net. If you wish to use other webpage or even a program, select Custom. When you have made desired changes, press Save. You can use the cogwheel icon to access the webpage or program.

6

PC Starter

In previous chapters you have learned how to use the TSPro device. In this chapter we´ll show you how to diagnose with the TSPro PC Center.

Now you will learn how to do common diagnostic procedures, e.g. memory readout and clearing, reading parameters, actuator tests and many more. If using of the functions varies depending to the manufacturer, it will be described. There is usually a lot of differencies when diagnosing VW-group vehicles, so we will focus on them in detail.

First steps

When the TSPro PCCenter program has started, you can see the main window called MainBar. To run the TSDiag module, press the rightmost button (Figure 6.1).

Figure 6.1

Now you can see the initial screen of the TSDiag application (Figure 6.2).

Figure 6.2

Vehicle diagnosing

We have to choose the vehicle´s manufacturer on the initial screen (Figure 6.2). If you choose the EOBD/OBD2 protocol, you can perform basic diagnosing which is supported by all manufacturers. The EOBD/OBD2 protocol is described in detail in Appendix A.
After the manufacturer is selected, you have to choose the vehicle type (1), control unit type (2) and control unit system (3) in the list.
In the upper right of the window you can see the diagnostic socket location (5) and down on the screen the cable needed (5).

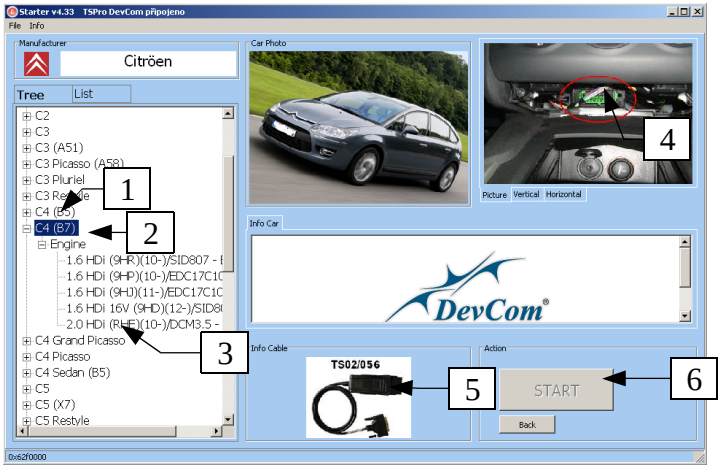


Figure 6.3

If the type and system of the control unit is selected and confirmed by clicking the START button (5), a dialog window (Figure 6.4) telling us to turn the ignition on appears. In the upper part of the screen you can see information about selected diagnostic device (1).
You have to start connecting procedure after turning on the ignition and clicking the corresponding button (2). Then, if the connection was successful, a Diagnostic menu appears (Figure 6.5). The actual Diagnostic menu may vary depending on the system type, manufacturer or year of manufacturing. In the following text we will describe individual diagnostic function that may appear.

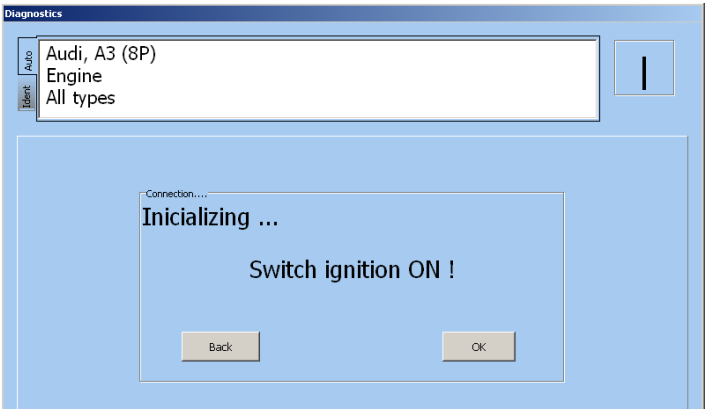


Figure 6.4

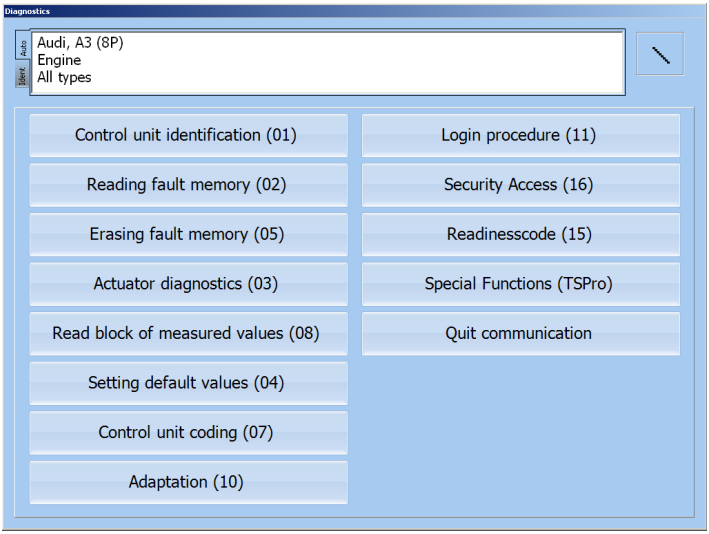


Figure 6.5

Control unit identification

In this unit (Figure 6.6) you can see basic control unit info, e.g. it´s type, manufacture number, manufacturer, program version etc. The list can be different in different control units. You can exit this menu, as well as any other, by clicking on the button in upper right corner (Figure 6.6 – 1).

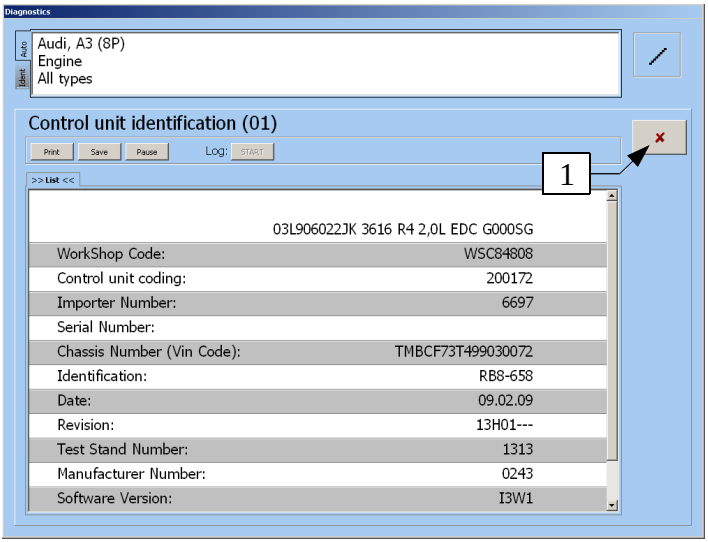


Figure 6.6

Reading fault memory

After confirming this option the device loads list of faults saved in the control unit´s memory, and displays them, if there are any (Figure 6.7). Warning - in real cases the number of faults may vary! Individual items contain a sequential number/number of faults (1), fault code (2) and the text description itself (3).

After the list loads you can save it, print it or copy to clipboard. All these options can be found in a box on the right side (4).

You can mark a saved list with your notes for better identification (Figure 6.8). To save the note, press OK.

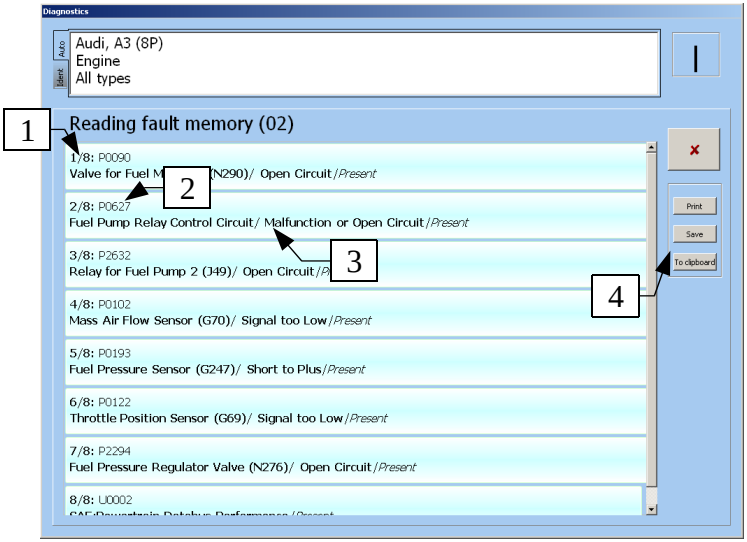


Figure 6.7

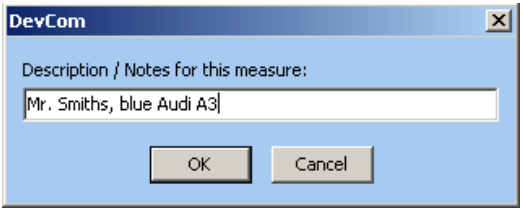


Figure 6.8

Erasing fault memory

In the previous paragraph you have learned how to read the fault memory. No we will show you how to delete it. Remember that the fault memory can be erased only if it has been read previously! After you select the corresponding item in the Diagnostics menu, a window asking for permission to erase it appears (Figure 6.9).

The memory erases by clicking the YES button (1), the NO button returns you to the Diagnostics menu.

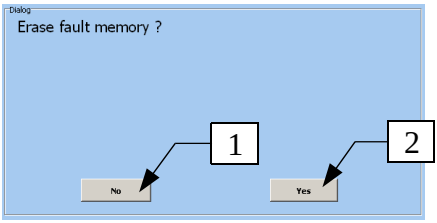


Figure 6.9

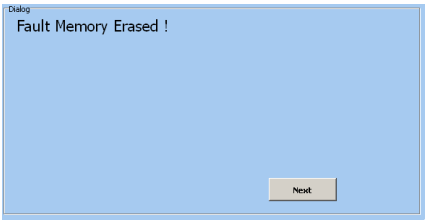


Figure 6.10

If the memory was erased successfully an informational window appears (Figure 6.10). By clicking the Next button you return to the Diagnostic menu.

System parameters

You can browse measured parameters in this menu (Figure 6.11). For example, in engine control unit you can find battery voltage, vehicle speed, intake air temperature, rpm, throttle etc. For detailed information on particular items see service manual of the diagnosed device.

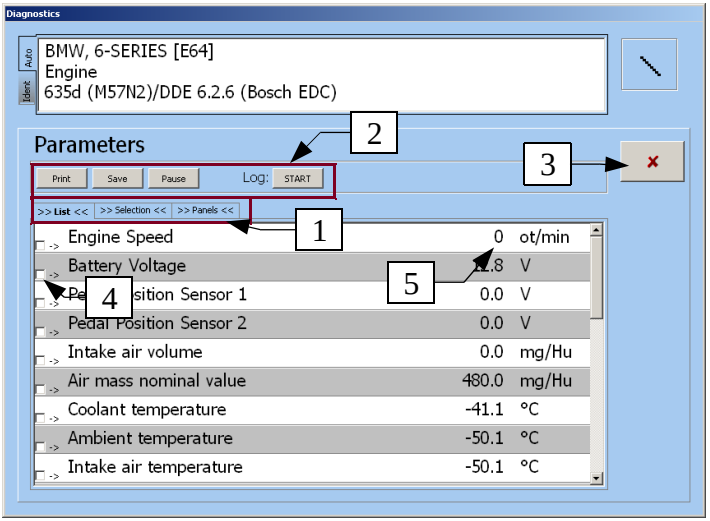


Figure 6.11

Using this function you can see all parameters supported by the control unit (Figure 6.11). To scroll the window up or down, press the arrows on the right

next to the scrollbar. A simple graph (6) and a minimal, maximal and average value (5) appears after checking a checkbox (4) next to any parameter.

You can save the list using the Save or Start buttons in the bar above the parameters (2), or a Print button to print it, or a Pause button to pause it.
The difference between saving the parameters using Save or Start icon is:

- If you press the Save button a list of currently displayed parameters with current value. The procedure is the same as when you save the fault memory (see Reading fault memory).
- Pressing the Start button starts logging (long-time parameter record). All displayed values are saved to a file; the size is limited by computer´s free memory.

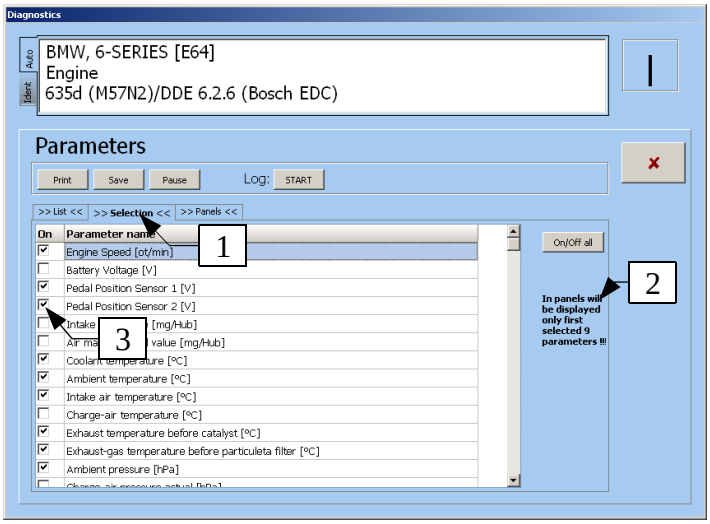


Figure 6.12

Sometimes you may want to watch only particular parameters. In this case you can make your own list of parameters by clicking the Parameter select tab (Figure 6.12 - 1) and checking desired parameters. Using the On/Off button you can check or uncheck all the parameters.
Another useful feature is displaying parameters on panels. This type of

displaying can be started by pressing the Panels tab (Figure 6.13 - 1). Maximum number of displayed parameters is 9, if you have selected more than 9 parameters only the first 9 of them are displayed. If there are less than 9 parameters selected the remaining panels are filled with dashes.

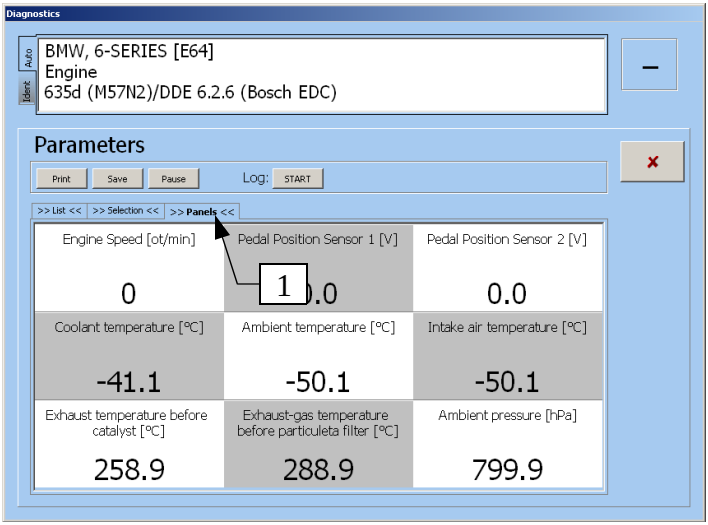


Figure 6.13

Read block of measured values

This function is a variation of the previous one and is designed for displaying measured parameters. This function can only be found in VW-group vehicles, e.g. Audi, Seat, Skoda and Volkswagen.

We can measure up to four independent parameter groups (G1 - G4) at once in the Read block of measured values mode (Figure 4.14), where every block contains up to four parameters, for example G1/1, G1/2 etc. Displaying the given group is activated by ticking the checkbox (1). We can change the number in the block, thus change the 4 parameters. A simple graph (6) and a minimal, maximal and average value (5) appears after checking a checkbox (3) next to any parameter.
Selection of parameters and panel displaying is similar to the System parameters.

Detailed explanation of particular items (groups) is not a part of this text.

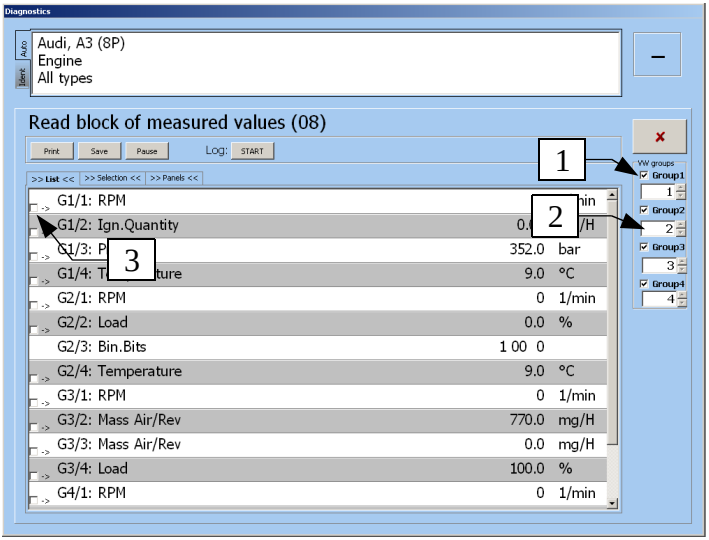


Figure 6.14

Single measured value reading

This menu is an other variant of loading measured parameters which you can find only in VW-group vehicles. It is not used in today´s vehicles; you can find it in older control units. It is used the same way as the Reading block of measured values option. All setting is done by buttons on the right side of the window.

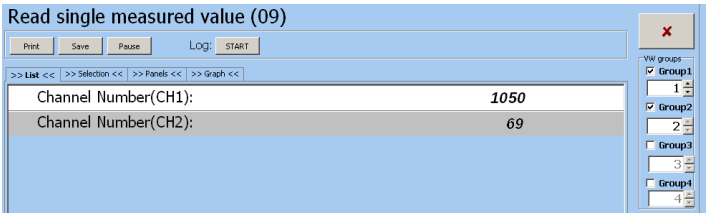


Figure 6.15

Actuators test

An other list item in the Diagnosis menu is Actuator diagnostics. Using this function you can test whether the actuators work or not. For example, you can test injectors, fuel pump relay and so on (Figure 6.16). The number of items in this menu depends on individual manufacturer and the year of manufacturing.

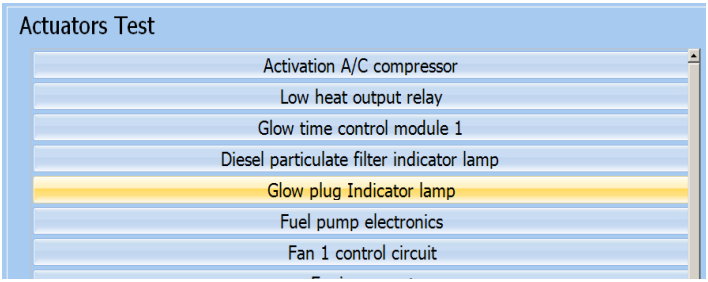


Figure 6.16

Actuator testing enables us to test the whole way from the control unit to the actuator, e.g. output circuit of the control unit, ports, cables and the actuator itself.

