ZETLab

SEISMOGRAPH

ZET 7152-N-VER.3

USER MANUAL

LLC "ETMS"

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Introduction

The present User Manual describes structure and operating principles of ZET 7152-N-VER.3, its operation rules as well as recommendations regarding its setting-up, start, maintenance, operation, transportation and storage.

Only qualified engineers and technicians can use ZET 7152-N-VER.3.

Unboxing, installation and start of ZET 7152-N-VER.3 can be performed by the user or by representative of organization responsible for technical maintenance in accordance with the provisions of the Contract relating to the purchase of ZET 7152-N-VER.3.

The manufacturer hereby reserves the right to introduce changes into design and structure of ZET 7152-N-VER.3, which do not affect technical characteristics and do not require introducing any amendments into the technical documentation.

It is necessary to observe the guidelines of the present manual and other documents supplied together with ZET 7152-N-VER.3 at all stages of its operation.

The present user manual and product certificate are included into ZET 7152-N-VER.3 delivery scope and should be used together with ZET 7152-N-VER.3.

To configure ZET 7152-N-VER.3 as well as to perform registered data analysis, one can use ZETLAB Software, which is delivered together with ZET 7152-N-VER.3. The software is to be installed on PC, which is going to be used together with ZET 7152-N-VER.3.

For user's convenience, ZETLAB Software has a description. It can be activated by "F1" key when ZET 7152-N-VER.3 is used.

List of abbreviations used

AWS - automated workstation.

1 Description of ZET 7152-N-VER.3

1.1 Functions

ZET 7152-N-VER.3 is used for seismic impact parameters measurements. ZET 7152-N-VER.3 can be used off-line or within the scope of automated monitoring system for the purpose of seismic and seismological research by means of reflected and refracted waves method and converted waves method. ZET 7152-N-VER.3 can also be used for geotechnical studies.

1.2 Technical specifications

Technical specifications of ZET 7152-N-VER.3 are shown in *Table 1.1*.

Table 1.1 Technical specifications of the

Characteristics	Values
Measuring channels specifications	
Amount of measuring channels	6
Measuring axes direction	Measuring axis Z is orthogonal to the base and is forwarded towards the lid of the seismograph, while axes X and Y – are parallel to the base
Nominal range of operating frequencies by measuring axes X, Y, Z:	from 0,3 up to 400 Hz
Relative measurement error for axes X, Y, Z, max	6 % (ZET 7152-N) 10 % (ZET 7156)
Max. measured value	±8 g (ZET 7152-N) 20 mm/s (ZET 7156)
Noise factor in operating frequencies range, max	0,2 mg (ZET 7152-N) 0,0001 mm/s (ZET 7156)
Sampling rate by channels	30, 125, 250, 500, 1000, 2000 Hz (ZET 7152-N) 1, 8, 16, 32, 64, 128 Hz (ZET 7156)
Primary transducer control	
Integrated electrical excitation system of sensing elements with actuator	yes
Primary transducer power control	yes
Off-line mode	
Off-line mode operation time, max	18 h
Battery type	lead
Integrated non-volatile memory volume	32 Gb
Time of data recording to integrated SD-card at 500 Hz sampling frequency	Over 1000 h
Synchronization parameters	
Synchronization types	GPS or PTP (IEEE1588)
Clock oscillator accuracy	0,1 ppm
General specifications	
Power voltage	16-27 V
Consumed power	4 W
Data interface	Ethernet and USB 2.0
Dust and water resistance rating	IP65
Average lifetime	10 years
Weight (without control panel), max	6,5 kg
Dimensions (without control panel), max	base diameter: 160 mm height: 260 mm
Operating temperature range	-10 … +50 °*C*

Guaranteed service life[1]	10 years

1.3 Delivery scope of ZET 7152-N-VER.3

Delivery scope of ZET 7152-N-VER.3 is shown in *Table 1.2*.

Table 1.2 Delivery scope

Item	Title	Amount
ZET 7152-N-VER.3		1 pc
HighSpeed USB 2.0 Cable		1 pc
Patch Cord UTP Cable (Cat. 5e)		1 pc
GPS/GLONASS receiver Trimble		1 pc
Battery charger SADP-65KB (220V → 19V)		1 pc
Pins for ground mounting (for off-line product version)		3 pcs
Mounting kit (for stationary use): mounting plates #1,2, set of mounting screws, junctions box		1 kit
ZETKEY		1 pc.
CD with ZETLAB software		1 pc
Product certificate		1 pc
User manual*		1 pc
* - it is allowed to provide a single copy of User Manual for products lot up to 10 pcs.		

[1] The guaranteed service life is only valid in the case of ZETLAB software updates at least once in two months. The warranty does not apply to the integrated battery of ZET 7152-N-VER.3

1.4 Construction of ZET 7152-N-VER.3

Components of the ZET 7152-N-VER.3 are placed inside of a cylindrical package. Overall

view of ZET 7152-N-VER.3 is shown in

Figure 1.1.

Figure 1.1 Overall view of ZET 7152-N-VER.3

ZET 7152-N-VER.3 is a complex multi-functional measuring complex, which includes:

1. ZET 7156 digital short-period seismometer

Digital short-period seismometer ZET 7156 is used for vibration velocity measurements of high structures (bearing and enclosure structures) and underground structures (foundations, piles, etc.). The seismograph consists of three identical sensing elements and a measuring module. The sensing elements detect low-frequency mechanical oscillations by three mutually transverse axes (X, Y and Z) and convert them into analog signal. The measuring module, in its turn, performs digital processing of the analog signals and transfers digital data via CAN 2.0 interface.

2. Digital accelerometer ZET 7152-N

Digital accelerometer ZET 7152-N is used for measurements and conversion of acceleration into a digital signal and further transfer of the data in digital format. The accelerometer consists of a vibration sensor with integrated triaxial sensing element, which converts acceleration value into a digital code by three mutually transverse axes X, Y and Z.

3. Off-line recorder ZET 7173

Off-line recorder ZET 7173 is used for recording the data obtained from digital sensors of ZET 7152-N-VER.3. Data recording starts automatically as ZET 7152-N-VER.3 is switched on. The data is saved to a microSD card as files in special format.

4. Synchronization module ZET 7175

Synchronization module ZET 7175 is used for synchronization of sensors time with global time.

5. Interface converter ZET 7176

Interface converter ZET 7176 is used to connect the digital sensors of ZET 7152-N-VER.3 to PC via Ethernet interface as well as to configure digital sensors parameters.

6. Integrated battery

ZET 7152-N-VER.3 has an integrated battery allowing to record the registered signals to non-volatile memory for further analysis by means of PC. ZET 7152-N-VER.3 data is transmitted via Ethernet in real-time mode. Battery capacity enables measurements during 18 hours.

Meanings of indicators located at the lid of ZET 7152-N-VER.3 are shown in *Table 1.3*.

Table 1.3 Meanings of indicators

Indicator name	Indicator color	Indicator state	Event
Battery	Red	On	It is necessary to charge the battery.
	Blue	On	Battery is charging.
	Green	On	Battery is charged (The indicator is active only when ZET 7152-N-VER.3 is switched off).
REC	Orange	On	Data recording to a memory card or data transfer to industrial PC via USB / Ethernet.
LAN	Green	On	ZET 7152-N-VER.3 is connected to PC via Ethernet interface.
Sync	Blue	Flashes	ZET 7152-N-VER.3 synchronization by GPS or PTP.
Error	Red	On	Error.

At the lid of ZET 7152-N-VER.3, there are ports for connecting external devices. Information on ports functions is shown in *Table 1.4*.

Table 1.4 Functions of ports

Icon	Title	Function
	USB	Transfer of the recorded data to PC via USB interface.
	Ethernet	Connection of ZET 7152-N-VER.3 to industrial PC via local Ethernet network.
	Charge	Connection of charging device SADP-65KB to ZET 7152-N-VER.3.
	Sync	Connection of external aerial GPS/GLONASS Trimble to the ZET 7152-N-VER.3.

«Power» key is used to switch ZET 7152-N-VER.3 on/off. In order to switch ZET 7152-N-VER.3 on, press and hold “Power” key for at least 3 seconds. To switch ZET 7152-N-VER.3 off, click the “Power” key.

2 ZET 7152-N-VER.3: setting-up procedures

2.1 Unboxing

Unboxing should be performed on a horizontal stable surface, after that one should:

- Check the completeness of ZET 7152-N-VER.3 in accordance with the items specified in *Table 1.2* (see Clause **Ошибка! Источник ссылки не найден.**);
- Perform visual examination, check ZET 7152-N-VER.3 for any mechanical damage.