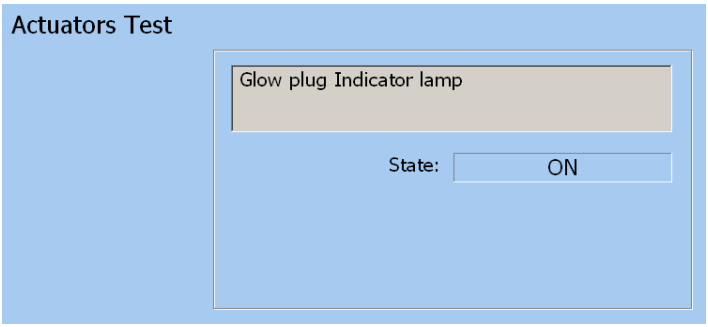


Figure 6.17

An informational window about the progress appears if any of the actuators is activated (Figure 6.17). During the test you can check the actuator´s activity visually or by hearing. The actuator test differs in the VW-group vehicles. A list of actuators does not appear if you select this function as on the Figure 6.16,

but the device sends a request and the control unit activates the actuators in a pre-programmed order, so the user only confirms start of a new test by clicking the Next button (Figure 6.18 - 1). If you send a request and the control unit has already performed all the tests a window with information appears.

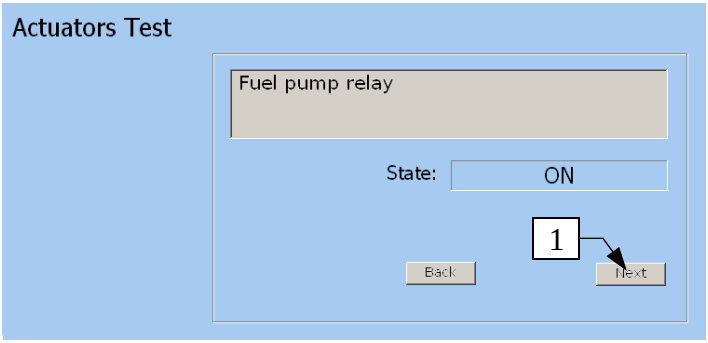


Figure 6.18

Configuration setting / Parameter setting

This item contains all functions used to set important system parameters, it´s configuration, initialization after changing parts and so on. A list of available functions of the EDC16C39 system can be found on the Figure 6.19. The actual number of items depends on current system type.

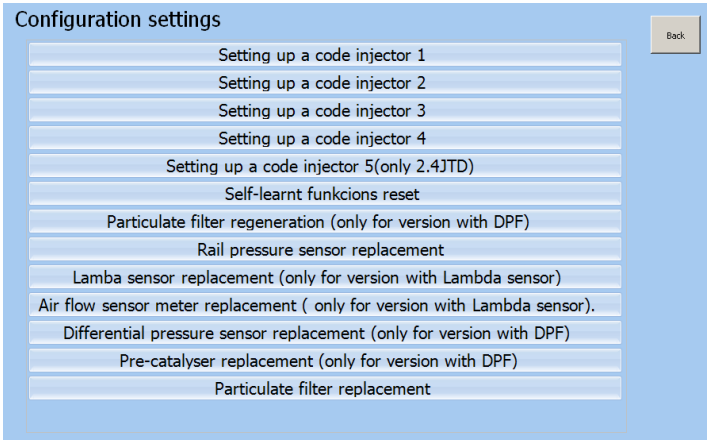


Figure 6.19

Let us now introduce some functions that you can find in this menu.

Injector coding

One of the most frequently used common-rail functions is injectors codes settings. The calibration constant contains mechanical parameters of the injector and it is necessary to edit them after every injector replacing. The length of this constant varies depending on the injector´s manufacturer and type. An example of this setting can be seen on the Figure 6.20.

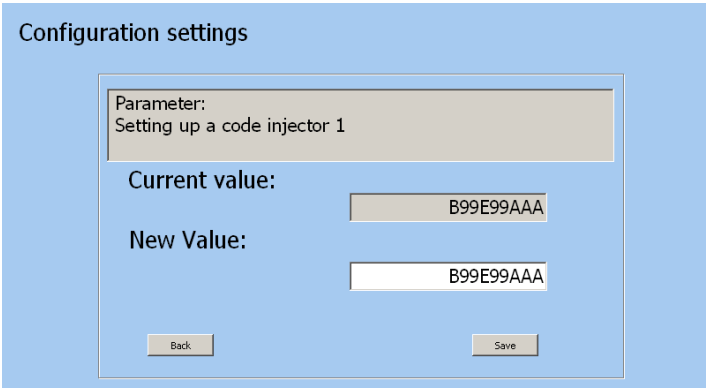


Figure 6.20

DPF regeneration

Another important function in diesel systems is diesel particulate filter regeneration. Whenever the engine is running the filter clogs and can be even blocked completely. In this cafe we have to perform regeneration. The device sends a request if we select this option and if all criteria are met (engine and exhaust temperature), the regeneration starts and may take up to 20 minutes.

Driving angle / acceleration sensor calibration

You can calibrate these sensors in the ESP system. It is important to do so when you have changed these sensors. Calibrating the driving sensor is also important after any axle servicing.

Configuration settings - airbag

Using this function we can change configuration of the airbag system, e.g. to turn on or off individual elements of the system, for example seatbelt pretensioners, passenger airbag, head airbags and so on. An example of such configuration is on Figure 6.21. If we choose a parameter, for example (1), we can change it´s value by pressing the button (2). All changed items are marked by a * (4). If you want to use these values, press the Save button (3). Now the setting is saved in the control unit. Then we recommend to turn the ignition off and on and check error memory.

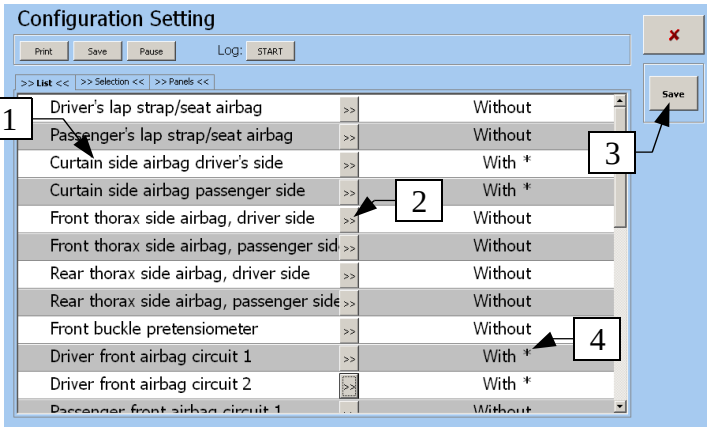


Figure 6.21

VW group and it´s differences

Now we will describe diagnostic functions which are specific for Volkswagen group vehicles.

Setting default values

This function enables returning the control unit to the original setting (Figure 6.22), which means that the adaptation data and setting is deleted. It is often used during or after throttle calibration, hydraulic ABS bleeding or xenon calibration.

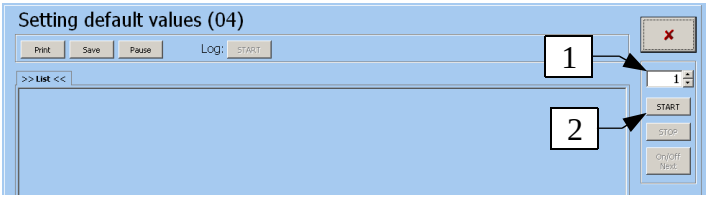


Figure 6.22

First we have to select the desired function using the icon (1) on the Figure 6.22. After you select the group, by clicking the Start (2) button you run the

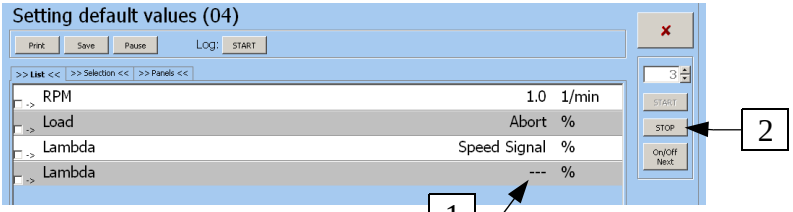


Figure 6.23

procedure. It´s status is indicated by the Status (1) value on the Figure 6.23. The state is indicated either by 1 and 0 sequence or by a sign ADP running / ADP OK. An exactly defined sequence of 1 and 0 or a ADP OK sigh indicates that the procedure is finished and we can quit it by pressing the Stop (2) button.

Control unit coding

Using this function we can input the 5-character code which defines the vehicle´s configuration (Figure 6.24), for example whether the AC or ABS is present, if manual or automatic transmission is used etc. This function is only present in VW-group vehicles.

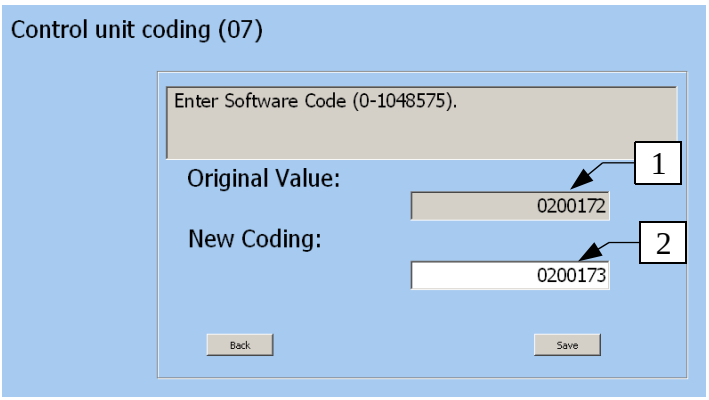


Figure 6.24

First, we have to select the desired group using the button (1) (Figure 6.22). After pressing the Start button (2) you will be asked to confirm the changes (Figure 6.25) and if you do so a result of the change is displayed (6.26).

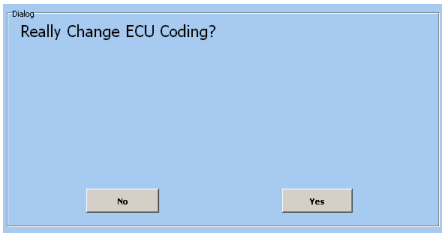


Figure 6.25

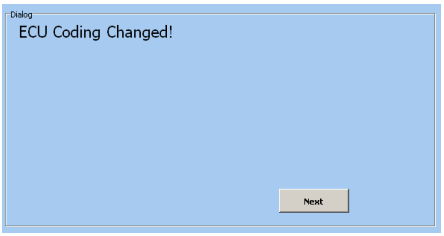


Figure 6.26

Control unit coding

Newer control units communicating via CAN protocol use Control unit coding to change it´s configuration. Using this function we can activate functions such as permanent lights, window comfort function, coming home etc.

Instead of a 5 character code a longer one (string) is used. Exact length depends on the type of the control unit; it can be up to 128 characters.

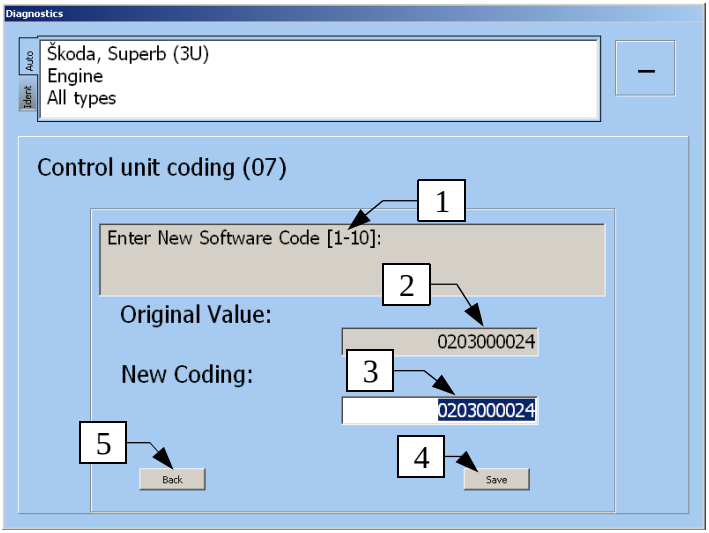


Figure 6.27

The string is divided into groups of 10 characters. You can see information about current part of the code in the upper part of the window (2 and 3). On the Figure 6.27 you can see a window with the first group of characters. If you have set the desired value (3), press the Save button and you will either be able to set the next 10 characters (Figure 6.28), in our case it is only 4 characters, or if there are no characters left you will be asked for final confirmation of the coding change (6.25) and if you do so a window with result appears (6.26). If you press the Back button during the changes, the function is aborted with no changes.

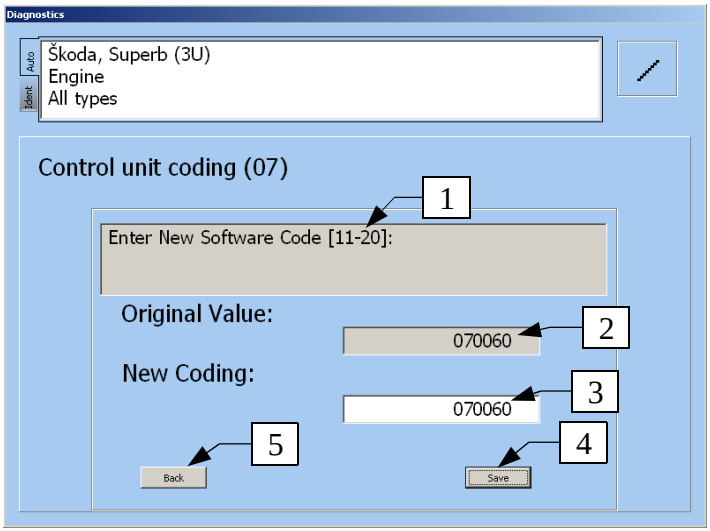


Figure 6.28

Adaptation

This function is used for specific setting (Adaptation) of control units. Using this function we can set and reset service intervals, perform an adaptation of new keys and remote controls, perform a correction of starting dose of a TDI engine, set idling RPM and so on.

An example of the procedure of changing adaptation values can be found on following pictures. On the Figure 6.29 you can see a window used for changing the channel number (1). After pressing Next button (2), a request for current channel number is send. On the Figure 3.30 you can see a window with the old adaptation value (1) as well as the one with the new one (2).
Press the Save button (3) if you have set the desired value, and you will be asked for final confirmation of the change (6.31), and if you do so a window with result appears (6.32). If you press the Back button during changing the function is aborted with no changes.

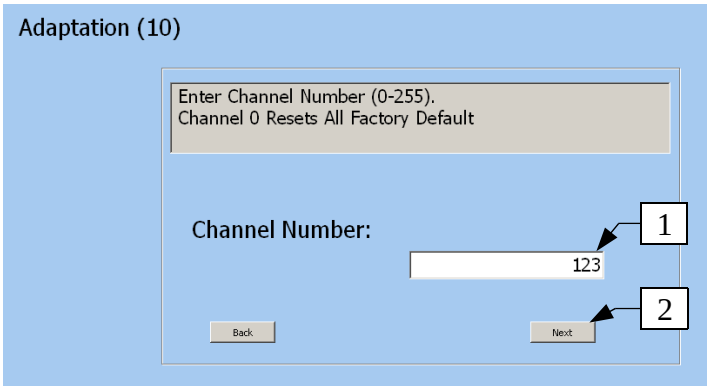


Figure 6.29

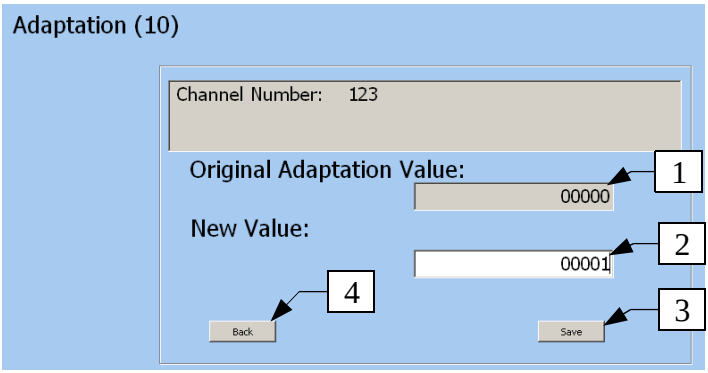


Figure 6.30

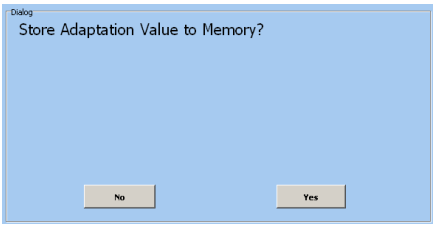


Figure 6.31

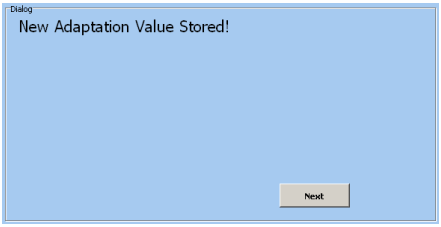


Figure 6.32

Login procedure

In some control units you have to input an authorization code/password in order to perform certain settings (changing keys etc.). This is done using the Login procedure option (Figure 6.33). After you input the password (1) and press the Save button (2), the program asks you for confirmation of unlocking.

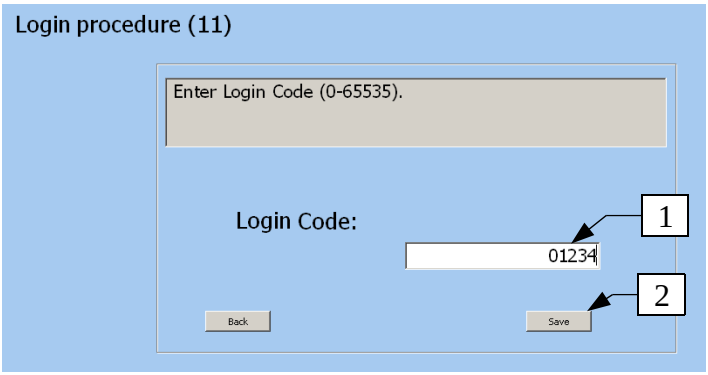


Figure 6.33

An information window about whether the code was accepted or not appears (Figure 6.35).

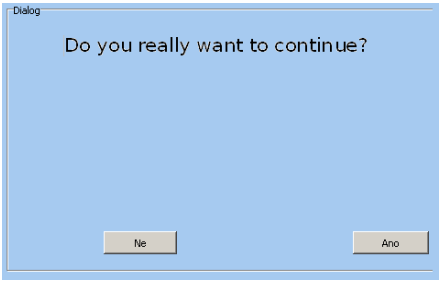


Figure 6.34

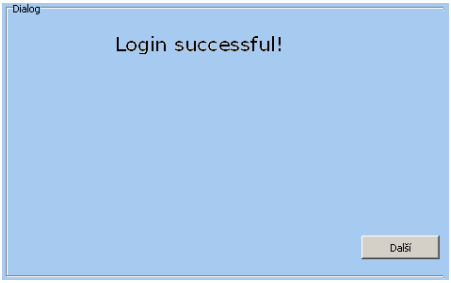


Figure 6.35

Readinesscode

Readinesscode appears in vehicles supporting OBD-II since 1996 and is related to the catalyst and lambda probes. Exact meaning of individual test bites is explained in Appendix A of this manual.