Recommendation: In the case if there is a room for storing of ZET 7152-N-VER.3*, it is recommended to save the package. If* ZET 7152-N-VER.3 *is transported, it should be placed into the package, so that to avoid damage.*

2.2 Integrated battery: operating rules

ZET 7152-N-VER.3 has lead battery (5 Ah capacity). The battery has leak-proof package and gas recombination system. Table 2.1 shows battery operational requirements.

Table 2.1 Battery operational requirements

Parameter	Value
Storage temperature range, ºC	-35…50
Operating temperature range, ºC	-10…50

Battery charging should be performed in the following sequence:

1. Connect the charging device (included into delivery scope) to the "Charge" port of ZET 7152-N-VER.3 panel. Connect the charging device to 220 V AC network.
2. During battery charging the "Battery" indicator should have blue color.
3. Green color of "Battery" indicator means that the battery charging process is complete. Upon charging process completion, disconnect charging device from ZET 7152-N-VER.3 and 220V AC.

Note! Battery replacement is not covered by warranty provisions and is to be performed by the Manufacturer.

Attention! In order to extend battery service life in the case of long-term storage, it is necessary to charge the battery at least once in 6 months.

Attention! It is allowed to use the battery at negative temperatures; however, it may lead to a shorter time of off-line operation.

2.3 Installation of ZETLAB software to PC

In order to install ZETLAB software to PC, one should:

1. Put the Software CD (included into delivery scope) into the PC;
2. Run «ZetLab.msi», follow the instructions and complete installing ZETLAB Software to the PC;

Attention! You should be logged-in as an administrator to install the software.

Note: the following system requirements should be met for proper operation of the software:

- *Dual-core processor or more;*
- *Core speed - over 1,6 GHz;*
- *RAM - over 2 Gb;*
- *HD free space – over 20 Gb;*
- *Video-controller: 3D-graphics acceleration, support of OpenGL, DirectX, memory: over 128 Mb;*
- *Resolution: min. 1280×1024;*
- *Mouse or any other pointing device;*
- *Standard keyboard or any other entry device;*
- *CD-ROM for programs installation;*
- *Supported OS versions:*
    - *Microsoft® Windows® 7 32/64 with SP1;*
    - *Microsoft® Windows® 8 32/64;*
    - *Microsoft® Windows® 8.1 32/64;*
    - *Microsoft® Windows® 10 32/64.*

2.4 Connecting ZET 7152-N-VER.3 seismograph to PC

The PC should have Windows OS and ZETLAB software installed. It is also necessary to connect ZETKEY (which is included into delivery scope) to USB port.

ZET 7152-N-VER.3 is connected to PC via Ethernet interface. In order to connect the ZET 7152-N-VER.3 to PC via Ethernet interface, connect the cable PatchCord UTP (Cat. 5e) to Ethernet port of ZET 7152-N-VER.3 and free Ethernet port of the PC. As ZET 7152-N-VER.3 is connected to the PC, enable “Power” key at the top panel of ZET 7152-N-VER.3. The system will find and install the corresponding driver.

IP address of the PC should be in the same network with IP address of interface converter ZET 7176 (included into seismograph). Local network should not block UDP (multicast).

Note: By default, interface converter has IP-address 192.168.1.76 with mask 255.255.255.0.

Configuring of the devices included into the scope of ZET 7152-N-VER.3 is performed in “Device manager” program from “Service” menu of ZETLAB panel. (*Figure 2.1*).

Figure 2.1 ZETLAB panel

The program “ZET Device manager” will search for available devices in the local network and depict them in the list of devices (*Figure 2.2*).

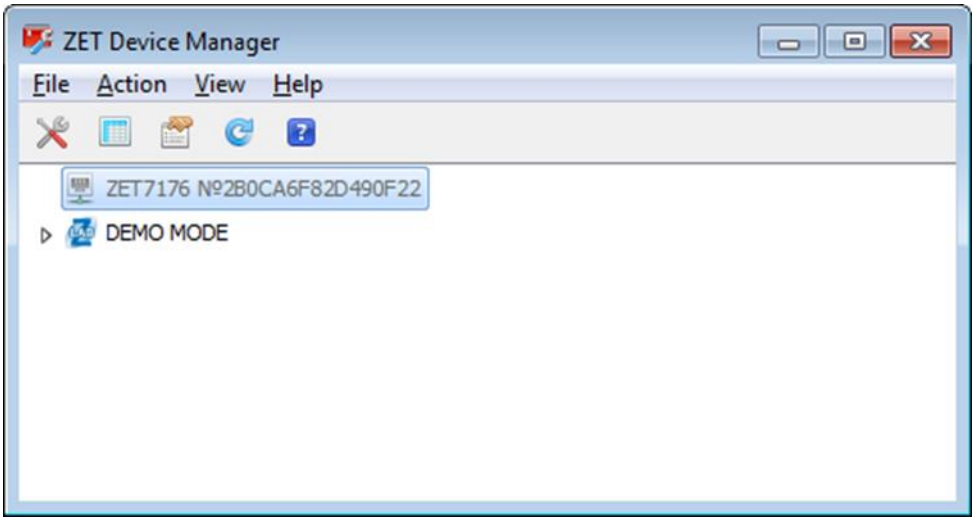


Figure 2.2 “ZET Device manager”: list of devices

The devices in the list are shown in grey color, which means that they are available, but not active. In order to connect to the interface converter, activate it from the menu with right click on its serial number. (*Figure. 2.3*).

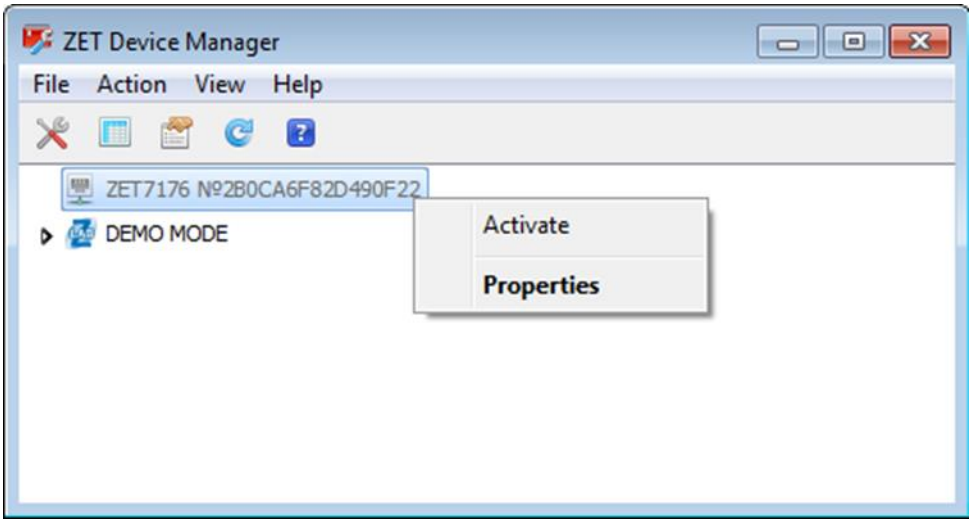


Figure. 2.3 Connecting to the interface converter

<u>Note:</u> Serial number of interface converter is specified in its product certificate.

During connection process, the device name will be highlighted with bold type. If the device name is depicted in bold type for a long time, it means that it is impossible to establish connection, Main reasons for that are as follows:

- IP-address of the PC connected to ZET 7176 is not in the same network with IP-address of the interface converter;

- There is a conflict of IP-addresses: in the local network there is a device with IP-address, identical with that of the interface converter.

In order to check current IP-address of the interface converter, enter the menu (with right click on the interface converter), enter “Properties” menu and go to “Device” tab (*Figure 2.4*). The parameter «IPv4 Address» will indicate the current IP-address of the interface converter.