Special functions (TSPro)

The Special functions option contains of predefined functions to make complicated operations easier. Using this function you can perform certain configuration without exact knowledge of the procedure. These are, for example: throttle setting, fuel dose setting, injection start setting, DPF regeneration, stretching the brakes, turning the ambient light on or off etc. This function appears mostly in VW-group vehicles and the exact functions depend on the given control unit. An example of these functions can be found on Figure 6.37.

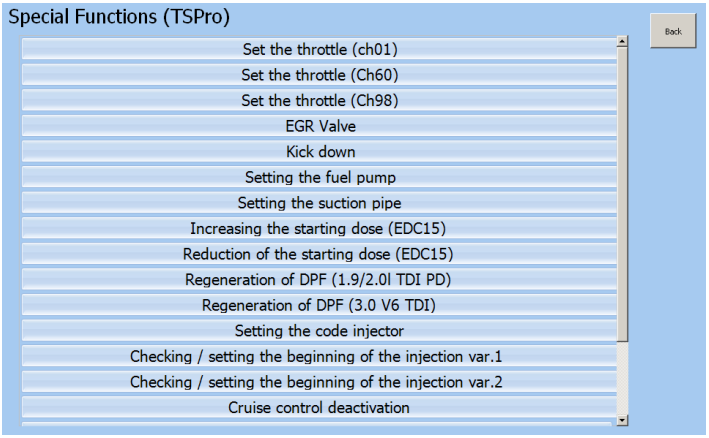


Figure 6.37

TSPro Service Functions

This menu provides access to functions such as setting oil or brake pads changing intervals etc. These functions are accessible either from the individual control unit or as an individual item in the Control Units menu (Figure 3.3 - last item).

Quit communication

It is necessary to disconnect the device properly after you finish with diagnosing. We can do this by clicking the Back button in the Diagnosis menu or by clicking the Quit communication icon on the screen. You will be asked to turn the ignition off (Figure 6.38). The Control unit selection menu appears on the TSPro device´s screen after confirming (Figure 3.3).

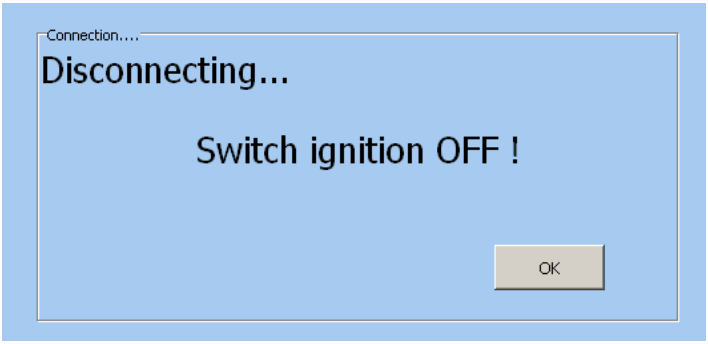


Figure 6.38

7

PC Scope

In the fourth chapter we focused on detailed description of the Scope. Besides of the application contained in the TSPro you can also use the program PC Scope. This chapter is devoted to it´s description and using.

Introduction

The best contribution of the PC in paralel diagnosis is very comfortable and clear display of measured waveforms even in multi-channel measuring. The PCScope - Oscilloscope application offers even more benefits, such as saving the measured waveforms using either one picture, or one measuring or long recording (logging). This feature is especially useful in driving tests. You can also compare measured waveforms with previously measured ones. Using every oscilloscope feature - triggering, range setting, AC/DC bonding, time, voltage and current cursors - is simple and fast.
The TSPro can be used as a 2, 4 or 8 channel oscilloscope after connecting to a PC. The number of the channels depends on device´s hardware configuration and can be changed only by using a different oscilloscope module. When you run the PCScope application, the last used configuration - channel number, timebase and voltage range - is loaded from the device. Using the scope is the same regardless the number of channels and will be described in following paragraphs.

Figure 7.1

After you start the TSPro PCCenter program, the main window of the MainBar application appears (Fig. 7.1). Click the encircled icon to run the Scope module. The workspace of the Scope application can be seen on the next page (Figure 7.2).
The workspace contains 4 main windows:

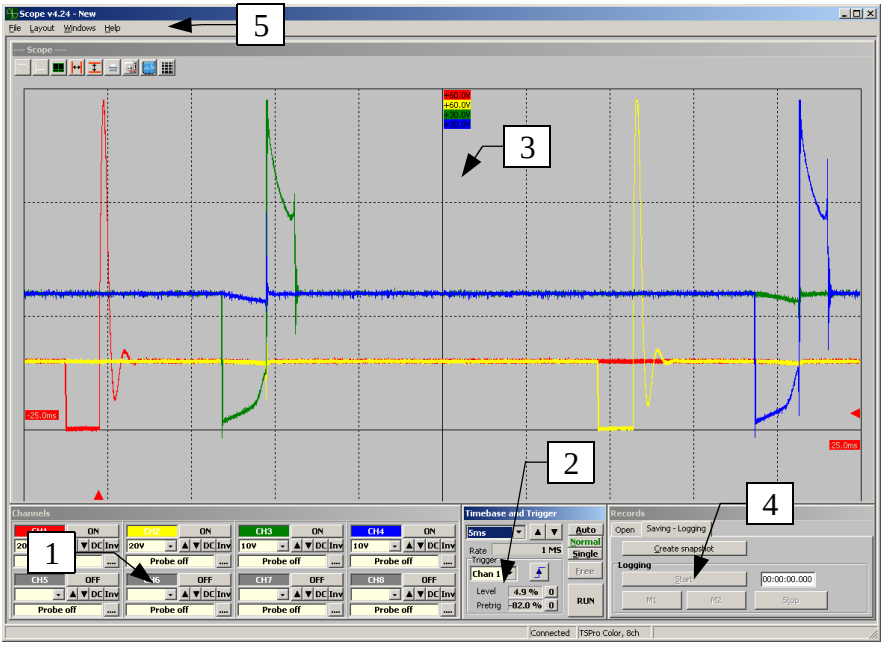


Figure 7.2

1. Individual channel´s parameters setting
2. Trigger and timebase setting
3. Main window displaying waveforms
4. Recording of measured waveforms
5. Menu bar

Now we will describe features and parameters of individual windows displayed on the Figure 7.2.

Parameters setting

In this window you can change settings of individual oscilloscope channels, e.g. voltage range, bonding type, signal inverting, measuring probe selection etc. The setting is individual for each channel.

On the Figure 7.3 you can see the parameter settings window. The procedure of changing setting is the same for all channels, so we will use Channel 1 (CH1) for explanation.

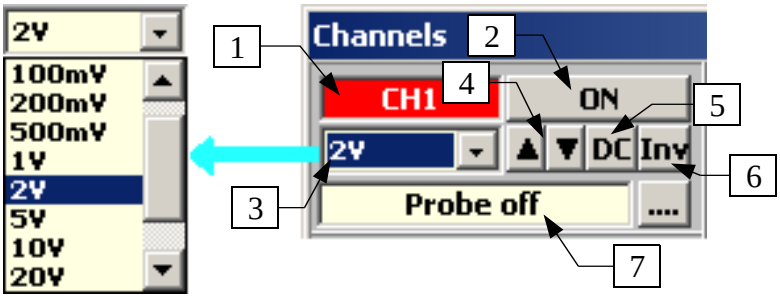


Figure 7.3

Now we will describe the individual setting options:

1. *Channel number :* Here you can see to which channel this window corresponds; the color of this icon is the same as the waveform in the main window (Figure 7.2).
2. *Turn channel on or off :* You can turn measuring on the channel on or off by clicking on this icon.
3. *Measure range :* Here you can find information about the measuring range for the given channel.
4. *Change measure range :* Using these icons you can change the measuring range from 50mV/square to 100V/square. You can also change it using the scrolling menu in Figure 7.3.
5. *Coupling type :* The coupling type can be changed using this icon. It can either be AC or DC (Figures 7.4 and 7.5). A detailed explanation of these terms can be found in the Dictionary paragraph.

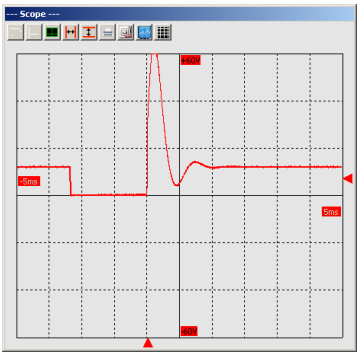


Figure 7.4

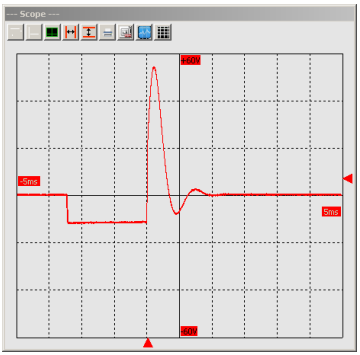


Figure 7.5

6. By clicking on this icon you can invert the input signal of the given channel; not inverted on Figure 7.6 and inverted on Figure 7.7.

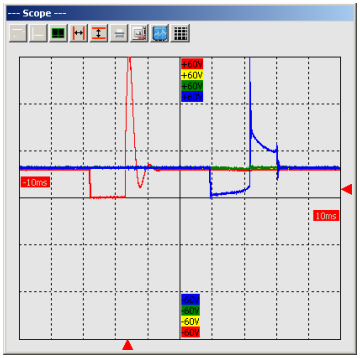


Figure 7.6

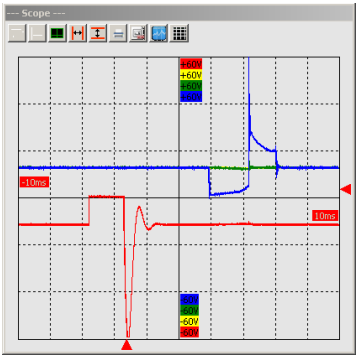


Figure 7.7

7. *Probe selection:* The waveform in the main window usually represents voltage and time. To measure different values, such as current or pressure, you need special probes. If there is a sign Probe Off in window 7 on the Figure 7.3, no probe is connected and the input voltage is shown on the screen with no modification. A window witch a list of available preset probes appears if you click on the icon next to the window 7. These probes are made by the TSPro´s

manufacturer. If no probe matches your needs, you can create your own setting; how to do so is explained in the Dictionary. On Figure 7.8 you can see the procedure of selecting a predefined probe, you can select them simply by clicking on them. The selected probe is displayed in the window 1 (highlighted in red) with it´s conversion values and units. The probe is selected by pressing the OK button (2) and it´s name is displayed in the Channels window (Figure 7.9), and it ´s measuring ranges (6) are changed according to it´s specifications. We can cancel the selection by clicking the icon 5.

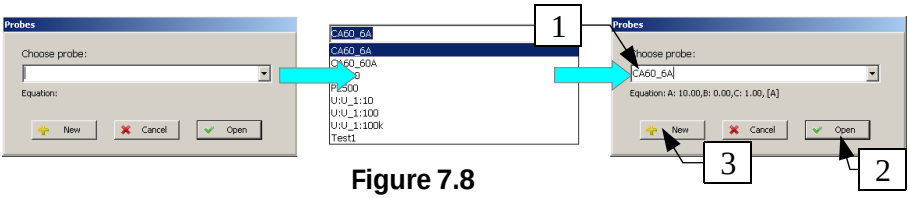


Figure 7.8

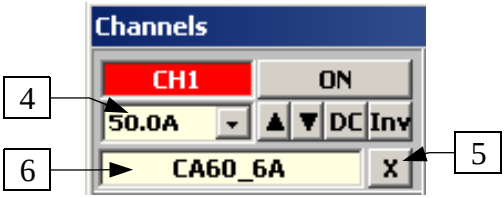


Figure 7.9

Timebase and trigger

Setting of time resolution (the section of time that is visible in the window 3 Figure 7.2) and parameters of measurement starting (triggering), is done here. Those parameters are common for all channels.
On Figure 7.10 we can see the Timebase and Trigger setting window.

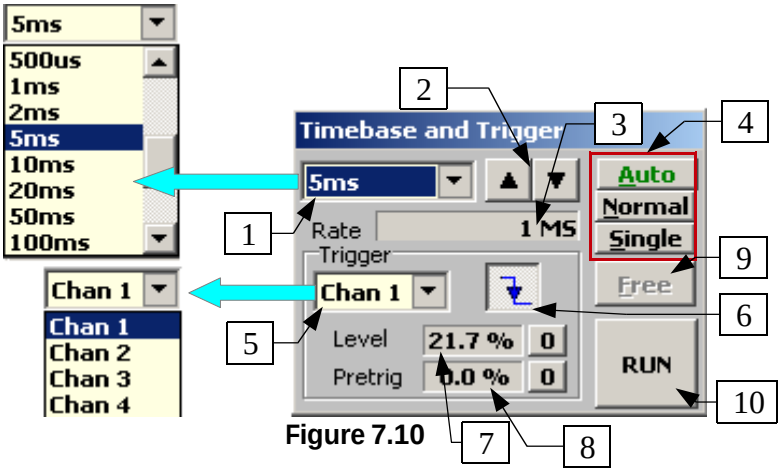


Figure 7.10

Now we will describe the individual items:

1. *Timebase selection :* Here you can see information about the current oscilloscope´s time resolution.
2. *Changing timebase selection :* Using these icons you can change the timebase in a range from 1µs/square to 5s/square. It can also be changed using the scrolling menu which is displayed after clicking the icon next to timebase info.
3. *Sampling rate :* This value is only informative and depends on timebase setting.
4. *Triggering type :* By clicking the **AUTO/NORM/SINGLE** buttons you can choose between triggering modes. It´s influence is described in the Dictionary.
5. *Channel used for triggering :* Here you can select the channel that is used for triggering.
6. *Rising/falling edge detection switch :* Here you can select whether the measurement is triggered by rising or falling edge of the signal. On Figure 7.11 you can see triggering by a rising edge and on the Figure 7.12 a falling edge is used.

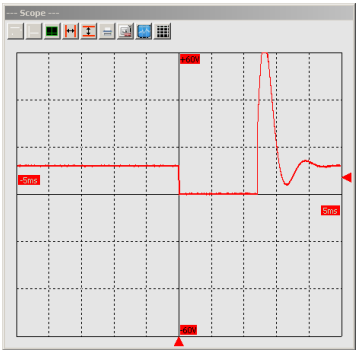


Figure 7.11

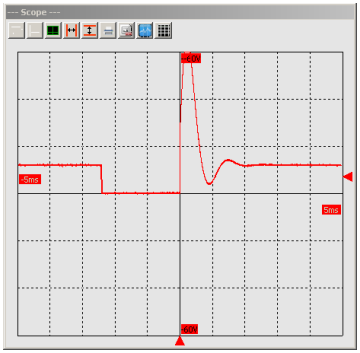


Figure 7.12

7. *Triggering level :* The value of signal level that must be reached on the triggering channel for measuring to start is shown here. You can change it by clicking and dragging the arrow in the color of the signal on the right side of the oscilloscope up (higher value) or down (lower value). An example can be found on the Figure 7.12.
8. *Pretrigger :* Pretrigger setting, e.g. displaying of the signal before the triggering moment (see dictionary), is done by clicking and dragging the arrow in the signal´s color in the lower part of the window right or left. Position of this arrow can be seen on Figure 7.11.
9. *Continuous measurement mode (Free) :* This mode is set automatically if the time resolution is 100ms/square or more. Data recording can be used in this mode only (see Data recording).
10. *Start/stop oscilloscope (RUN) :* This button turns measuring on or off on all channels simultaneously. Last measured waveform remains displayed on the main screen (Figure 7.2 - 3). A RUN sign on the button indicates that the measurement is running..

Main window displaying waveforms

This window (Figure 7.2 - 3) is used for displaying waveforms of measured signals and for working with them - zooming, time and voltage measuring, averaging, comparing, print etc.

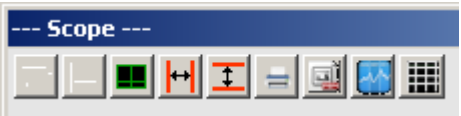


Figure 7.13

First we will describe the individual icons in the upper right corner of the window, from left to right (Figure 7.13)

1. *Transparency ON/OFF :* If there are more waveforms displayed in several windows, we can make one of the windows transparent by clicking on this icon. Then we can move it around the screen and compare it to other waveforms. This icon is active in Detail window type only. On Figure 7.14 you can see two windows with transparency turned off on the left and on the right these two windows with transparency turned on.

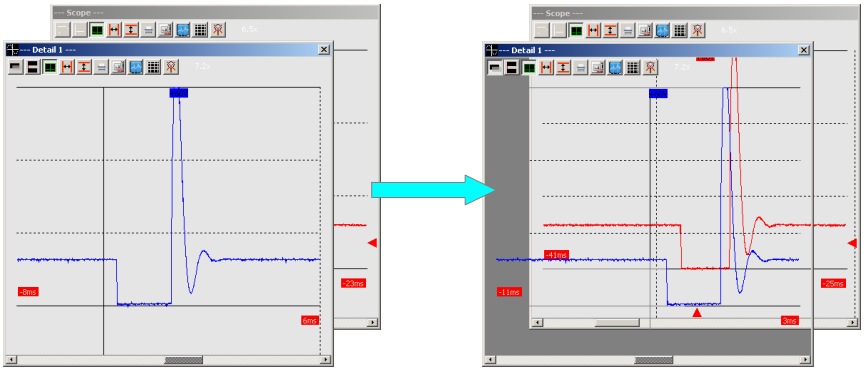


Figure 7.14

2. *Align with main window :* If there are two or more Detail windows (made according to the step 1 above), you can equalize their sizes according to the main window. This makes comparing waveforms easier because it eliminates problems of different resolutions etc.
3. *Switch half grid ON/OFF:* This function is useful for precise analysis of positive signals. After you click on this icon the positive half doubles in vertical size. You can see window with standard grid on the left and a half grid on the right on Figure 7.15.

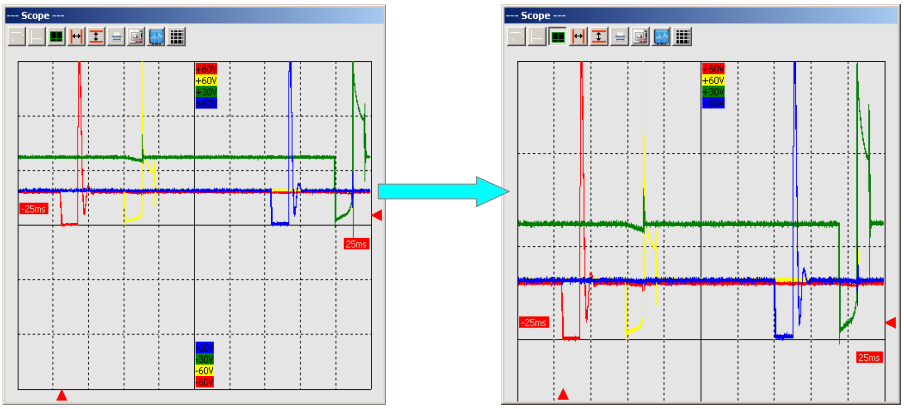


Figure 7.15

4. *Time cursors:* This icon activates two vertical lines (Figure 7.16 - 2). Those are Time cursors used for measuring time intervals. They can be moved by clicking and dragging right or left. Measured values are shown in the upper right corner of the window (Figure 7.16 - 1). This also applies for voltage cursors.
5. *Voltage cursors:* Voltage cursors are used to measure voltage differences. They are similar to time cursors in the matter of control. The measured values are displayed for each channel individually, in the color of the according channel, because they can have different voltage settings.