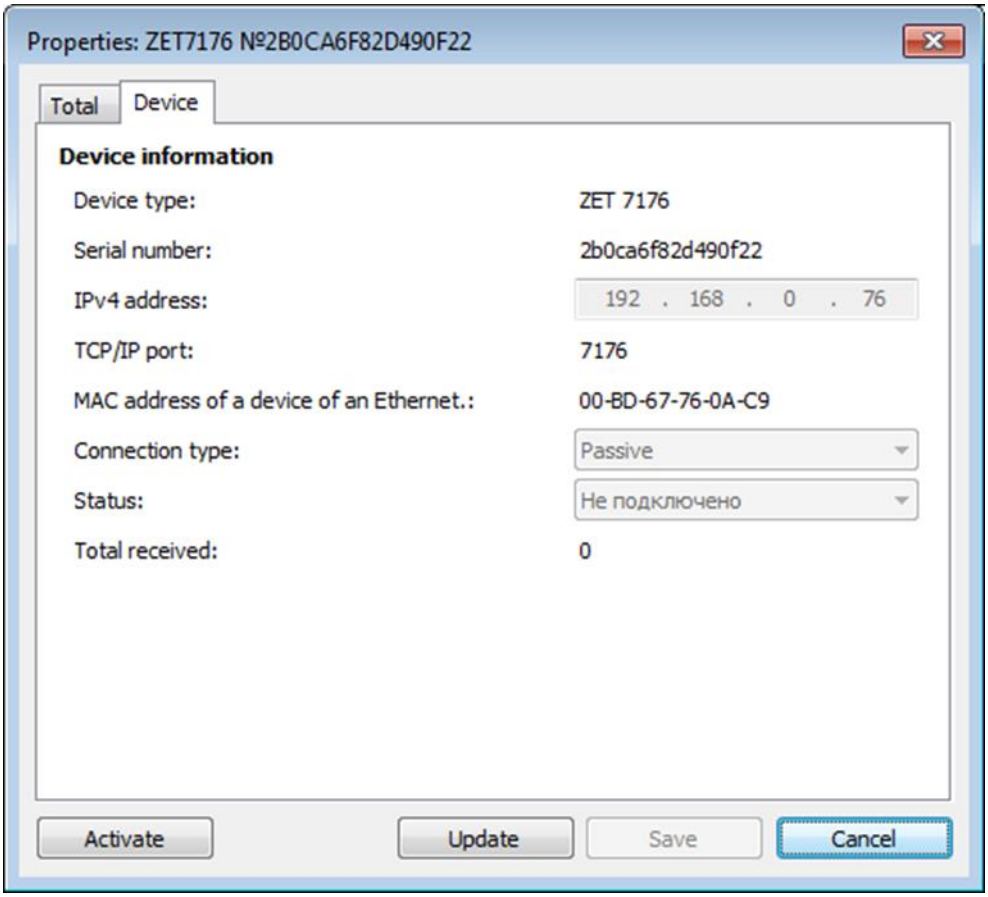


Figure 2.4 “Device” tab

As the connection is established, there will be formed a list of digital sensors connected to the interface converter (*Figure 2.5*).

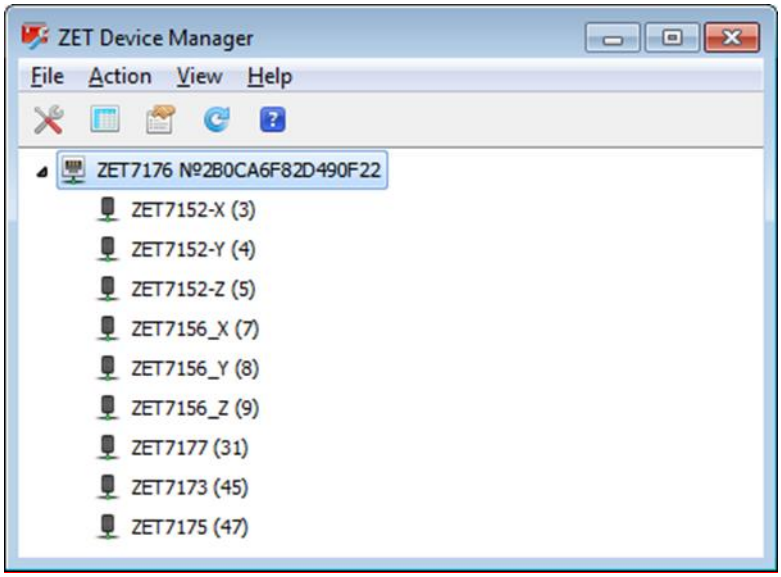


Figure 2.5 Active ZET 7176 and corresponding list of the sensors connected

The left section of the window depicts tree of devices, that are connected to the PC. The first level depicts interface converters and devices, that are connected to PC. The second level shows sensors, that are connected to a particular interface converter. To the right from the digital sensor one can see device address in the measuring network (*Figure 2.6*).

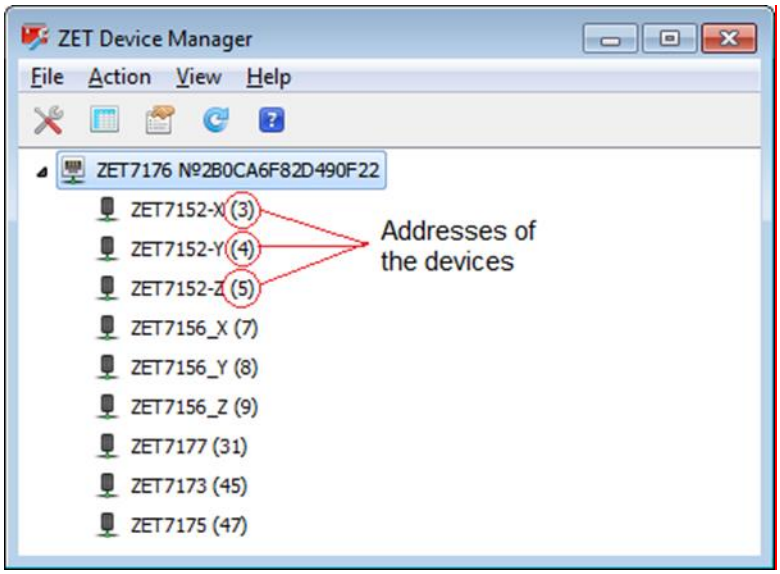


Figure 2.6 Addresses of the devices in the measuring network

In the case if detailed display mode is enabled, the right section of the window will display basic parameters of measuring channels.

In order to select a sensor to be configured, double-click its name (more information is available in “ZETLAB Software. User manual”).

2.5 Configuring ZET 7176 interface converter

In order to configure interface converter ZET 7176, one should:

- Set the network address in accordance with applicable requirements in the fields “Ipv4 address”, “Subnet mask”, “Default gateway” of “Ethernet” tab (*Figure 2.7*).

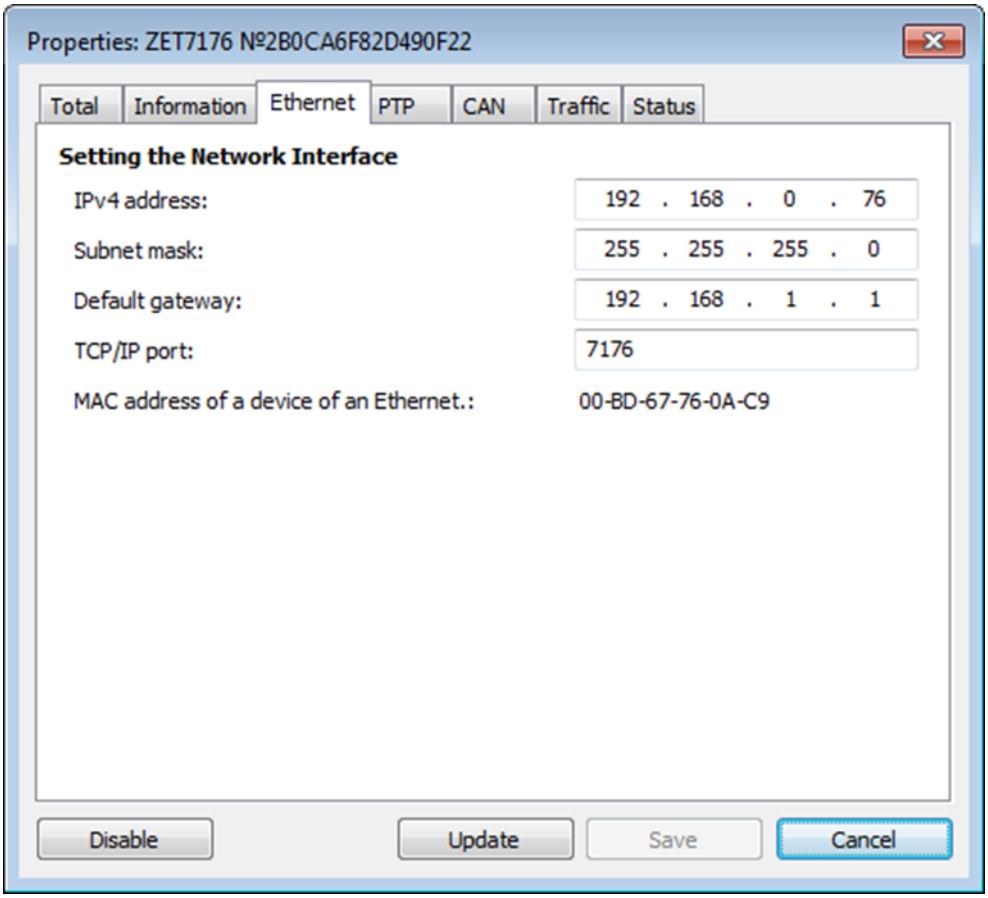


Figure 2.7 «Ethernet» tab

- Select the bit rate in accordance with the applicable requirements in the “Bit rate, kbps” field of “CAN” tab (*Figure 2.8*).