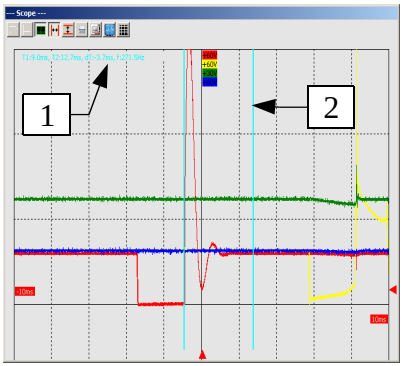


Figure 7.16

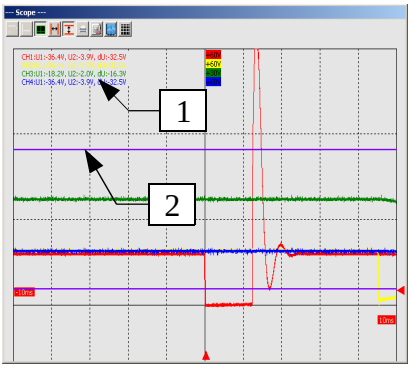


Figure 7.17

6. *Print:* A dialog window for printer setting appears if this icon is clicked. If there are multiple windows at once, the waveform from the window in which you have clicked on the icon, is printed.
7. *Export to bitmap:* You can save the current waveform to a picture in *.BMP format by clicking on this icon.
8. *Turn averaging ON/OFF:* Clicking on this icon activates or deactivates averaging; you can reduce noise of all channels in the given window.
9. *Turn grid ON/OFF:* You can display or hide a grid in the main window. You can see windows both with grid and without in on the Figure 7.18.

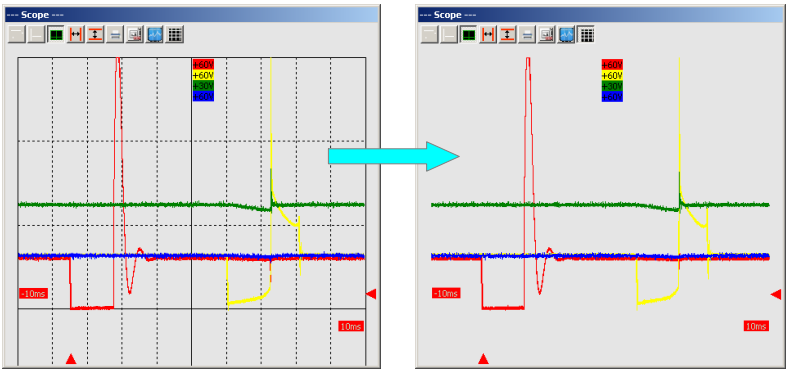


Figure 7.18

In the following text we will describe program´s other useful functions, such as creating another windows, zoom, data recording etc.

Creating a new window

This function enables you to display selected waveforms in another window. It means that selected waveforms are no longer displayed in the main window, but in a new Detail type window.

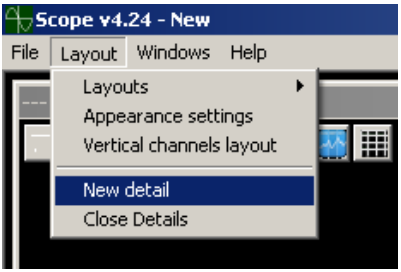


Figure 7.19

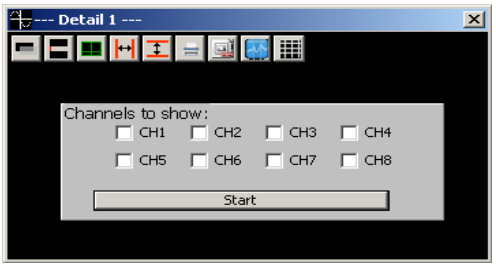


Figure 7.20

The procedure of creating a new window is following: Click on New Detail in the Layout menu and select which channels you want to display in the new window (Figure 7.20). After clicking the start icon, a new window with these selected waveforms appears. They are no longer displayed in the main window (Figure 7.21). We can perform all the operations such as zoom, voltage cursors etc. in the new window. If it is closed, the waveforms are displayed in the main window again.

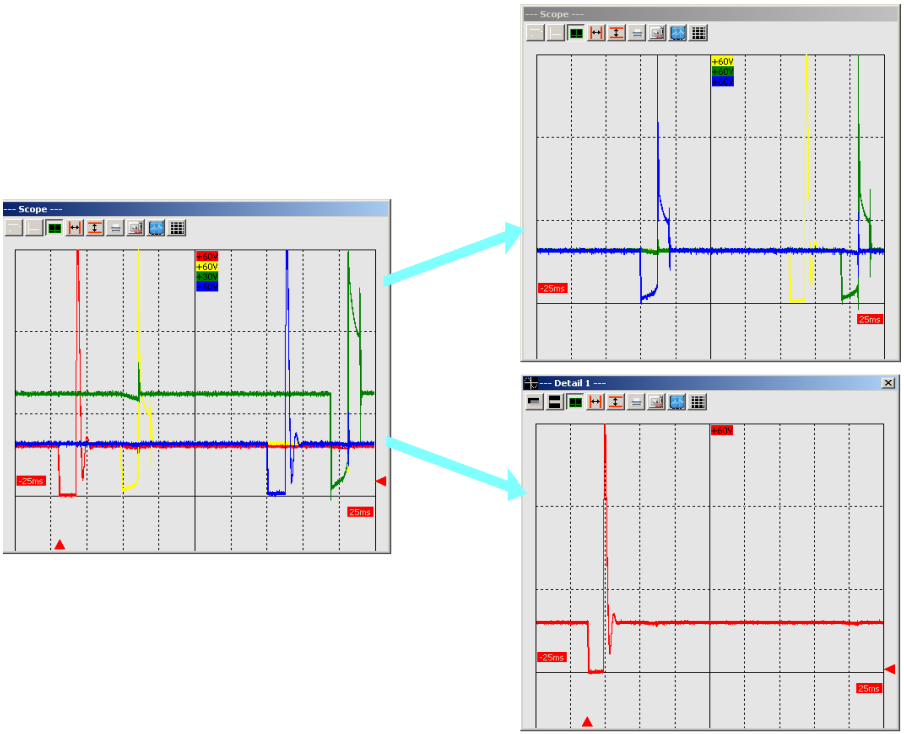


Figure 7.21

Zoom

The zoom is one of the most used functions in oscilloscope records viewing. To enlarge an area, hold left mouse button and drag left or right until the desired area is marked, then release it (Figure 7.22 - 1). The smaller is the marked area, the bigger zoom. If the zoom is used, you can see a number (3) in the upper left corner of the window representing the level of zooming. In the lower part of the window there is a scrollbar which enables you to move around the waveform. To cancel the zoom, press the marked icon (4).

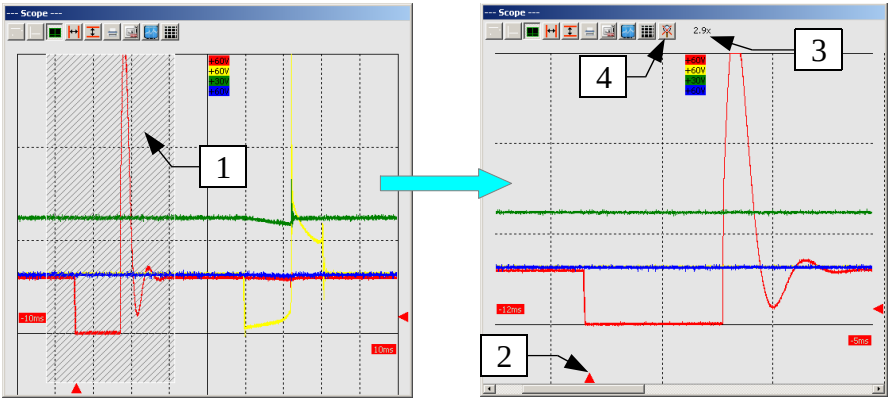


Figure 7.22

You can use this function if measurement is either running or stopped. It is completely independent on other functions; if there is zoom activated in a window you can use all other functions, such as measuring cursors etc.

Data recording

Another very useful function is Data recording. This function enables you to record and view measured waveforms. You can control this function using the Records window (Figure 7.2 - 4).

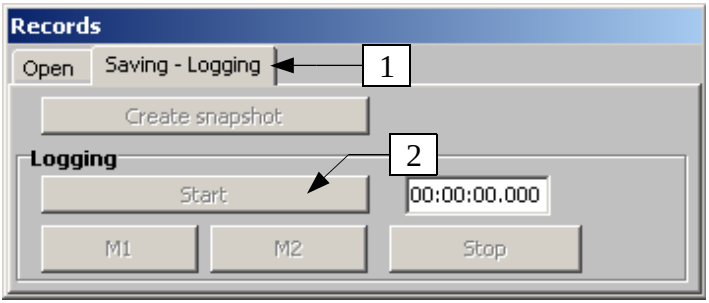


Figure 7.23

First, we will have a look at signal recording options (Figure 7.23).

The Scope application offers two types of saving measured waveforms:

- *Snapshot:* This type of record saves the waveforms currently visible in the main window. It can be used regardless of channel settings, timebase etc. The procedure of saving this record is following - after clicking the icon Create snapshot (Figure 7.32 - 1) the program asks for a name of the file in which it will be saved, then after clicking the OK button the snapshot is saved. This type of record is used for saving waveforms of individual sensors or actuators, such as phase sensors, injectors etc.
- *Logging:* This type of record saves the waveforms of all channels in a longer period of time that can be displayed on a screen; it means that you can create records tens of minutes long. It´s maximal length is limited by the computer´s free memory. The oscilloscope must be in the FREE mode (timebase 100ms or longer) to use this function. If this condition is not met, recording can not be started. If the oscilloscope is in the FREE mode, after clicking the Start button the program asks for a name of the file in which the record will be saved, and after you confirm it by clicking OK button the recording starts (Figure 7.24). During recording you can insert your marks, for example when there is an error in the signal, by clicking the M1 (1) or M2 (2) icons. The current time of recording is displayed in a text field (3) next to the Start button. A red circle indicates if the recording is running. It can be finished by clicking the Stop icon (4). This type of recording is used in test drives and when you have to find random failures that are caused by short time error of a sensor or actuator signal.

In following paragraphs we will describe how to work with saved data.

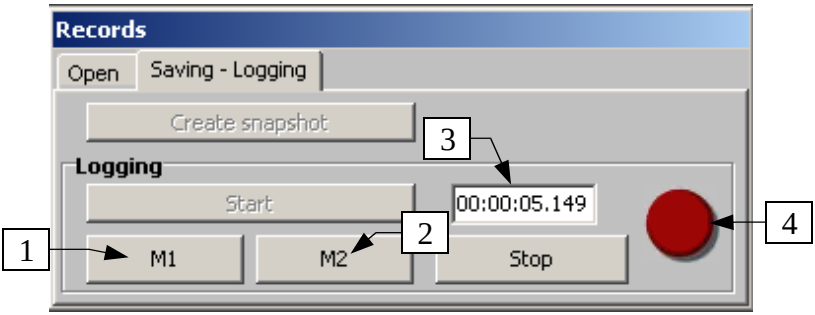


Figure 7.24

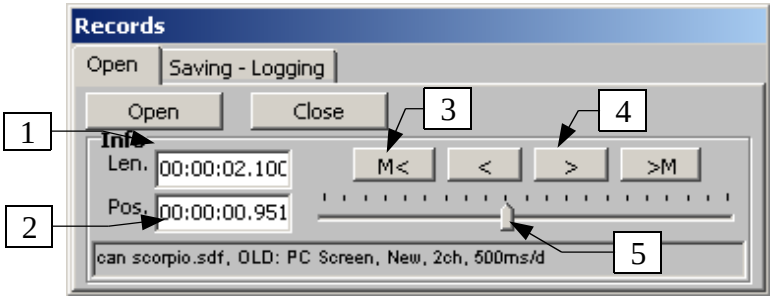


Figure 7.25

In the Open tab of the Records window we can find tools for opening and viewing an existing record (Figure 7.25). A dialog window asking you to choose the record file appears after clicking the Open button. After selecting and confirming by pressing OK, the waveform(s) saved in the file appear in the main window (Figure 7.26), and information about the record, such as it´s name, channel number, timebase setting, it´s lenght (1) and current position in it (2) can be found in the Info section. You can move around the record using a scrollbar (5), icons <> (4), or you can jump following the signs by clicking the M< and M> icons (3). An example of a waveform with a M2 mark found can be seen on Figure 7.26. You can use all above mentioned functions such as zoom, measuring cursors, transparency etc. in the window with a loaded record. You can quit viewing the record by pressing the Close icon.

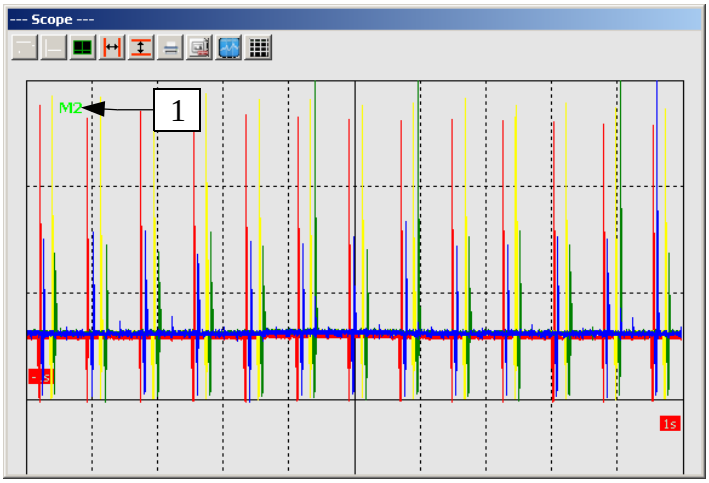


Figure 7.26

Window switching

In the Windows item in the menu bar (Figure 7.27) you can switch between individual windows of the Scope application. After clicking the desired item, the selected window becomes active and is moved to the front.

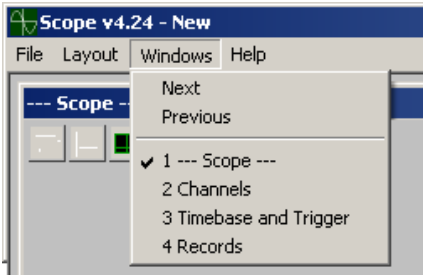


Figure 7.27

Layouts

In the Layout item in the menu bar you can find Layouts menu (Figure 7.28). The overall layout of the Scope application can be changed here. We can

choose between 3 options of the number of the windows - 1, 2 and 4. If 2 or 4 windows are selected, the displayed signals are divided according to this scheme (for an 8-channel oscilloscope):

- *2 windows*: In the first window there are waveforms of channels 1, 3, 5 and 7 and in the second one 2, 4, 6 and 8..
- *4 windows*: In the first window you can find signals of channels 1 and 5, in the second one 2 and 6, in the third one 3 and 7 and in the last one 4 and 8. This option is only available for the 4 and 8 channel oscilloscope.

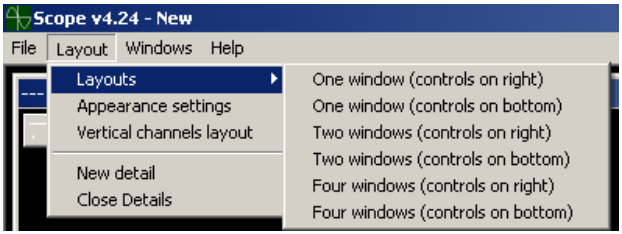


Figure 7.28

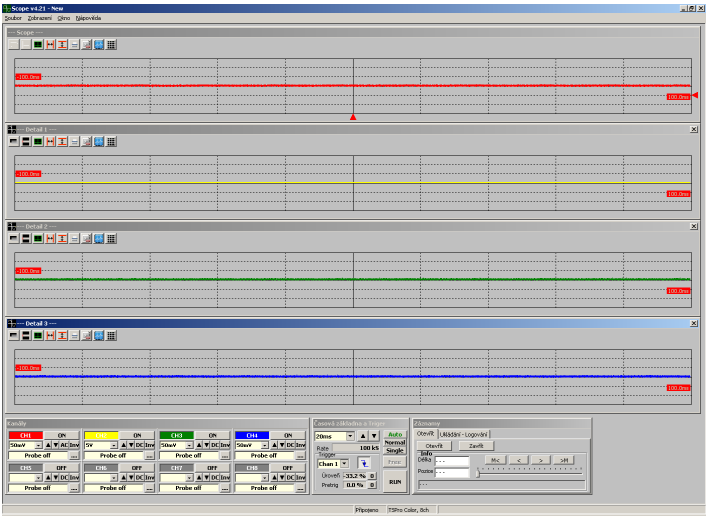


Figure 7.29

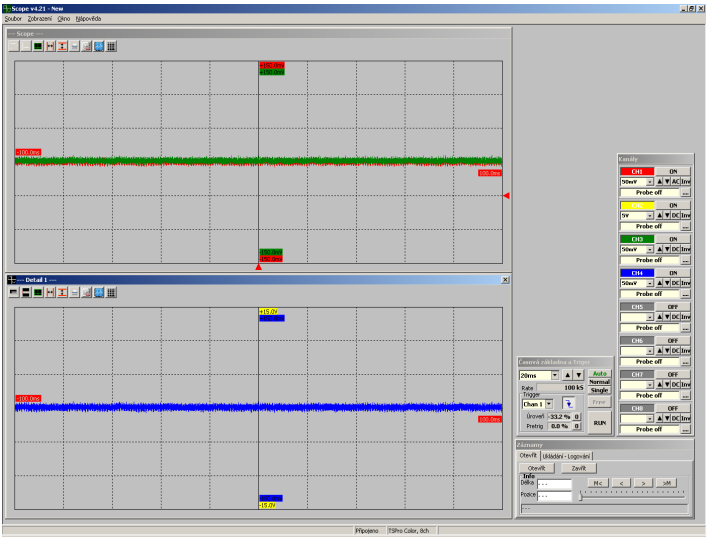


Figure 7.30

An example of two layout modes can be found on the Figure 7.29 (4 windows, controls on bottom) and Figure 7.30 (2 windows, controls on right).

Appearance setting

At the end we will show you how to change the overall appearance of the Scope application. We have to find the Appearance settings menu in the Layout item in the menu bar (Figure 7.31); we can open a new settings window (Figure 7.32) by clicking on it. Here you can customize the looks of the main window. The setting is, of course, common for all windows including Detail type windows.

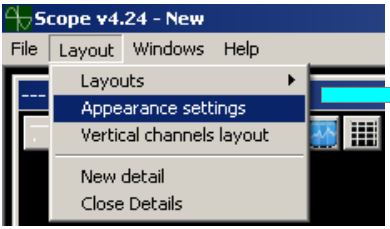


Figure 7.31

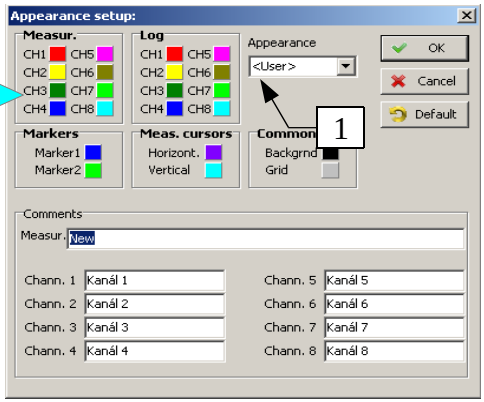


Figure 7.32

In this menu you can change color of background, grid, waveform, measuring cursors and time markers. You can also choose individual names of the channels. The application´s appearance can be also chosen from three predefined schemes (Figure 7.32 - 1). It´s factory settings can be restored by clicking the Default icon. The new setting is applied by clicking the OK button.

8

PC Archive

In this chapter we will describe the Archive application which is used for customers and recorded data management.

Introduction

The application is started from the MainBar by clicking on the drawer icon (Figure 8.1).

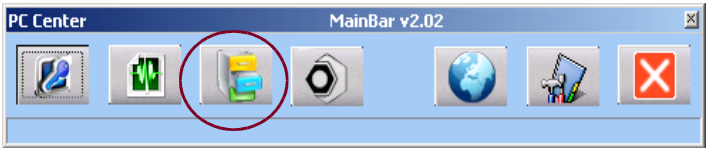


Figure 8.1

When it is opened, you can see the Archive application (Figure 8.2).

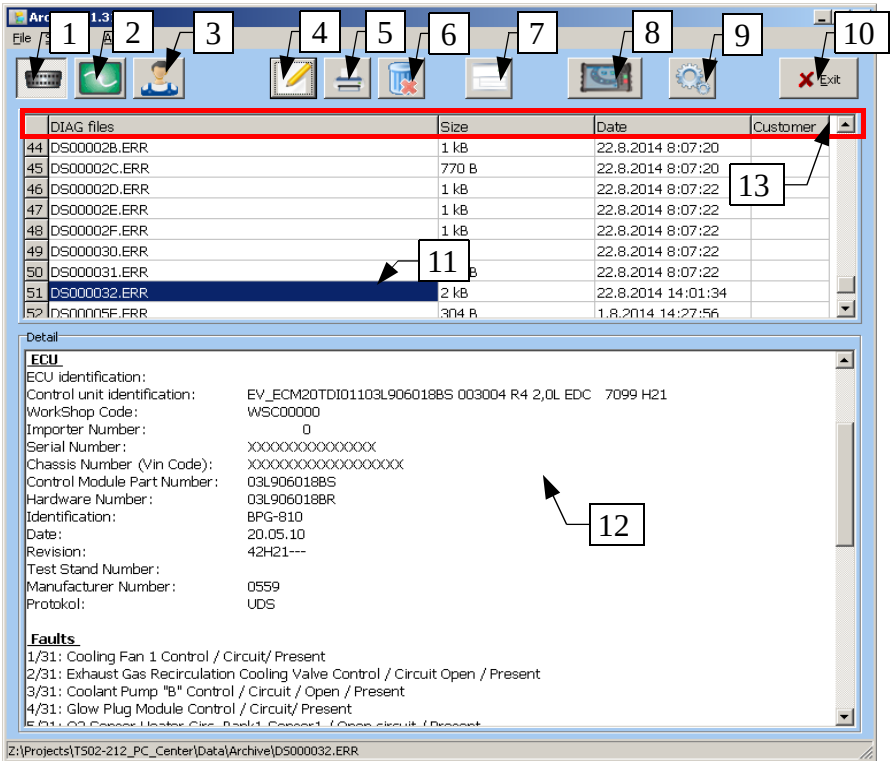


Figure 8.2

Using this application you can perform complete management of measured data, such as loading data from the device, showing the content of the individual records, adding notes, renaming or deleting records, print, matching records to individual vehicle or customer and many more. The main window is divided into three parts. In the first one you can find the menu bar and icons of the mostly used operations, such as selecting the desired database, loading data from the device, application settings and so on. The second one (11) shows the list of records from the currently selected database, and the third one (12) shows the content of the currently selected item.

Now we will describe functions of individual icons and displayed windows (from left to right):

1. *Diagnosis* - open the database of records from serial diagnosis (faults, parameters)
2. *Oscilloscope* – open the database of oscilloscope measurements
3. *Customer* – open the database of customers
4. Records editing
5. Printing diagnostic protocols
6. Deleting records
7. Changing of the proportions of windows (11) and (12)
8. Loading data from the TSPro device
9. Application settings
10. Quit application
11. Window displaying the list of records
12. Window for displaying contents of selected item from the window above.

Database of diagnostic data

If you want to use the diagnostic data database, click on the Diagnosis icon (1). The list of saved records appears in the window (11) (Figure 8.2). Every item in this list contains the name and size of the file, date and time of creation and an identification number of the assigned customer (U1, U2, ...).

The content appears after clicking on an item from the list in the Detail window (12). An example of such record can be found on the Figure 8.8, where you can see information about the control unit from which this record comes from, vehicle type, control unit type and it´s identification and error memory content.

You can sort the items in the diagnosis database by their names, file sizes, date or by customer identification number by clicking on the title of a column. For example, if you click on the Size title, the records are sorted from smallest to largest, and if you click on it again, it is sorted in reverse order - from largest to smallest. Sorting records by their name etc. follows the same principle.

Oscilloscope records database

If you want to work with the database of oscilloscope measurements, click on the second icon from left (2). The list of stored files appears in the window (Figure 8.2 - 11). Every item contains the same identification info as the ones in the Diagnosis database. Oscilloscope database contains two types of records: *.BMP pictures (1) and *.SDF Logs (2). The content of a type (1) file appears as a picture after clicking on it (Figure 8.3 - 3).

The other file type (*SDF). can be opened using the Scope program only; See chapter 7 PC Scope, paragraph Logging. (Figure 8.4).

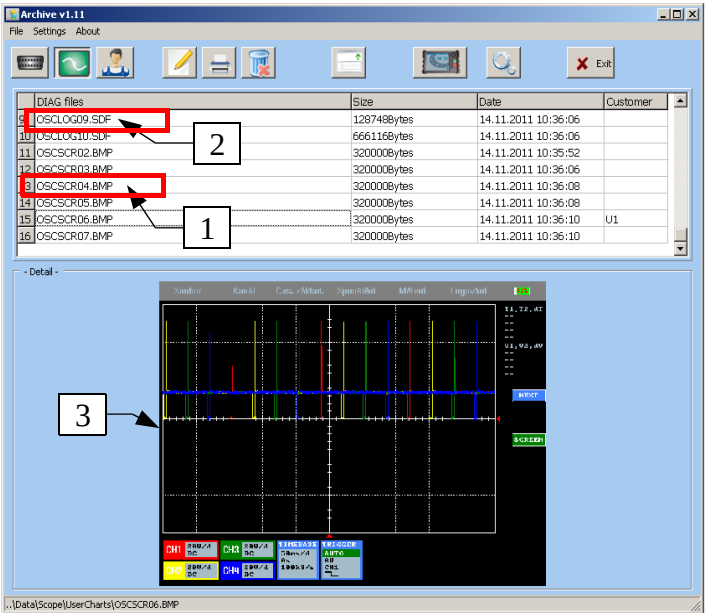


Figure 8.3

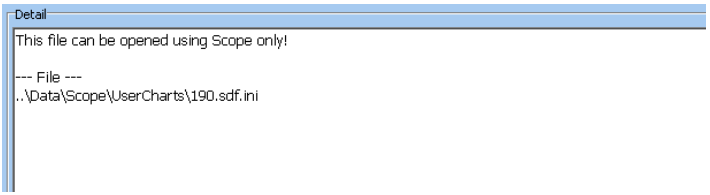


Figure 8.4

The records in the oscilloscope database can be sorted in the same manner as the ones in the diagnosis database.

Database of customers

If you want to work with the database of your customers, click on the third icon from left (3). The window is divided into three parts (Figure 8.5). There is a list of customers in the first part (1), containing their ID, name, vehicle type, license plate and address. In the second part (2) you can find the list of records from oscilloscope or diagnosis database (the type of the selected database is highlighted (Figure 8.5)) assigned to a selected customer. The third part of the window (3) shows the content of the record selected in the second window. The items in this third window can be also sorted in the same manner as the oscilloscope and diagnosis files.

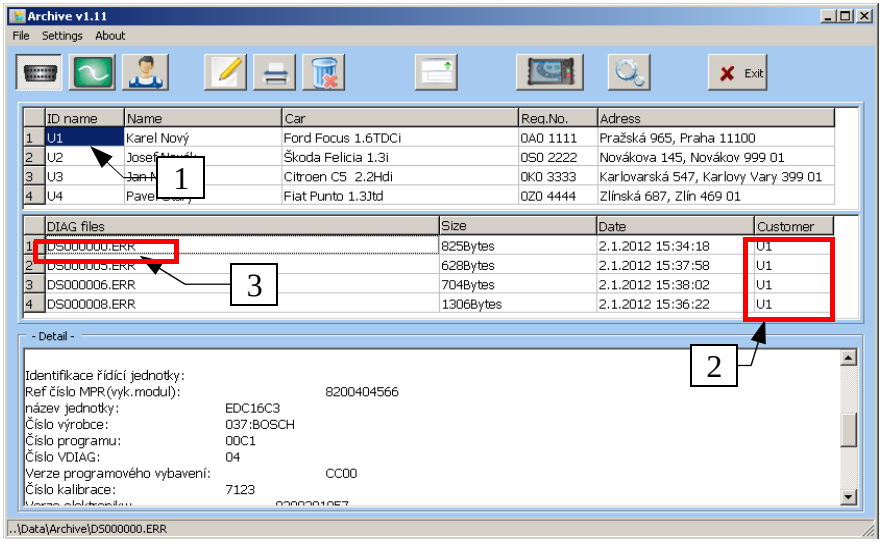


Figure 8.5

You can change customer details by double clicking on a customer record. A new window with detailed informations appears (Figure 8.6). In this Customer details window you can change all the informations about the customer. The changes are applied by clicking the Save changes button. To create a new customer record, click on the New customer icon (2). A blank Customer details window appears. After you fill in the informations you want, click on the Save changes icon. A new entry appears in the customers list.

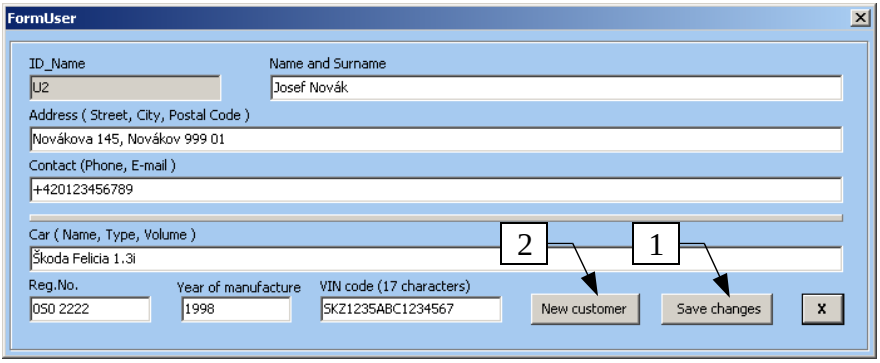


Figure 8.6

Records modification

Saved data can be modified after clicking on the Modify file icon (Figure 8.7 - 4). You can alter or add informations about any saved oscilloscope or diagnosis file. The file´s name, measurement description and customer assignment can be changed. Changing file name is done in the window (1). You can write file´s new name here and by clicking Rename! (4) the name is changed. Changing or adding of a measurement comment is done in the window (2) following the same procedure as in renaming file. The window (3) is designed for changing customer assignment. To assign a new customer to the record, click on his or her name in the list and click on the Change customer icon. If you want to remove an assignment, click on the sign NOT ASSIGNED (highlighted on Figure 8.7). If you don´t want to do any changes anymore, click on the Back icon (6).

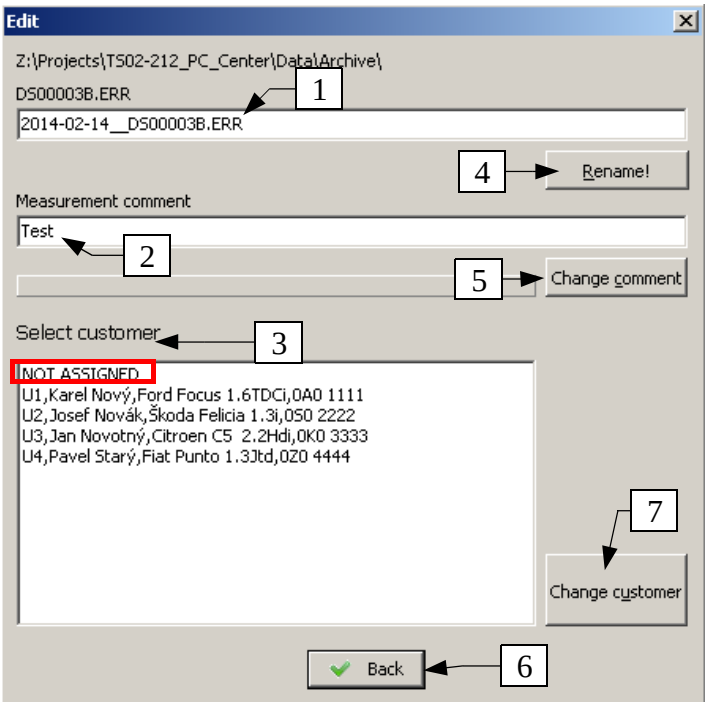


Figure 8.7

Deleting records

To delete any record, find it in it´s database, mark it by clicking on it and then click on the sixth icon from left - Delete file (Figure 8.2 - 5). A dialog window with warning appears; here you can confirm deleting or abort it. If it is confirmed, the file is permanently deleted.

Printing diagnostic protocols

Diagnostic protocols can be printed from diagnosis database only. First, you have to select the file you want to print by clicking on it, then click on the Print icon. A printer setting window appears; then by clicking on the OK icon the protocol is printed. You can find an example of such a protocol on the Figure 8.8.

Company name
Your name, Street 1, Street 2, City, ZIP code
Email: email@mail.com, Tel:123 156 789, Note1, Note2

Diagnostic protocol

File
Z:\Projects\TS02-212_PC_Center\Data\Archive\DS000032.ERR
22.8.2014, 13:55:29, TS02-TEST40004

Vehicle
Škoda, Octavia III (5E)
Engine, All types

ECU

ECU identification:	
Control unit identification:	EV_ECM20TDI01103L906018BS 003004 R4 2,0L EDC 7099 H21
WorkShop Code:	WSC00000
Importer Number:	0
Serial Number:	XXXXXXXXXXXXXX
Chassis Number (Vin Code):	XXXXXXXXXXXXXXXXX
Control Module Part Number:	03L906018BS
Hardware Number:	03L906018BR
Identification:	BPG-810
Date:	20.05.10
Revision:	42H21---
Test Stand Number:	
Manufacturer Number:	0559
Protokol:	UDS

Faults
1/31: Cooling Fan 1 Control / Circuit/ Present
2/31: Exhaust Gas Recirculation Cooling Valve Control / Circuit Open / Present
3/31: Coolant Pump "B" Control / Circuit / Open / Present

Figure 8.8

Loading data from the TSPro device

First you have to make sure that the TSPro is connected to the PC properly (see paragraph TSPro PCCenter settings). Then click on the eighth icon from the left - Show dialog for loading from the device (Figure 8.2). A new Files window appears in device (Figure 8.9). Now you have to select whether you want to download data from Archive (diagnosis) or Scope (oscilloscope). Then after clicking on the Check files in device a list of saved measurements appears (Figure 8.10).
We have to select desired records either by clicking in the boxes next to them (4), or you can click on the Select all icon (5). Then proceed to the data transfer

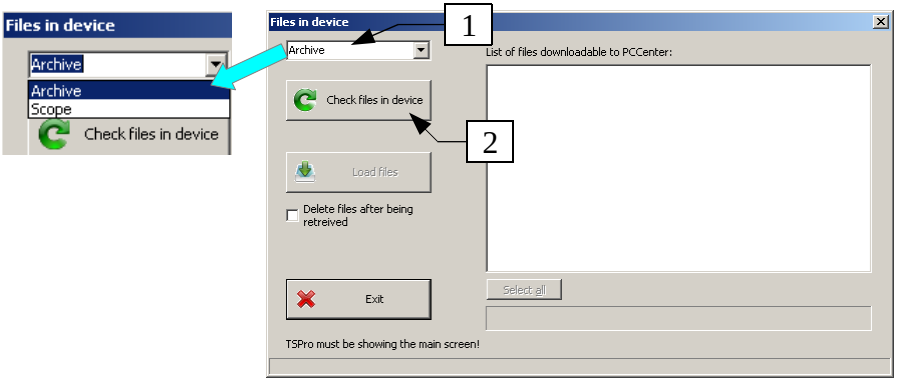


Figure 8.9

by pressing the Load files icon (1). The transfer is indicated in the lower part of the window (6). If you click on the box Delete files after being retrieved (2), the transfered files will be deleted from the device. The loaded files are daved in a directory defined in the Settings window (see paragraph TSPro PCCenter Settings.

After the loading is finished, close the window by clicking the EXIT icon.

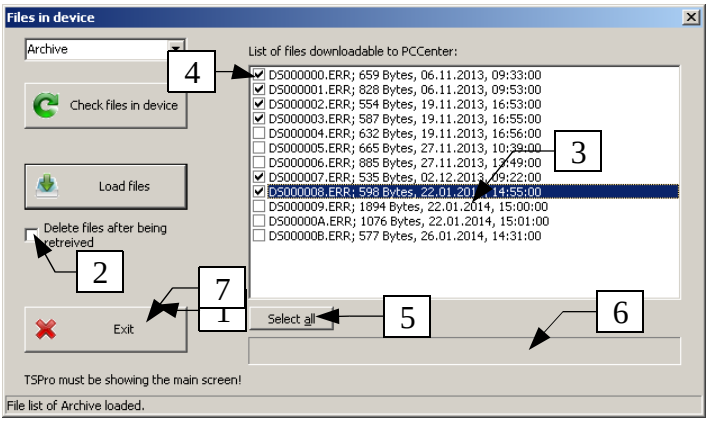


Figure 8.10

Program settings

In the Settings menu (Figure 8.11) we can find information about settings of the Archive program. There are information about the folders where the data is stored; they can be changed in the Settings menu in the MainBar menu.
One of the parameters that can be changed here is the size of the text in the Measurement details window (12). Click on the Save icon if you want to use new setting, or click the Default icon if you want to restore the default settings, or by clicking the X icon you can exit the settings window.