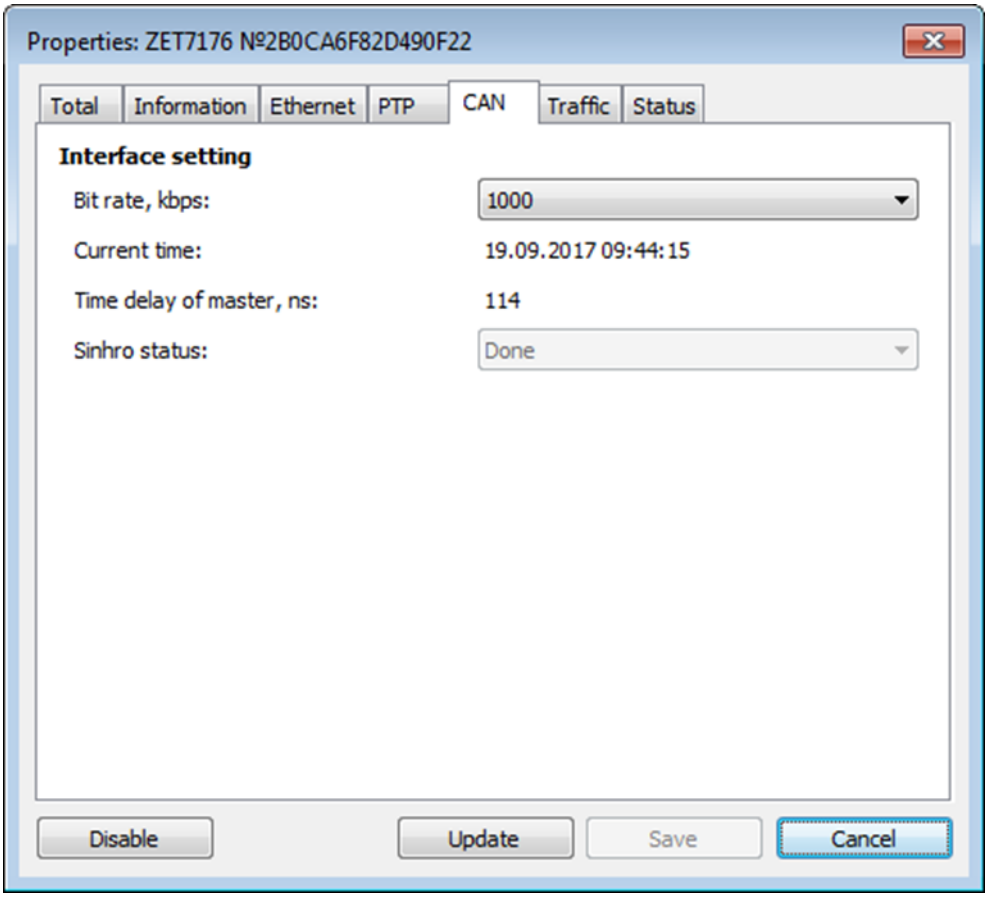


Figure 2.8 «CAN» tab.

<u>Note:</u> After changing the bit rate of interface converter it is necessary to cycle power ZET 7152-N-VER.3. The system will automatically change the bit rate of digital sensors, which are connected to the interface converter.

<u>Note:</u> additional information regarding configuration of ZET 7176 interface converter is available in the document “ZET 7176 User Manual”.

2.6 Configuring sensors included into the scope of ZET 7152-N-VER.3

Before starting to use ZET 7152-N-VER.3, it is necessary to configure corresponding digital sensors.

Note: primary configuration of ZET 7152-N-VER.3 is performed by the manufacturer.

Please, note that in the field “Node 2 ÷ 63” of “Information” tab there should be set a unique address of each device of the measuring network. All the devices within the scope of the seismograph should have unique address – it is an obligatory condition for normal operation of ZET 7152-N-VER.3. The nodes are set in the range from 3 to 63. *Figure 2.9* shows an example of “Information” tab of digital accelerometer ZET 7152-N with «3» node set.

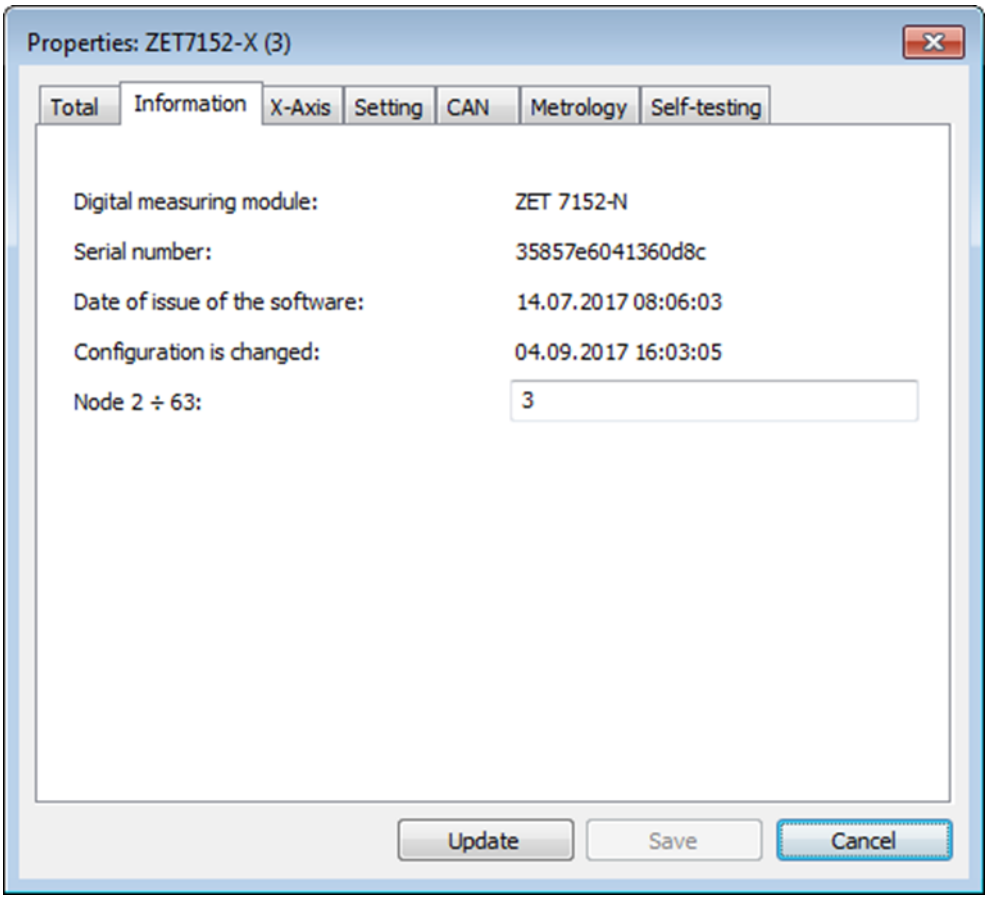


Figure 2.9 “Information” tab

The devices included into the scope of ZET 7152-N-VER.3 have the following addresses:

- Digital accelerometer ZET 7152-N – «3», «4», «5»;
- Short-period seismometer ZET 7156 – «7», «8», «9»;
- Off-line recorder ZET 7173 – «45», «46»;
- Synchronization module ZET 7175 – «47», «48».

<u>Note:</u> short-period seismometer ZET 7156 consists of three channels (by default named as: «ZET 7156_X», «ZET 7156_Y», «ZET 7156_Z») and has three addresses in the measuring network. It is possible to configure the seismometer parameters only in the tab of the first channel «ZET 7156_X». In the case if the first channel device address is changed, the system will automatically change the addresses of the remaining channels by "1".

<u>Note:</u> digital accelerometer ZET 7152-N consists of three channels (by default named as: «ZET 7152_X», «ZET 7152_Y», «ZET 7152_Z») and has three addresses in the measuring network. It is possible to configure the seismometer parameters only in the tab of the first channel «ZET 7152_X». In the case if the first channel device address is changed, the system will automatically change the addresses of the remaining channels by "1".

<u>Note:</u> off-line recorder ZET 7173 and synchronization module ZET 7175 consist of two channels and has two addresses in the measuring network (the second channel is not depicted in the system, but still has one address).

2.6.1 Configuring digital short-period seismometer ZET 7156

Configuration of seismometer ZET 7156 is performed in the «Settings» tab of «Properties» menu (*Figure 2.10*). In order to configure the seismometer, set corresponding parameters in "Configuration" tab.

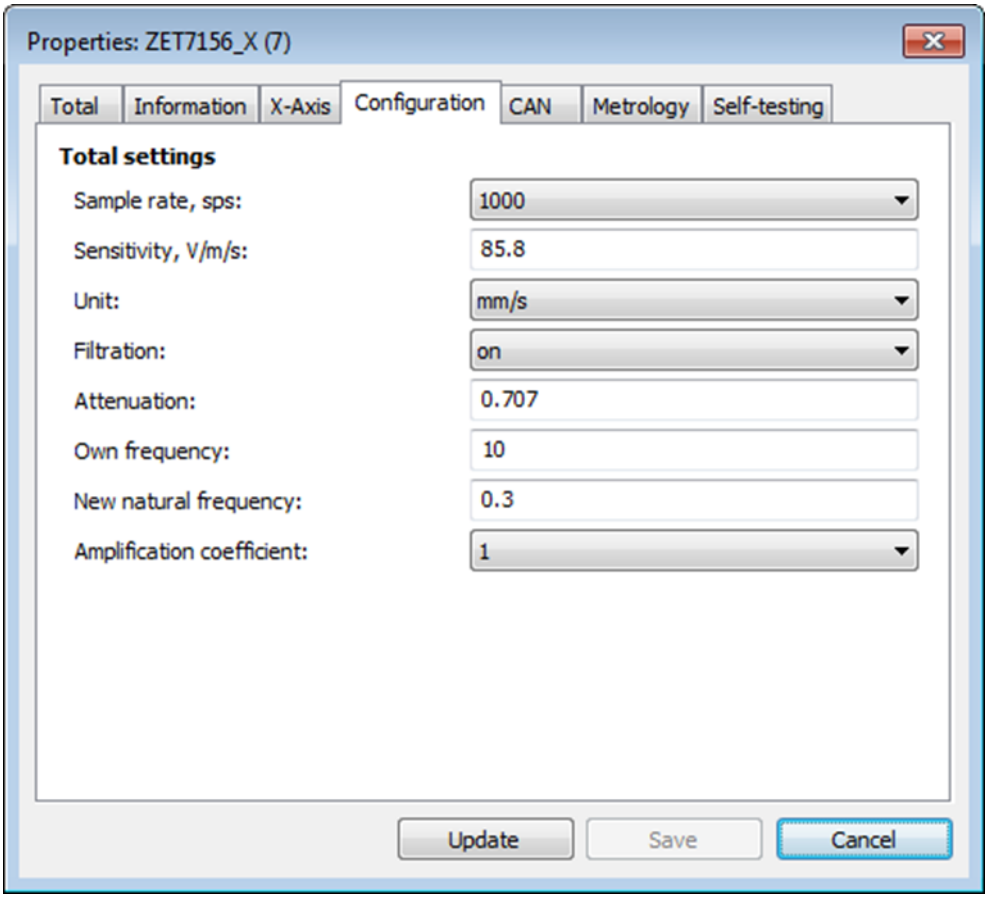


Figure 2.10 "Configuration" tab

<u>Note:</u> additional information regarding configuration of short-period seismometer ZET 7156 is available in "ZET 7156 user manual".

2.6.2 Configuring digital accelerometer ZET 7152-N

Configuration of accelerometer ZET 7152-N is performed in “Settings” tab of “Properties” menu (*Figure2.11*). In order to configure the accelerometer, set corresponding parameters in “Settings” tab.

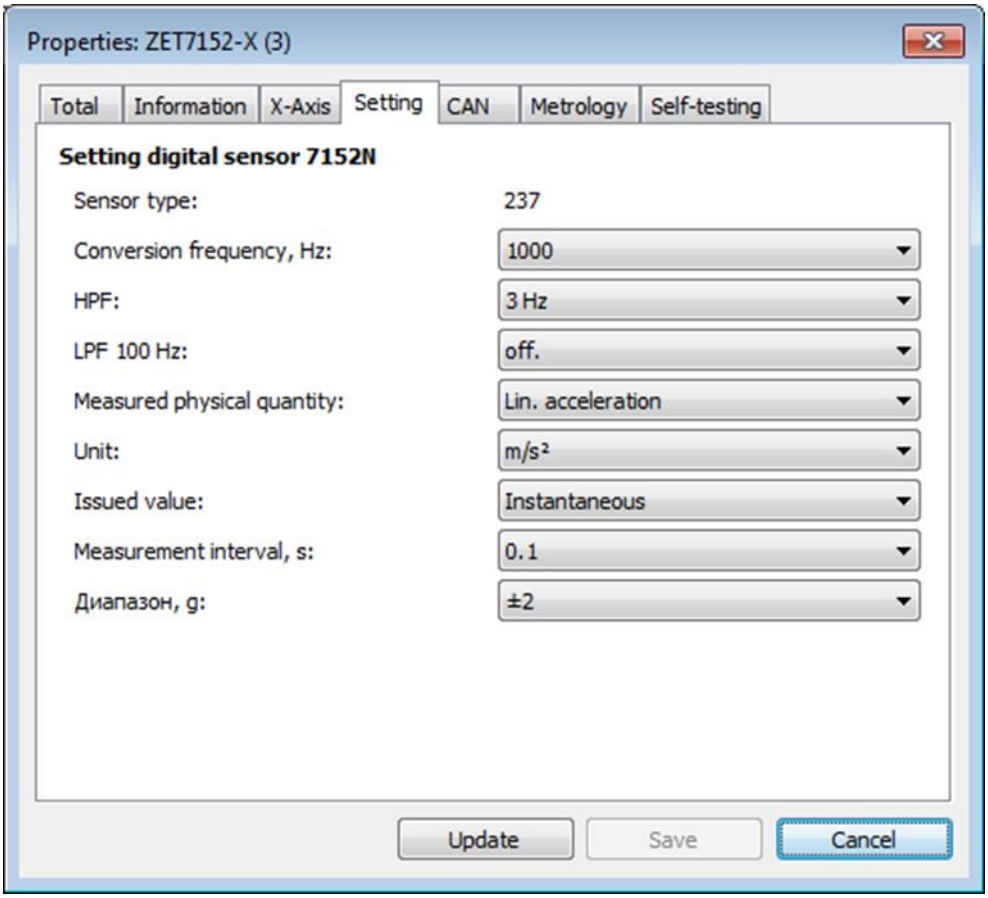


Figure2.11 “Settings” tab

<u>Note:</u> additional information regarding configuration of digital accelerometer ZET 7152-N is available in the document “ZET 7x52-N, User Manual”.

2.6.3 Configuring off-line recorder ZET 7173

In order to configure off-line recorder ZET 7173, it is necessary to:

- Select property “All addresses” in the field “Data recording mode” of “Recording” tab (*Figure 2.12*).

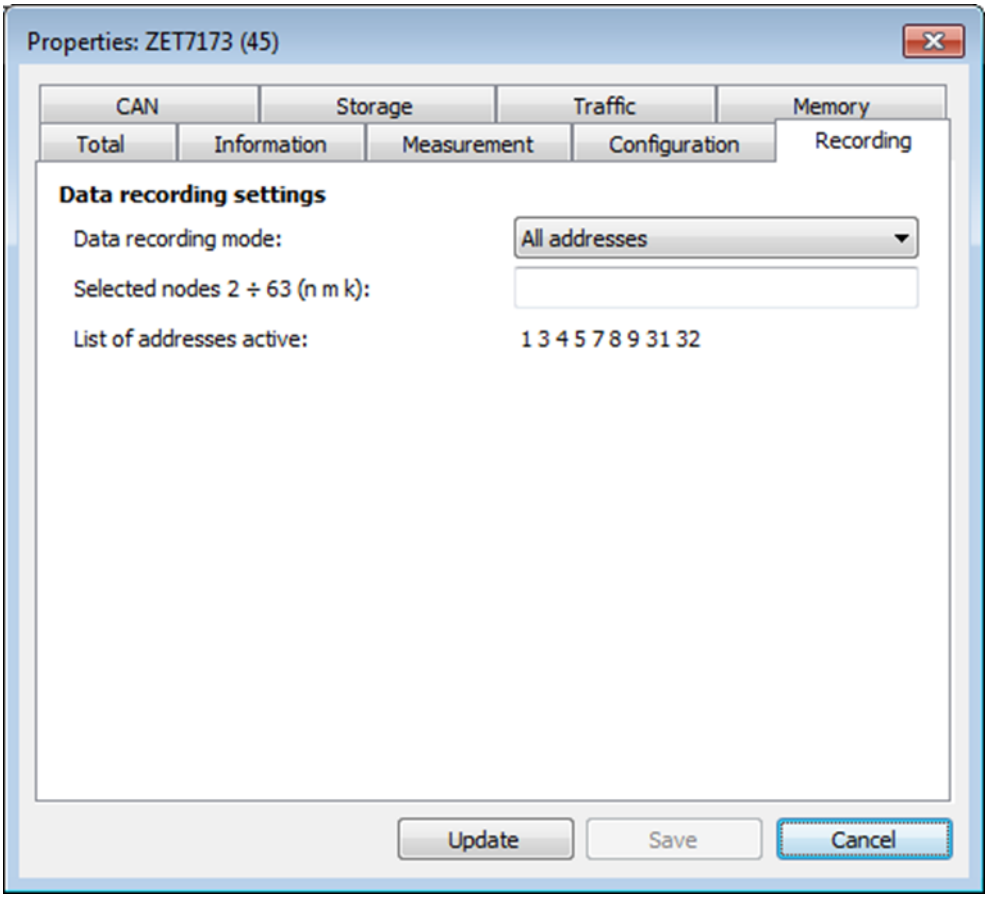


Figure 2.12 ZET 7173: “Recording” tab

- select “Linear” property in the field “Type of record” of “Storage” tab (*Figure 2.13*)