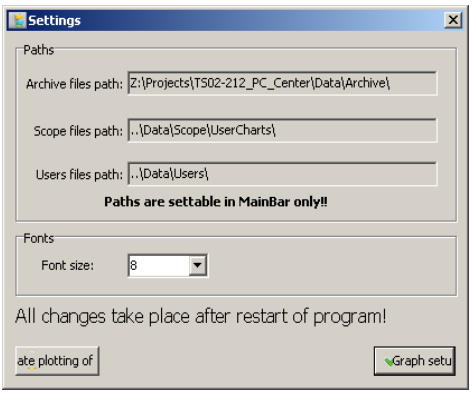


Figure 8.11

File

If you need to load the database from a different folder one time, we can Temporarily change DIAG/SCOPE files path in the File menu in the menu bar (Figure 8.12). After closing the Archive program, the paths are set back to the values from the Settings menu in the MainBar.

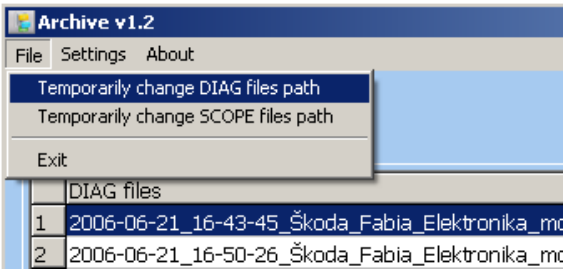


Figure 8.12

Settings

Because the list of loaded records can be very long if you work with the TSPro intensively, by default only up to one month old data are displayed. If you wan to work with older data, you can display data from last half year or whole year . These options can be set in the Settings menu in the menu bar.

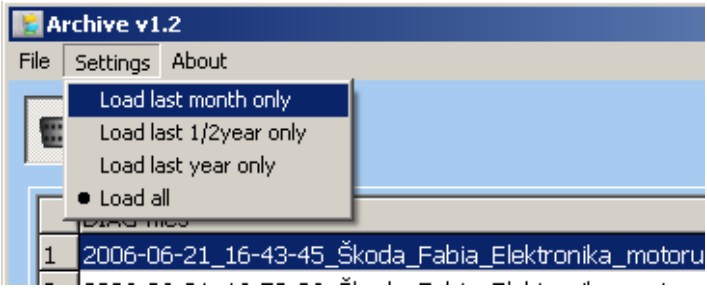


Figure 8.13

Closing the program

To quit the Archive application click on the Exit icon (1) or on the icon in the upper right corner (Figure 8.2).

9

Appendix A
(OBDII and EOBD introduction)

In order to use the TSPro diagnostic device effectively you should understand the basic of OBD systems. Principles of the diagnosis are summarized in this appendix.

Introduction

The EOBD/OBDII is a uniformed diagnosis of motorized vehicles with emphasis on the emission behavior. Because there is lots of literature covering this theme, we will talk about it briefly.
EOBD´s main advantage is the possibility of using a universal test device for all vehicles equipped with this interface. This universal diagnostic device can therefore be used for diagnosing any vehicle with the EOBD/OBDII system regardless it´s manufacturer. This is especially useful for unofficial services which work with vehicles of different manufacturers.
The diagnostic device must be able to communicate in two different modes: ISO and SAE. The ISO mode is used by European manufacturers and the SAE by Asian and American ones. The diagnostic device must distinguish in which mode the vehicle communicates.
4 different protocols are used for transferring data. most European manufacturers use protocol ISO 1941-2, but some use 14230-KWP2000. American manufacturers prefer a SAE J1850 protocol. Nowadays, a CAN protocol us used more and more frequently.

The OBDII diagnosis is mandatory for USA´s petrol engine manufacturers from 1995 and for diesel engines from 1996; EOBD is demanded by EU directive 98/69/ES.

The control unit must check the individual systems. Frequency of the checks depends on the system´s importance and they are divided into permanently or occasionally checked systems.

Permanently checked systems

- Misfires
- Electrical test of the emission-relevant components
- Fuel system

Occasionally checked systems

Because some systems can be tested properly only under certain circumstances, they are tested only sporadically.

- Secondary air system
- Catalytic converter
- Lambda probes and their heating
- Emission gases recirculation
- Venting of the fuel tank and leaks

Readiness code

One of the control unit´s features is indicating the testing readiness of individual modules. It indicates whether the control system supports individual diagnostic procedures and if the tests can be performed or not.
The readiness code contains two information (Chart 9.1). The first value indicates which systems are checked or tested by the control unit. The second one specifies which systems have been successfully checked. However, the readiness code doesn´t contain the results of the tests; they have to be read out of Fault codes. Unfortunately, it is necessary to know all the readiness codes in order to perform complete diagnostics, which requires a fairly difficult test drive.

Bite number	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
Test supported	0	1	0	0	1	0	1	0	1	1	0	0
Test not performed	0	0	0	0	0	0	0	0	0	1	0	0
	Misfires	Fuel systém	Overall components check	Not used	Catalyst	Catalyst heating	Vaporisation systém	Secondary air systém	Cooling systém	Lambda probes	Lambda probes heating	Flue gas reduction

Chart 9.1

Test Modes

Independently on used protocol, data must be listed in 9 specified Test Modes (or just Modes). Modes 1 to 9 are used for emission analysis and can be used for diagnosis purposes as well.

Request current powertrain diagnostic data - mode 1

In this mode there are various information about system condition, measured values of analog and digital inputs and outputs, values computed by the ECU, number of failures stored in the ECU memory etc. Values relevant to engine emission measurements as well as readiness codes are presented.

Request powertrain freeze frame data - mode 2

This mode retrieves certain data that was saved at the time the vehicle set a diagnostic trouble code (DTC). If other failure occurs with higher priority, running conditions will be overwritten with newer ones. Failures related to fuel mixture regulation and ignition misfiring are considered to be of highest priority. Up to six running conditions parameters are stored with one error code.

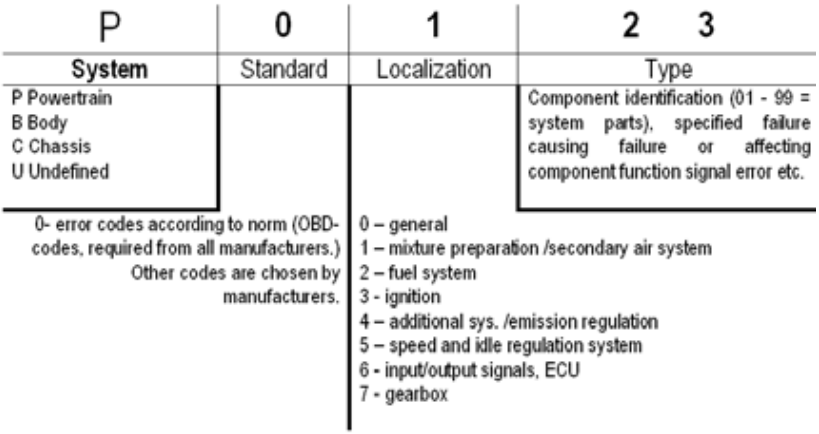
Request emission-related powertrain diagnostic trouble codes - mode 3

The error memory is usually divided into two parts. If the failure occurs for the first time it is saved in the Pending error memory. It is moved to the Confirmed error memory after it is identified and verified. After confirmation the MIL error indicator on vehicle´s dashboard starts to shine.

If the diagnosed failure doesn´t appear in three following driving cycles, MIL is turned off. After another forty engine start-ups the failure is deleted from the memory.

The principle of decoding is shown in chart 9. 2. The TSPro diagnostic device automatically performs decoding of each code to significantly reduce time

needed to perform diagnostics.



Clear/reset emission-related diagnostic information - mode 4

Mode 4 clears the memory of all systems. In other words it clears powertain DTC memory (mode3), running conditions memory (mode 2), oxygen sensor test results memory (mode 5) as well as confirmation of test performed on non-continuously tested systems.

Request oxygen sensor monitoring test results - mode 5

Results of tests of oxygen sensors are reported in mode 5 (values are often obtained from tests in mode 1). Reports are sorted according to test Ids, ie. Threshold voltage lean-rich mixture etc. Mode 5 can be used during emission tests when not all readiness codes are known.
In figure 1 you can see a photo of an oxygen sensor. In the following figure 2 the values of voltages on oxygen sensors during measurement are displayed.

Figure 9.1

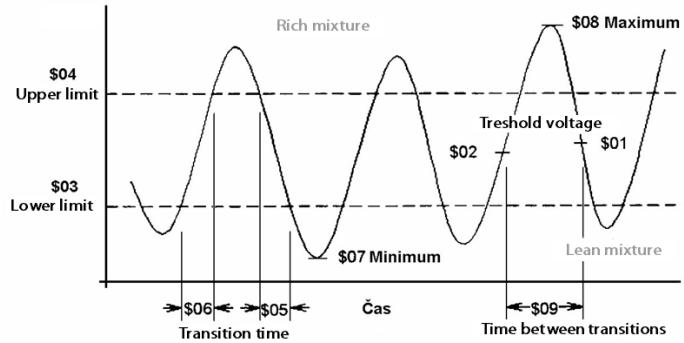


Figure 9.2

Request on-board monitoring test results for continuously monitored systems - mode 6

Mode 6 is used to load pending errors memory. ECU must confirm their status in following driving cycle, and if appropriate, move them to the confirmed error memory. Although this mode is not used to diagnose emissions, their results are important for diagnostic. The codes are similar to mode 3.

Request on-board monitoring test results for non-continuously monitored systems - mode 7

This mode is not defined by norm and is specified by each manufacturer independently. Moreover, it is not supported by all ECUs.

Request control of on-board system, test or component - mode 8

This mode is also specified by each manufacturer. It is meant to be used for special tests such as driving actuators tests etc. It is not widely spread.

Request vehicle information - mode 9

Even this mode is specified by each manufactured differently. It contains VIN (vehicle identification number), CIN (calibration identification number) and CVN (calibration vehicle number) codes.

OBD socket

The position of the EOBD or OBD-II diagnostic socket, it´s shape and pinouts must adhere to a norm.

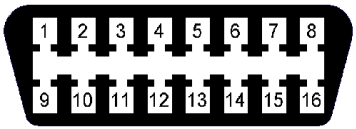


Figure 9.3

The unified diagnostic socket (often referred to as a CARB connector) has 16 pins; it´s schematics is displayed in Figure 9.3 and pinouts are summarized in chart 9.3.
Pins listed in the chart have exact function and must be implemented according to the norm. Other pins (ie. 1,3,8,9,11,12,13) can be used for other purposes and manufacturers often assign them different diagnostic functions.

Pin	Used for
7 a 15	Data transmission according to ISO 9141-2 or ISO 14230 (KWP2000) norms
2 a 10	Data transmission according to SAE J 1850 norm
4	Vehicle ground
5	Signal ground
6 a 14	CAN bus (ISO 15031-3)
16	Battery positive

Chart 9.3

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Appendix B
(Diagnostic dictionary)

In this chapter we will focus on explaining some terms you can meet while diagnosing control units. Incorrect understanding can lead to, for example, incorrect interpretation of failure codes and consequently in wrong repairing procedure.

- **+apc**. Battery power supply
- **adaptation** readjustment of, for example, engine regulation parameters according to ambient conditions
- **anomaly** abnormality, deviation
- **control deviation** the difference between actual and requested value
- **deceleration** slowing speed
- **drift** shift, displacement, slow change caused by changing conditions such as temperature change
- **checksum** a checking sum which serves to ensure the validity of data in the memory of the control unit
- **IMA code** calibration number of an injector
- **impedance** **Electrical impedance** is the measure of the opposition that a circuit presents to a current when a voltage is applied
- **initialization** opening value setting
- **coherence** a logical, orderly, and aesthetically consistent relationship of signals
- **incoherence** discontinuity, disparity (see coherence)
- **correlative** mutual relation between two values; if one of them changes, the second changes too. It helps the control unit localize the failure.
- **correction** modification, expressing the deviation from the default values, such as the duration of the injection correction
- **oxygen probe** see lambda probe
- **lambda probe** a sensor of the amount of oxygen in exhaust gases
- **random failures** an error that appears unpredictably
- **O2 probe (sensor)** lambda probe
- **offset** change/shift of signal value against the reference value
- **proportional regulator** a type of regulator which changes it´s value accordingly to the action value
- **reinitialization** to initialize again

- **occasional failure** sporadic error

11

Appendix C
(oscilloscope dictionary)

For it is very important to set the oscilloscope correctly in order to locate a failure, and because not everyone understand it´s principles, we will explain basic important terms that appear while working with oscilloscope.

AC/DC Coupling

Electric signals can be in principle alternating (AC) or direct (DC). Measuring direct signals is very simple, but alternating signals are a bit more complicated. Alternating signals can also contain a direct part, which is manifested as a positive or negative shift of the mean signal value (Figure 11.1).

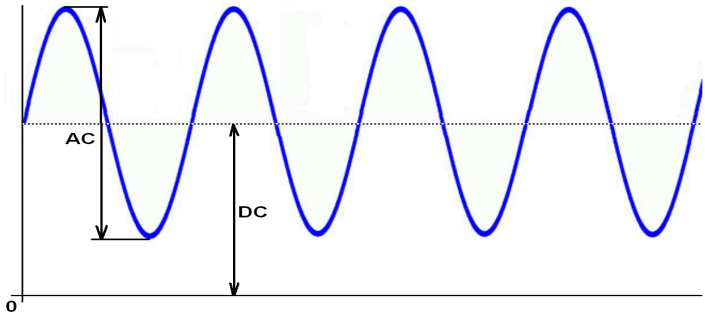

Figure 11.1

The TSPro oscilloscope supports the two following coupling settings:

- *AC coupling:* the oscilloscope displays only the alternating signal; the direct part, if present, is filtrated and not shown.
- *DC coupling:* the oscilloscope displays both alternating and direct parts of the signal.

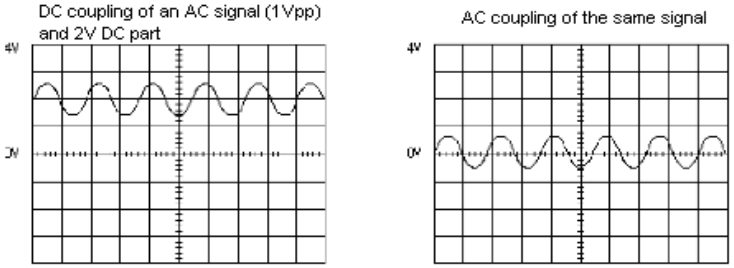

Figure 11.2

Time-square / Volt-square

The main window displaying waveforms is divided by a grid into N squares (vertical lines) in the time axis and M squares (horizontal lines) in the voltage axis (Figure 11.3). This grid is useful for fast measuring of time and voltage of the displayed signal. The number of squares represents the maximal value that can be displayed using current voltage setting and timebase.

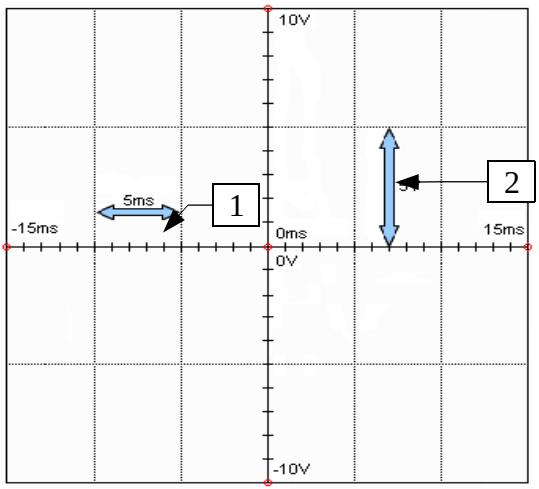

Figure 11.3

Now we will show you some examples of these terms on the Figure 11.3:
Timebase setting: 5ms/square (1)
Voltage range setting : 5V/Square (2)
Number of lines/squares in the time axis: 6
Number of lines/squares in positive voltage axis: 2

Using this setting, a signal of maximal length 30 ms (6 squares * 5ms/square) and maximal voltage 10V (2 squares * 5V/square).

Trigger

The trigger is used to display periodical waveforms statically, so the signal does not blink. Without this function, the oscilloscope´s screen would look like the one on the Figure 11.4. The trigger has several modes which define the way the oscilloscope loads data, e.g. how is the signal displayed if there is or isn´t a triggering event detected.

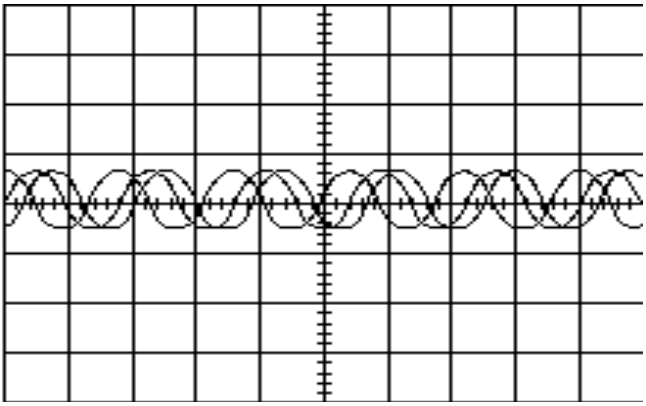

Figure 11.4

- *Triggering event:* The basic parameters of a triggering event are selection of triggering level and edge (Figure 11.5). Triggering event is defined by a voltage level (value which the signal must reach - 1) and edge type (whether the measurement starts while it rises - 2, or while it falls – 3).
- *Trigger NORMAL:* This mode is used to create a schart, stationary image on the oscilloscope´s screen (synchronization) based on repeated displaying of the measured waveform that starts at the same place every time. This place is defined by the triggering event.

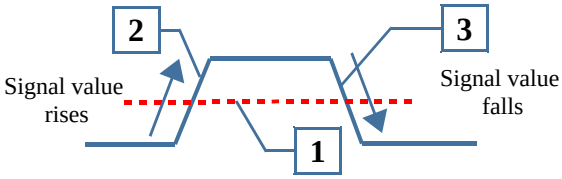

Figure 11.5

In this mode, the measuring starts only if the triggering event criteria is meet. If it is not, a signal that has been measured last time stays displayed. A disadvantage of this mode is that if the triggering event is set incorrectly, the user may see an old waveform or the measurement may not start at all.

- *Trigger AUTO:* In this mode the measurement is started periodically, even if the triggering criteria are not meet. This mode is useful for finding a signal you do not know much about.
- *Trigger SINGLE:* This mode is similar to the NORMAL mode; the difference is that the measurement starts only once while the triggering criteria are met and another triggering is disallowed. Loaded data are still displayed regardless of whether triggering criteria were met or not. The user has to allow another measurement manually.
- **Trigger** *FREE*: This mode is set automatically when the time resolution is 100ms/square or higher. It is used for work with slow signals, such as lambda probes, air weighting etc. Logging can be activated in this mode (see chapter Oscilloscope).
- *Pretrigger:* This function allows us to see what happens before the triggering event. In this mode the measurement is divided into two parts called Pre sample (measured before the triggering event) and Post sample (measured after it) (Figure 11.6). You can set how many of the total record is occupied by the Pre sample. This function is especially useful if you have to locate a random error and you want to see what happens right before it.