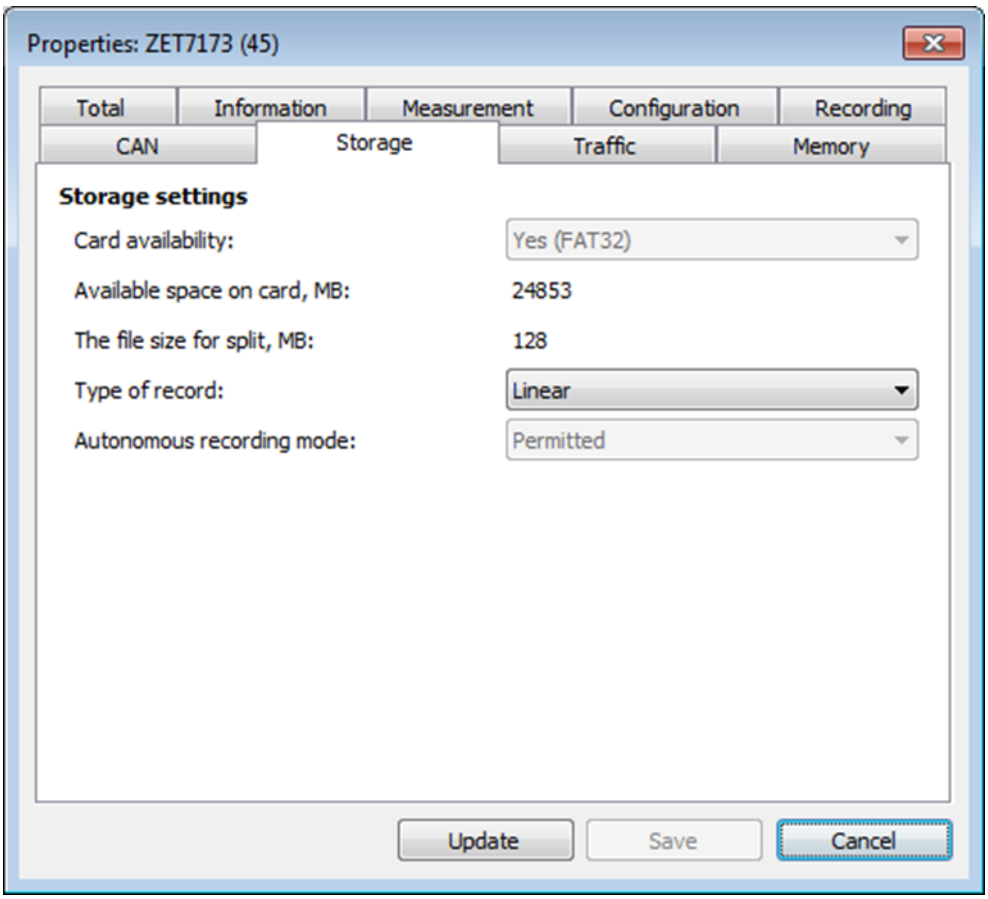


Figure 2.13 ZET 7173: “Storage” tab

<u>Note:</u> additional information regarding configuration of off-line recorder ZET 7173 is available in «ZET 7173 User manual».

2.6.4 Configuring synchronization module ZET 7175

Configuration of synchronization module ZET 7175 is performed in the “Properties” menu of “Configuration” tab (*Figure 2.14*).

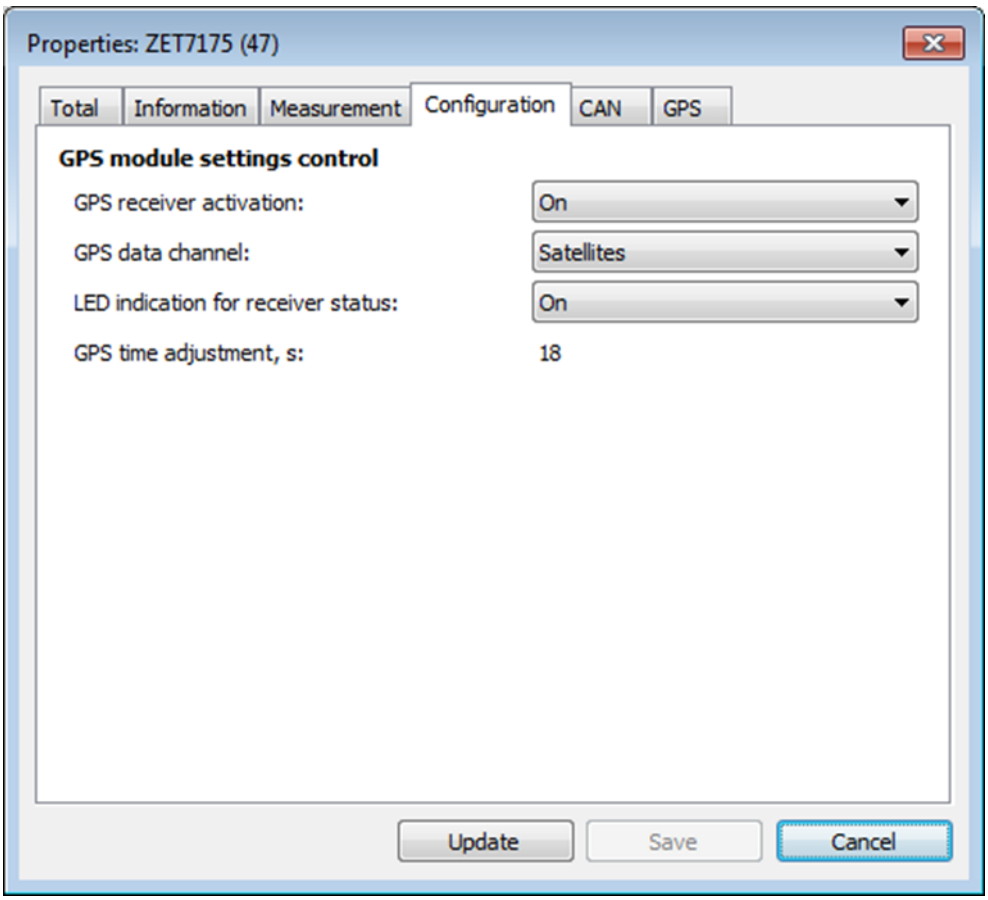


Figure 2.14 ZET 7175: “Configuration” tab

In order to configure synchronization module ZET 7175, one should set the following parameters in the “Configuration” tab (*Figure 2.14*):

1. Select “On” in the field “GPS receiver activation”.
2. Select “Off” in the field “LED indication for receiver status”.

Note: additional information regarding configuration of synchronization module ZET 7175 is available in the document « ZET 7175, User Manual».

3 Operation of ZET 7152-N-VER.3

3.1 Mounting of ZET 7152-N-VER.3: off-line use

Mounting of ZET 7152-N-VER.3 on solid surface (steel, concrete) is performed by means of the pins located at the bottom part of the seismograph. Mounting sequence is as follows:

- Place ZET 7152-N-VER.3 in the installation area, align measuring axis “X” by azimuth (normally direction to the North is used);
- Using the pins, align ZET 7152-N-VER.3 by horizontal plane, use bubble cell to check the level;

In order to mount ZET 7152-N-VER.3 on ground surface, use special pins for ground mounting.

- Remove adjustable pins from ZET 7152-N-VER.3 base;
- Install the pins for ground mounting;
- Place ZET 7152-N-VER.3 in the installation area, align measuring axis “X” by azimuth (normally direction to the North is used).
- Push ZET 7152-N-VER.3 into the ground (the pins should be placed into the ground by 2/3 of their length). If necessary, use additional pressure to align ZET 7152-N-VER.3 by horizontal plane (use bubble cell to check the level).

3.2 Mounting of ZET 7152-N-VER.3: stationary use

Mounting sequence for stationary use:

- Remove adjustable pins from the base of ZET 7152-N-VER.3;
- Fix the mounting plate #1 with M8 screws (included into the mounting kit) to the base of the seismograph;

Note: Mounting dimensions of plate #1 are specified in Annex A.

- Using M8 screws, attach the mounting panel #1 fixed to ZET 7152-N-VER.3 (observe direction of X axis of ZET 7152-N-VER.3) to the concrete surface in the area of seismic activity control – for instance, at the top surface of bore pile, foundation surface, etc;

3.3 Using ZET 7152-N-VER.3 in off-line mode

In order to use ZET 7152-N-VER.3 in off-line mode, one should:

- Make sure that the battery is charged; if necessary, charge the integrated battery (see Clause **Ошибка! Источник ссылки не найден.**).

Note: full battery charge level enables over 18 hours of ZET 7152-N-VER.3 *operation at ambient temperature over 10°C.*

- Connect ZET 7152-N-VER.3 to PC via Ethernet interface (see Clause **Ошибка! Источник ссылки не найден.**), click «Power» key at the front panel of ZET 7152-N-VER.3. Set the necessary parameters (see Clause **Ошибка! Источник ссылки не найден.**);
- As the parameters are set, switch on ZET 7152-N-VER.3 with «Power» key;
- Mount ZET 7152-N-VER.3 in the area of seismic research performance (see Clause **Ошибка! Источник ссылки не найден.**);
- Connect GPS aerial to «Sync» port of ZET 7152-N-VER.3;
- Switch on ZET 7152-N-VER.3 with «Power» key, register seismic signals during necessary time period, switch off ZET 7152-N-VER.3 with «Power» key;
- Copy the registered signals data from ZET 7152-N-VER.3 memory to PC (see Clause **Ошибка! Источник ссылки не найден.**5);
- Perform viewing and analysis of the signals recorded using ZETLAB software.

3.4 Using ZET 7152-N-VER.3 in stationary mode

Stationary installation of ZET 7152-N-VER.3 is used in the case if ZET 7152-N-VER.3 is used within such automated monitoring systems as seismic impact control system, structural health monitoring system, etc.

Stationary mounting of ZET 7152-N-VER.3 implies its connection to local automated monitoring system for the purpose of further data transfer to server and AWS systems. Configuration of server, AWS and ZET 7152-N-VER.3 within the scope of automated monitoring system is to be performed in accordance with “Administrator manual”, which is included into the automated control system documentation.

“Operator’s manual” describes guidelines regarding operation of ZET 7152-N-VER.3 connected to the local network of automated monitoring system. The manual is included into the automated control system documentation.

3.5 Copying the signals from ZET 7152-N-VER.3 memory to PC

In order to save the registered signals to PC memory, ZETLAB software uses two directories – one for saving signals and another one for storage of compressed signals data.

In order to set directories configuration, it is necessary to activate ZETLAB icon and enable the panel «User's path configuration» in the window «Main menu of the control panel» (*Figure 3.1*).

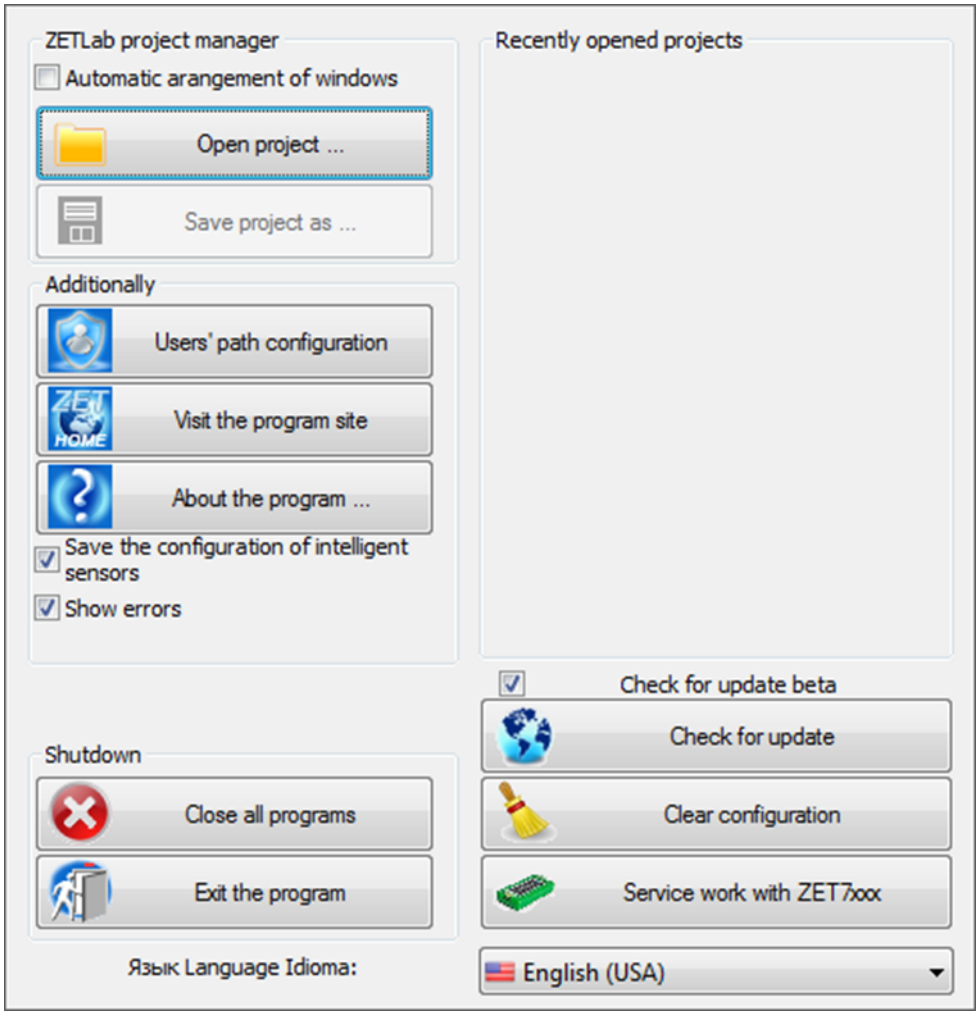


Figure 3.1 Main menu control panel

In the window “Adjusting configuration access” (*Figure 3.2*) enable the panel «...» for each of the directories corresponding to the type of the saved data (signals, compressed signals), you will see the window “Choose the directory”. Here you can assign configuration path and enable “Apply” key.