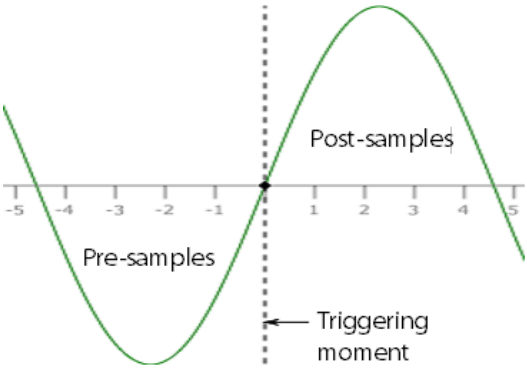

Figure 11.6

Probes

The oscilloscope always displays a course of voltage in time. Special probes are necessary to display other values, such as pressure or current. These probes convert the input value (pressure, electric current etc.) to electric voltage according to a predefined formula. That is why you have to input the formula in order for the oscilloscope to display values in kPa or amperes.

Figure 11.7 shows an example of a convention formula setting for a current probe with a conversion constant 100mA / 1mV in the PCScope program. The principle of setting a formula is easy, we just have to know the gain (parameter A), offset (parameter B) and correction factor (parameter C).

Now we will show you how to set this formula in the PCScope program. First, click on the New button (Figure 7.8 - 3) and fill in the requested information (Figure 11.7). Then save the probe by clicking on the Create icon. After you click it, the newly created probe appears in the list of probes (Figure 7.3).

All probes distributed by the manufacturer of the TSPro are already predefined in the PCSsope program and can be selected easily in the menu (see chapter 7).

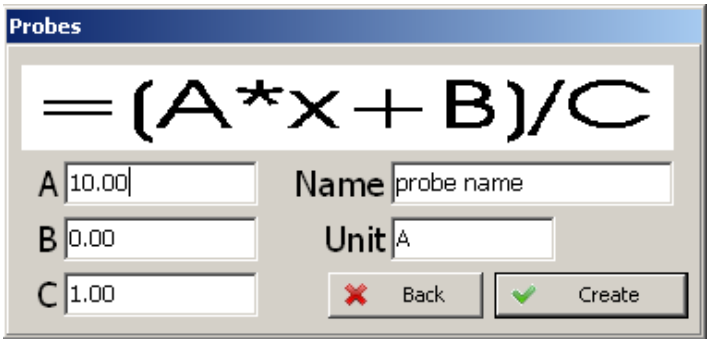
Probes
=(A*x+B)/C
A
10.00
B
0.00
C
1.00
Name
probe name
Unit
A
Back
Create

Figure 11.7

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Appendix D
(Ways of connecting the oscilloscope)

In this appendix you can find several ways of connecting the TSPro device to a vehicle in order to perform oscilloscope measurements.

Introduction

The oscilloscope can be connected to a vehicle using either cables with 2, 4 or 8 banana plugs or with BNC connectors, depending on the type of oscilloscope module installed. Other accessories, such as measuring spikes, current or pressure probes are connected to this cable. Power ban be obtained either from the vehicle´s battery or from 230V/12V DC adapter.
On the following pictures you can find several options of connecting measuring probes and device´s power supply.
Legend:

1 – black clip
2 – red clip
3 – oscilloscope probe
4 - 230/12V DC power supply
5 – current clamps
6 – black connector
7 – green connector
8 – red connector
9 – high voltage clamps

Power supply from battery + oscilloscope probes

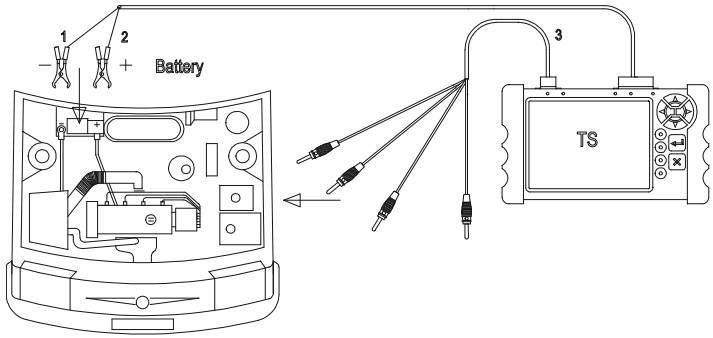

Figure 12.1

Power supply from wall socket + oscilloscope probes

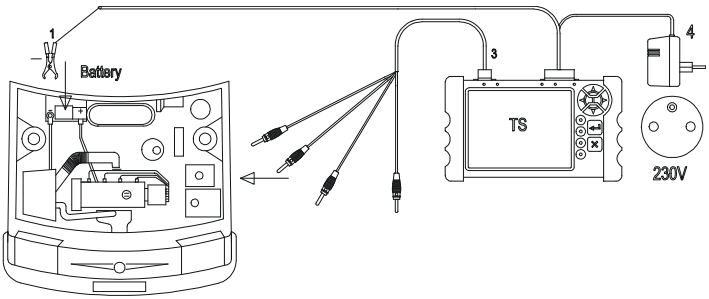

Figure 12.2

Power supply from battery + current clamps

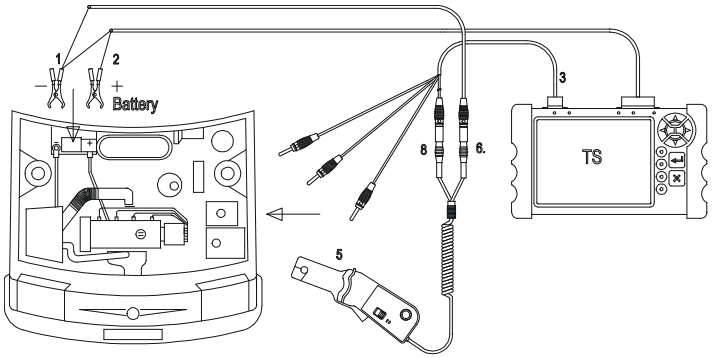

Figure 12.3

Power supply from wall socket + current clamps

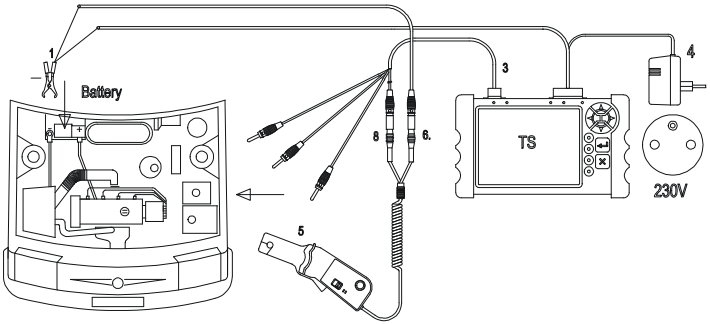

Figure 12.4

Power supply from battery + high voltage clamps

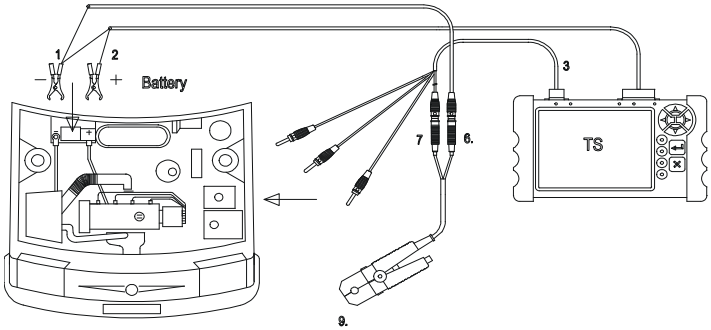

Figure 12.5

Power supply from wall socket + high voltage clamps

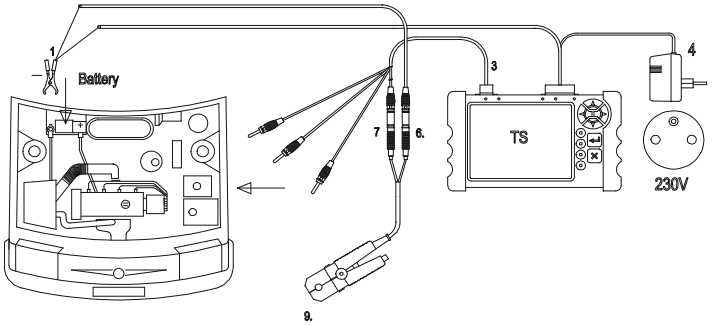

Figure 12.6

13

Appendix E
(TSPro PC Center installation and TSProWizard)

This appendix contains description of installation and setting of the PSPro PCCenter program for MS Windows operating system. The TSPro Wizard is also described in the second part of this chapter.

Installation and administration of TSPro PC Center

After you insert the installation CD into the CD-ROM drive of your computer, the installation program runs automatically. Now we will guide you trough the installation process and explain basic setting of the program. If an installing window does not appear after you insert the disc into the drive, double click This Computer icon, select the CD-ROM drive and double click on it, then run the StartCD.exe program.

TSPro Pc Center installation

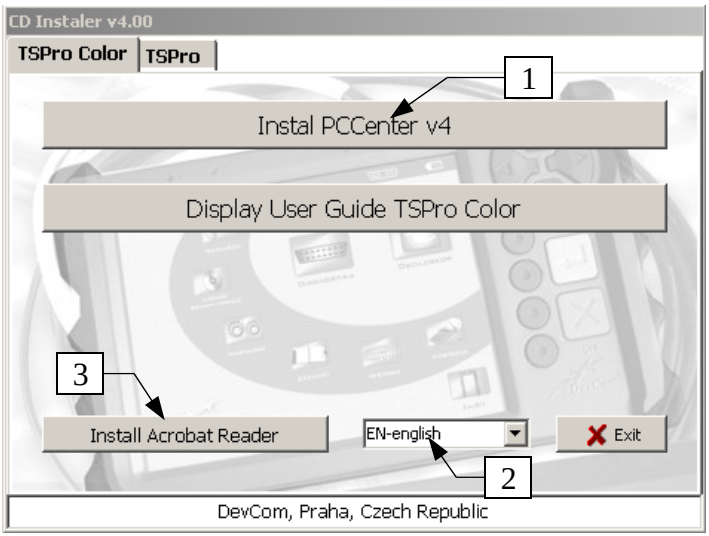

Figure 13.1

A window (Figure 13.1) appears when the installation program is started. You can set the parameters of the installation here such as language, device type, installed software version etc. The selected language inflicts only the installation, not the program itself. The program´s language can be selected in the MainBar (see below).

You can not only run installation of the PCCenter from the main window, but

also install an additional program Acrobat Reader, which is used to view files in the PDF format. Install this program if it is not installed already in your computer, because it is used to view an included manual when you click the Show TSPro Color manual icon.

When the Install PCCenter v4 button is clicked, the installation begins with displaying a welcome window of the installation and continue by clicking the Next button. You can terminate the installation anytime by clicking the Cancel button.

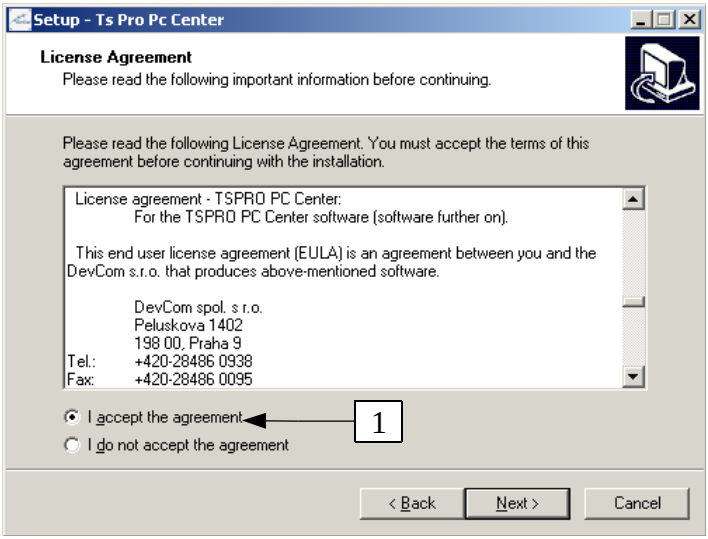

Figure 13.2

The license agreement is shown in the next window (Figure 13.2). Read it carefully, by clicking the I accept the agreement you are obligated to obey it. If you don´t agree with it, the installation can´t be proceeded. To continue installing click the Next button.

In the next window you can see information about the manufacturer, perms and conditions of using this program and minimal requirements for your computer (they can also be found in Appendix B of this manual).

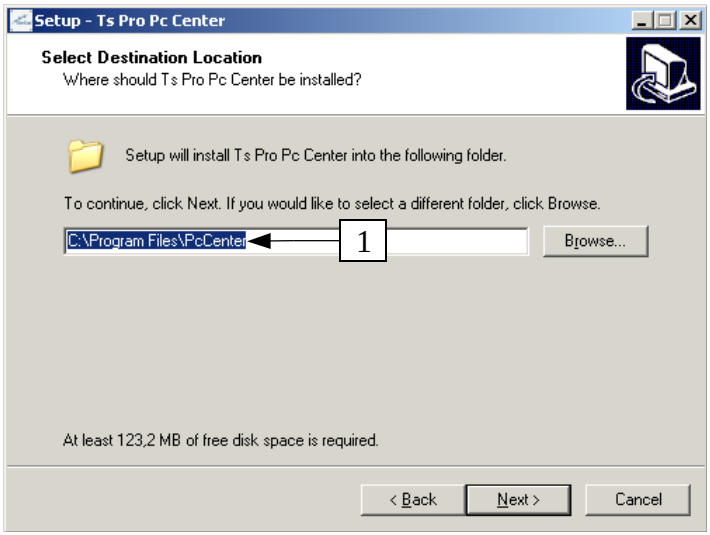

Figure 13.3

When you click the Next button, a window with option of installing location appears (Figure 13.3). We recommend to use the default setting, but you can change it, of course. To continue, click the Next button.

In the next window you can change name of the directory in the Start menu or it´s location, which we do not recommend. By default, a PCCenter2 directory in the Programs menu is created. To continue installing, click the Next button again.

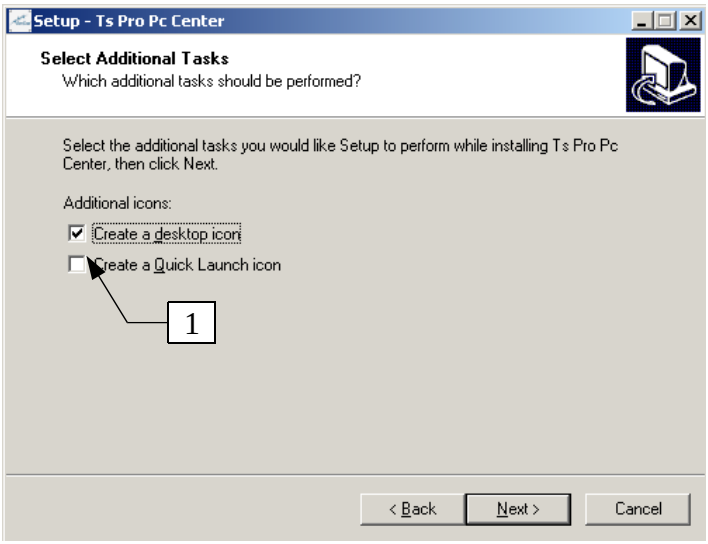

Figure 13.4

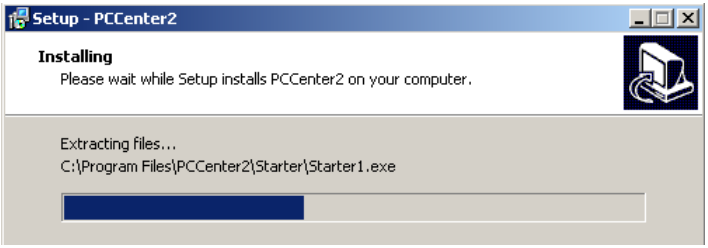

Figure 13.5

In the following window you can choose whether you want to create a desktop icon and an icon in the quick launch panel or not. Then click the Next button.

The new window shows summary of the installation setting. Installation begins by clicking the Install button. The process of installation is shown on the Figure 13.5.

A window showing installation summary appears when the installation is finished. It also reminds you that you should change some settings before you start working with the TSPro diagnostic; they are described in chapter TSPro PCCenter settings. To continue, press the Next button.
The next window is the last and informs that the installation process was successful. By clicking the Finish button the installing program closes and the installed program is ready for use. If you tick the box Launch TSPro PC center it will run immediately after you finish the installation. If you will not do so, you can run it by clicking the PCCenter2 item in the Programs folder in the Start menu or in the quick launch panel if you have selected the option before.

Uninstalling the TSPRO PC Center

If you want to remove the TSPro PCCenter from your computer, follow these steps. In the Start menu in the Programs folder there is a PCCenter2 folder and here you can find an item Uninstall program PCCenter. After you click it a dialogue window asking you to confirm removing appears (Figure 13.6).
By clicking the Yes button you agree that the program will be deleted. A window informing about process´s finish appears after the program is successfully deleted. (Figure 13.7).

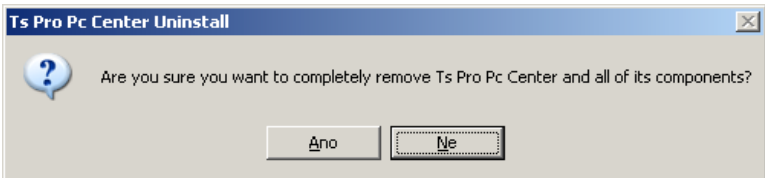

Figure 13.6

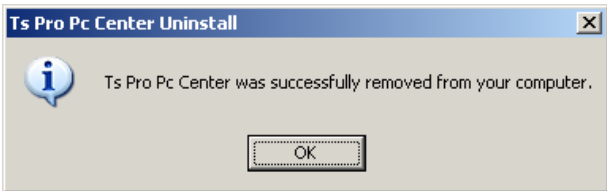

Figure 13.7

TSPro Pc Center´s directory tree

A directory tree, where all program´s data is saved, is created when the program is installed. This directory can be found on Figure 13.8. It´s location may vary according to the destination folder chosen during installation, but the directory tree is always the same.

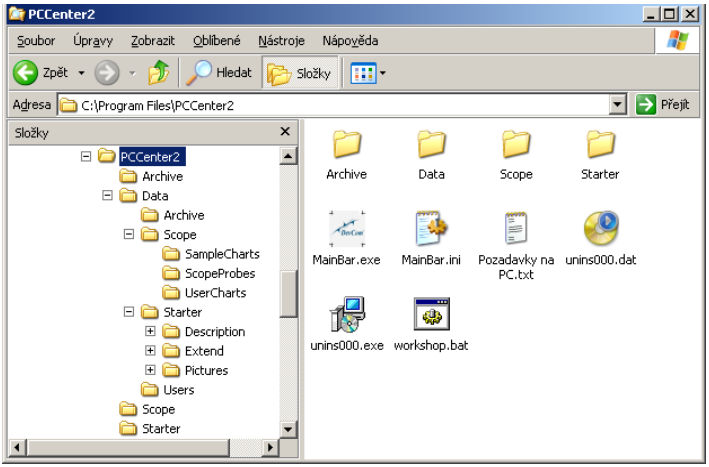

Figure 13.8

The PCCenter2 folder always contains 4 folders; 3 folders of sub-programs (Starter - serial diagnosis, Scope - oscilloscope and Archive - data management) and Data folder (Figure 13.8). The last one is special because it contains data and settings of all applications.