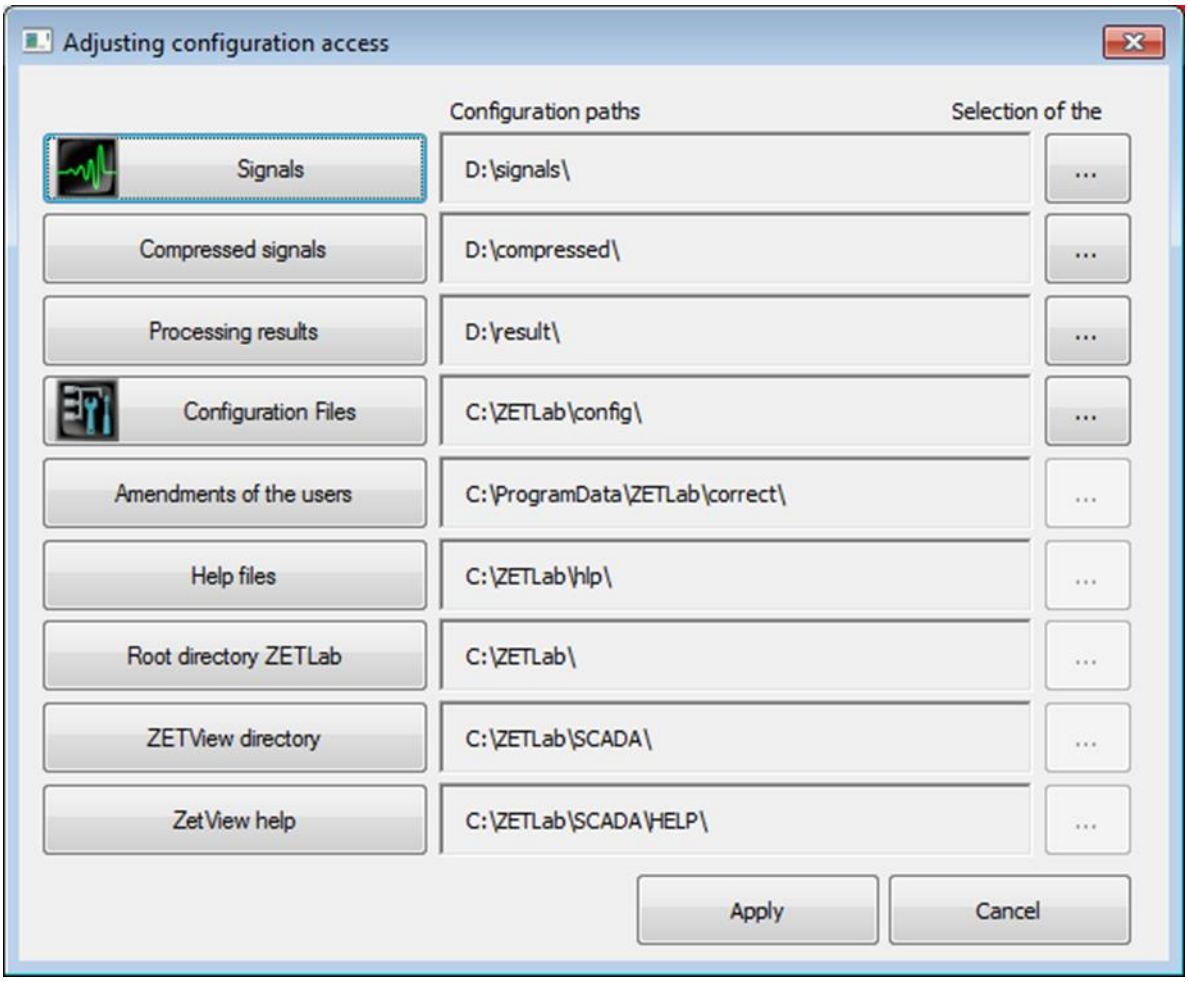


Figure 3.2 Window “Adjusting configuration access”

Sequence of copying the registered signals from ZET 7152-N-VER.3 to PC is as follows: 1) Start ZETLAB Software, 2) Connect USB cable to “” port of ZET 7152-N-VER.3 and a free USB-port of the PC. 3) The program for files saving and conversion (*Figure 3.3*) will start automatically.

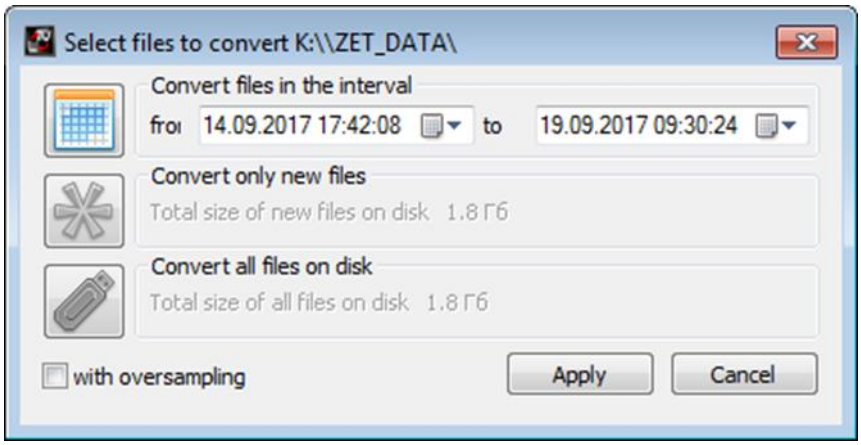


Figure 3.3 Window of program “Select files to convert”

4) Select the necessary time span and activate “Apply” key. It will start the process of files saving and conversion into the file directories for storing signals and compressed signals data (*Figure 3.2*).

5) Upon completion of files copying and conversion, you will see a window offering you to start “View historical events” program (see ZETLAB Software. Operator’s Manual).

***Note**: In the case if “Cancel” key of “Select files to convert” window is enabled (Figure 3.3), the corresponding window will be closed. The next start of the program for files copying and conversion can be initiated by means or re-connecting the USB-cable.*

***Attention!** Early interruption of copying and conversion process may lead to necessity of ZET 7152-N-VER.3 reloading.*

4 Possible faults, troubleshooting

- Errors during copying of the data via USB interface.

Make sure that there is a direct USB connection between PC and ZET 7152-N-VER.3 (without any intermediate devices, like HUB, etc.)

- Connection failure of ZET 7152-N-VER.3 via Ethernet interface.

Make sure that ZET 7152-N-VER.3 and the PC are located in one and the same subnet (see Clause **Ошибка! Источник ссылки не найден.**).

5 Technical maintenance

Technical maintenance of ZET 7152-N-VER.3 should be performed at least once in 6 months (integrated battery should be charged in accordance with the requirements specified in Clause **Ошибка! Источник ссылки не найден.**).

6 Storage and transportation requirements

In accordance with the applicable requirements, it is recommended to store ZET 7152-N-VER.3 in the package set and in heated space at the temperature of 5-40°C and air humidity up to 80%.

There should not be any acid or caustic fumes or any other chemically active substances and their fumes, which may cause corrosion in the room, where ZET 7152-N-VER.3 is stored.

In the course of ZET 7152-N-VER.3 packages loading and transportation, the handling marks and symbols requirements should be observed.

Fastening and securing of the seismograph package inside of the vehicles used for its transportation should guarantee its stable position as well as prevent it from shifting during transportation process.

Transporting allocation of ZET 7152-N-VER.3: not more than in two rows.

Transportation: climatic requirements:

- Ambient temperature: from - 35 up to + 60 °C;
- Relative humidity: up to 98 % at the temperature of +25 °C;
- Atmospheric pressure: from 84 up to 107 kPa (from 630 up to 800 mmHg).

In the course of transportation process, it is necessary to protect ZET 7152-N-VER.3 package from atmospheric precipitation and solar radiation impact.

The packaged ZET 7152-N-VER.3 should be transported in accordance with the following requirements:

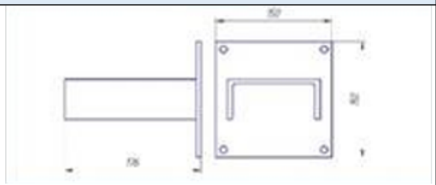
- Vehicular transportation: at the distance up to 1000 km at the max. speed of 60 km/h by highways or at the distance up to 500 km at the speed of up to 20 km/h by unimproved roads;
- Railroad transportation: at the distance up to 10000 km in accordance with the applicable requirements of Ministry of Railways (ZET 7152-N-VER.3 can be transported in any section of the train);
- Transporting by air: at any distance and at any speed (inside of a pressurized section).

Annex A

Stationary mounting of ZET 7152-N-VER.3

ZET 7152-N-VER.3 is mounted on solid surface and is fixed by means of mounting plates.

The table below contains guidelines for mounting plate selection.

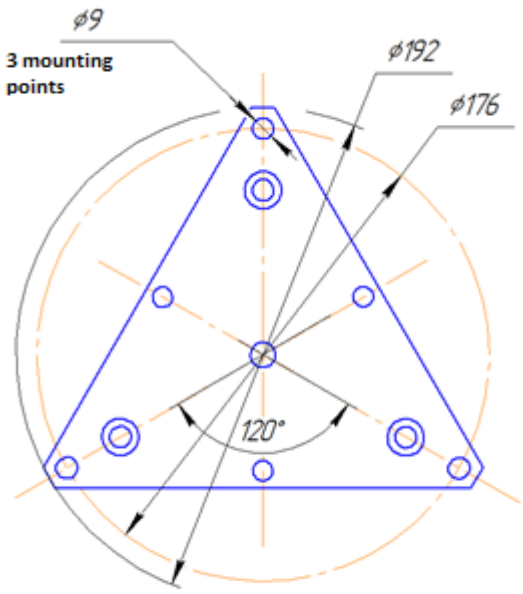
Kitting of Seismographs depending on a particular mounting option				
Type of material of the mounting surface	For horizontal surface			For vertical surface
	Stationary mounting (no adjustment)	Stationary mounting (adjustment by azimuth and horizontal plane)	Quick connection (no adjustment)	Stationary mounting (adjustment by azimuth and horizontal plane)
Steel	Plate 1	Plate 1 Plate 2 Magnetic supports	Plate 2 Magnetic supports	Plate 1 Bracket
Concrete	Plate 1	Plate 1 Plate 2 Magnetic supports	Plate 1 Plate 2 Magnetic supports	Plate 1 Bracket
Graphical representation of mounting elements				
Plate 1	Plate 2	Bracket		Magnetic support
				

In the case of mounting at horizontal surface one should use “Plate 1”.

“Wafer 2” is used in the case of horizontal mounting when adjustment is required: rotation of ZET 7152-N-VER.3 by azimuth (360 degrees) and angle (+/- 3 degrees).

For mounting at vertical surface, one should use “Plate 1” and “Bracket” (U-piece and a plate with a thickness over 6 mm welded to it (not included into delivery scope)).

Connection dimensions of Mounting Plate 1



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