Lets describe the purpose of individual folders:

- **Archive:** This directory contains files with diagnostic data loaded from the control units, such as identification, error memory, parameters etc. These files end with *.ERR and are managed by the TSArchive program.
- **Scope:** Data from oscilloscope measurements can be found here.

They are divided into 3 sub-folders:

- ***SampleCharts:*** This directory contains files with examples of waveforms of the most important probes and actuators. It´s content is loaded as a part of installation process. These files end with *.SDF and are used by the PCScope application.
- ***UserCharts:*** In this folder you can find files created while working with the oscilloscope. There are 2 types of files - logs ending with *.SDF and pictures ending with *.BMP. These files are used by programs PCScope and PCArchiv
- ***ScopeProbes:*** This folder contains files with probes data. These files end with *.INI and are used by the PCScope program.

- **Starter:** Files used by the PCStarter program are stored here.
- **User:** In this folder there are files containing data about customers. Files end with *.INI and are used by the PCArchiv program.

TSPro Wizard

The TSPro Wizard (Figure 13.9) is used for loading data to the TSPro device, notably the diagnostic programs (modules). This program is not a part of PCCenter instalation CD and is shipped separately. It´s installation and functions are described in a document which can be found on the TSPro Wizard CD.

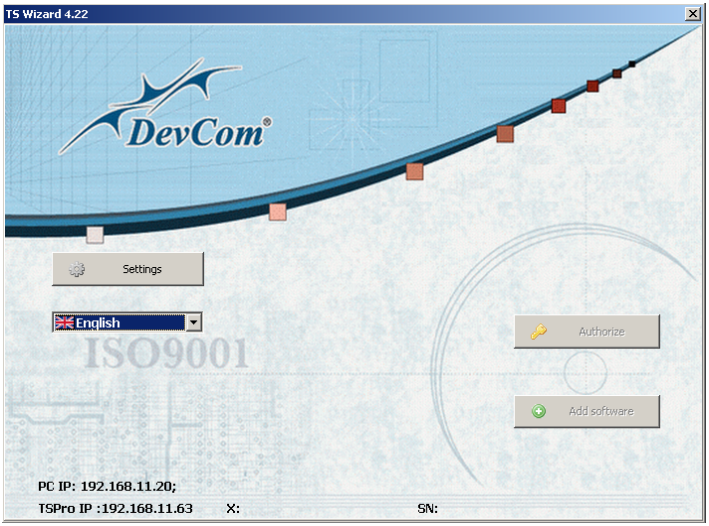

Figure 13.9

14

Appendix F
(LAN connecting, IP address setting)

In this chapter we will describe how to connect the TSPro to a computer network and how to set your computer´s IP address. This is required for connecting the TSPro to a PC and for using the TSPro PCCenter program. The procedure will be described for the Windows XP operating system; it is similar for Windows Vista and Windows 7.

It is necessary to connect the TSPro device to your computer and to set some important parameters in order to use your computer for control unit diagnosing or performing oscilloscope measurements.

Connecting TSPro to the PC

First, it is necessary to connect the PC and the TSPro with a UTP cable (included). You can see the port where it connects on Figure 14.1.

Figure 14.1

It can be connected directly to the computer, or you can connect it into an existing network using a hub/switch. It is important to remember that you have to use a crossover cable if you connect it directly to the computer, and straight-trough cable when connecting it to a network (Figure 14.1).

TSPro also supports wireless connection using WiFi. The device can be connected to a network using wireless router (Figure 14.3).

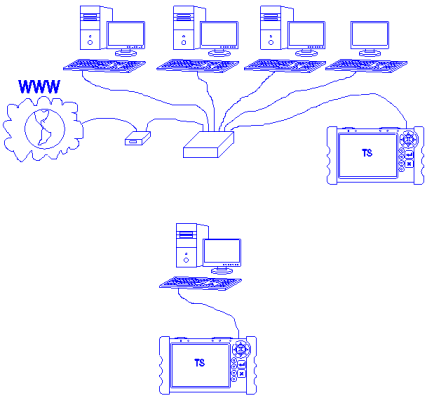

Figure 14.2

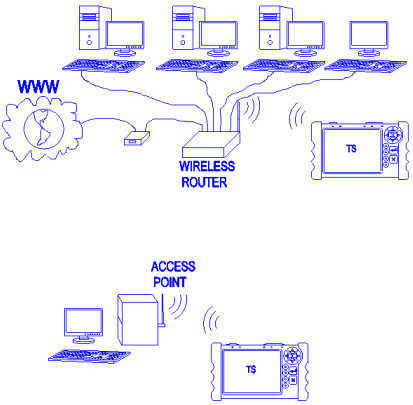

Figure 14.3

IP address setting

We recommend using of following IP address setting when connecting the TSPro directly to a PC: *192.168.13.1* for the TSPro device and *192.168.13.2* for your computer.

An example of network setting for PC <-> TSPro direct connecting::

1. *Network parameters setting in TSProColor : 192.168.13.1*

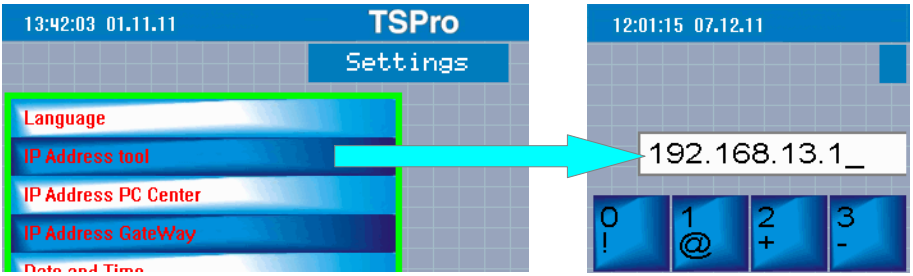

Figure 14.4

2. *Network parameters setting in PC* : 192.168.13.2

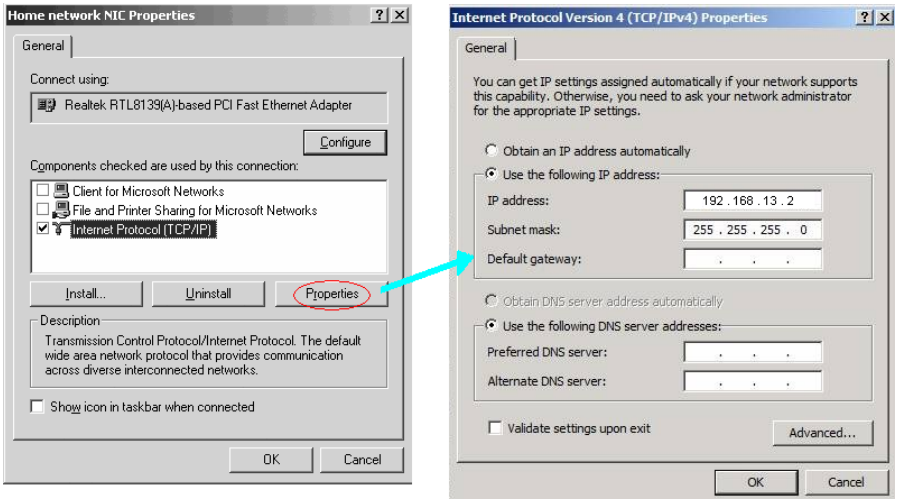

Figure 14.5

3. *MainBar application setting:* The same address which is set in the TSPro device (192.168.13.1) must be set in the Settings menu (Figure 14.6).
4. *Test:* If all network parameters are set and the computer is connected to the TSPro via a crossover cable we can perform a connection test. If a sign "Connection OK" (Figure 14.7 - 2) appears after you press the

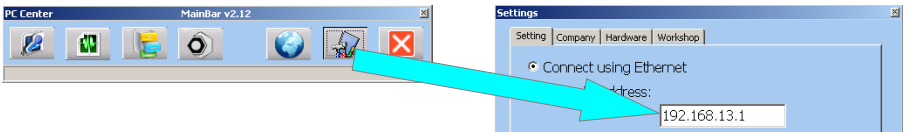

Figure 14.6

Test connection button (Figure 14.7 - 1), all parameters are set correctly.

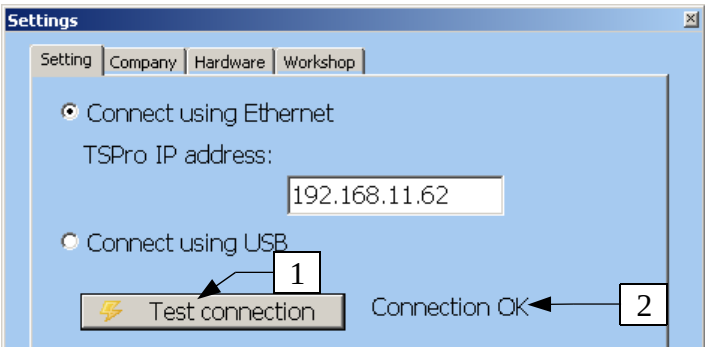

Figure 14.7

The TSPro may also be connected to the network trough a switch or hub; in this case it is necessary to set the device in order to match it with network´s settings. Wrong setting may lead to conflicts and communication with the device may not work.

Wireless connection setting

The wireless network has to have following parameters:

Topology:	Infrastructure
Network name:	DEVCOM
Security:	none
Data rate:	11 Mbps

The IP and MAC addresses are the same as for wired connection. This setting is programmed in the TSPro and can not be changed.
Gateway´s IP address in the TSPro is the address of a wireless router or an access point.

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Appendix G

(technical parameters)

This chapter describes technical specifications of the electronic diagnosis device TSPro Color and it´s peripherals.
Required hardware and software accessories is also mentioned.

Technical specifications of the electronic diagnosis device TSPro Color are listed in chart 15.1.

Operating temperature	5 - 40°C
Storing temperature	-10 - 50°C
Connectors	canon 25 pins for CAN bus connection RJ45 for PC connection power connector canon 9 pins for oscilloscope probes connection
Dimensions	200 x 120 x 54 mm
Display	5.7“ color touchscreen (resolution 640x480 pixels)
Keyboard	Silicon buttons
Power	battery (2 hours with no oscilloscope usage), 12V DC (Car battery, diagnostic port) or 220V from wall socket using adapter
Power consumption	8 W
Cover	P44
Mass	746 g

Chart 15.1

The chart 15.2 contains technical parameters of the integrated oscilloscope. Using a special cable is required. All voltage ranges can be used with both AC and DC bond.

Channel number	2/4/8 (depends on purchased module)
Sampling frequency	20 MS/s for each channel
Voltage per square	50mV – 100V
Current per square	5A – 1kA
Timebase	5us – 5s
Bond	AC/DC
Trigger	Single, Auto/Roll, Normal (rising or falling edge)
Logging	Up to 2 hours of 4-channel recording
Viewing	In the device
Memory card	1 GB

Chart 15.2

PC requirements

The TSPro device supports communication with personal computers. Your computer must meet following parameters in order to work properly:

- MS Windows 2000/XP/Vista/7/8
- Intel Pentium compatible processor
- Frequency 1.5 GHz or more
- RAM 2GB or more
- A graphic card with proper drivers
- Monitor with 1024x768 resolution, color depth 32bits
- Network card 100Mb/s

One can say that the TSPro PCCenter runs on any today´s computer. We recommend to use it on computers with operating system Windows XP or 7.
Program Adobe reader is needed to view the manual included on the installation CD. It is also included on the CD and can be also downloaded from www.adobe.com.

Oscilloscope module installation

The device must be turned off. Then, in a clean and dry area, unscrew the cover, insert the module and screw it back. It is recommended to lose your static charge by touching something conducting connected to the ground. Figure 15.1 shows the procedure.

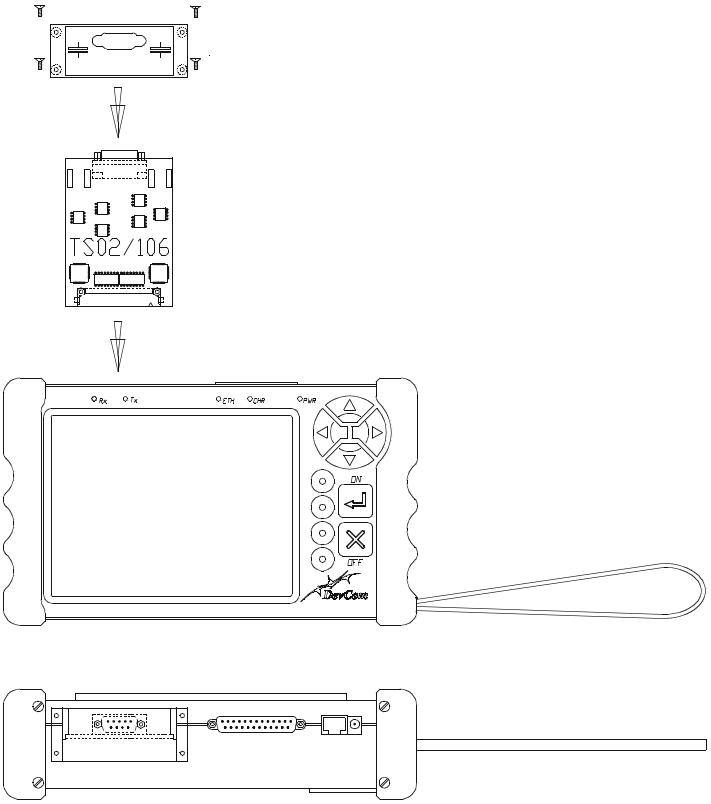

Figure 15.1

Battery installation

If the battery lasts for shorter time, which happens after many charging cycles, you may want to change it for a new one. It must be opened in a dry and clean environment. Batteries can be changed only for new ones purchased from the manufacturer of the device. The procedure is shown on Figure 15.2. Please make sure the old batteries are recycled; they should not be treated as a household waste.

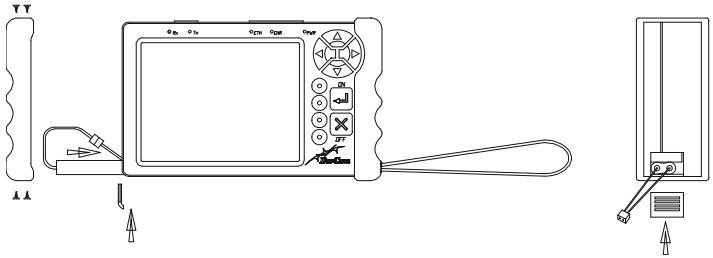

Figure 15.2

16

Appendix H

(Warranty conditions, Service)

In the last chapter you can find warranty and service conditions for your device.

Warranty terms and conditions

These are manufacturer´s general warranty terms and conditions, which apply in the Czech Republic. Laws of the county of purchase apply if there is a conflict between them and the warranty terms and conditions.

Any part of the TSPro device will be repaired or replaced for free if you find it damaged or badly assembled at the time of purchase. The device itself is covered by the warranty in matters of material defects and montage quality only.

Contact your reseller if you believe that the device was working properly at the time of purchase and the fault has taken shape during the warranty period. Both the manufacturer and the reseller believe in the quality of our products and will do our best to make you satisfied.

Warranty restrictions

The following cases are not covered by the warranty:

- minor faults or deviations in the quality of a product which do not affect the product's value or fitness for its intended purpose
- rechargeable and disposable batteries (these products have a shorter service life, the length of which also depends on the frequency of use)
- faults resulting from improper use (e.g. operating errors, mechanical damage, incorrect operating voltage) Proper use for the purposes of this warranty is defined as use of the product under the conditions stated in the instructions for use.
- faults due to wear and tear
- any modification of Devcom products effected by you or a third party, unless Devcom has given its prior written consent to the nature and extent of the modification

- faults due to force majeure
- faults which the purchaser was already aware of at the time of purchase

The reseller

The reseller / distributor from whom you have purchased the product is the first one who you should ask to accept your warranty claim. He or she identifies the fault and either proceeds it to the manufacturer or repairs it himself. You should contact the manufacturer only if you can not contact your reseller.

Licence conditions

The software installed both in the Troodon interface and PC (PC Center) is property of the manufacturer and is protected by copyright and other laws. The software product is not being sold, you are only granted one licence to use. The licence is issued for individual device´s serial number. It is forbidden to change, modify or decompile the software, perform a backward analysis of it or make any derived work.

Warranty disclaims

The warranty covers products, devices and items made or sold by the Devcom spol. s r. o. only. The manufacturer is not responsible for any damage caused by using it´s products. The user accepts and takes over all responsibility of any arising consequences. Manufacturer´s responsibility can never exceed the selling price paid for the product.

Warranty and after-warranty service

Warranty and after-warranty service is provided by:

Devcom spol. s r.o.
Pelušková 1402
PRAHA 9
info@devcom.cz
+420 284 860 938
Czech Republic

How to ship products to the service

First call or e-mail your distributor or the manufacturer. The device may be working properly, and it was only not used properly. One e-mail or call with us may solve anything!

While sending the device to be serviced, do not forget:
-copy of a purchase certificate
-your address
-a telephone number where you can be contacted during work hours
-e-mail address
-detailed description of the problem

Packaging

Advices you can find below may help you save shipping costs, reduce the risk of additional damage and will help our technicians process the service.

Do not send batteries, manuals and other accessories, except you are asked by the technician to do so. You will save shipping costs and it cannot be lost during shipping. The manufacturer is not responsible for lost of unsolicited accessories.

Insure the device for the price of a new one. The manufacturer is not responsible for lost of the device during shipment.

Pack the device carefully and safely in a solid box not much bigger than the device. Make sure it can not move around it, but please avoid shredded paper

and very small pieces of polystyrene; if you have to use it, wrap the device into a plastic bag.

Please enclose your description of the problem, as well as your address, telephone number or e-mail address so our technician can contact you. The more detailed the description is the faster we can repair it.

Certificate of compliance - CE

This a certificate of compliance, issued according to §13, paragraph 2, 22/1997; 71/2000 and §7 169/1997 (Czech Republic laws). You can find the whole document in Czech at www.devcom.cz.

Manufacturer: DevCom spol. s r. o. IČO 25 78 75 94
hereby confirms that:
This equipment in combination with our accessories complies with the requirements for CE marking when used in a residential, commercial, vehicular or light industrial environment, achieving all the appropriate provisions of the relevant legislation in the EU.

Testing institute:
TESTCOM, IČO 00003468
Protocol number: 23/06

These harmonized Czech technical standards were used when assessing the compliance:
ČSN EN 61000-2-2:2000, ČSN EN 61000-4-2:1997, A1:1999; Z1:2001, ČSN EN 61000-4-3:1997; A1:1999; Z1:2001, ČSN EN 61000-4-4:1997, Z1:2001, ČSN EN 61000-4-6:1997, Z1:2001, ČSN EN 55022:1999 class A

Warranty certificate	
Article	TSPro Color
Production number	
Dispatch date	
Dispatched by	
Warranty	
Sell date	
Distributor	
User/Owner	

2014, 1st edition