

**DIGITAL
SHORT-PERIOD SEISMOMETER
ZET 7156**

USER MANUAL

Table of contents

1	Designation and technical specifications	3
1.1.	Designation of digital seismometers	3
1.2.	Operational environment	3
1.3.	Technical specifications	4
2	External view, contacts labelling and connection diagram	5
2.1.	External view of digital seismometers	5
2.2.	Digital seismometers: contacts labelling	5
2.3.	Establishing measuring circuit: connection diagram	6
3	Parameters configuration: preparation	7
3.1.	Connection of digital seismometers	7
3.2.	The program “Device manager”	7
4	Configuration of digital seismometers	8
4.1.	Configuration of interface part of digital seismometers	8
4.2.	Designation and contents of the tabs used for configuration of measurements part of the digital transducers.....	9
4.2.1.	“Measurements” tab	9
4.2.2.	“Settings” tab	11
4.3.	Configuration of digital seismometers ZET 7156.....	13
5	LED indication: operation modes description	14

1 Designation and technical specifications

1.1. Designation of digital seismometers

Digital short-period seismometer ZET 7156 is intended for measurement of vibration velocity of elevated structures (i.e., bearing and protective structures) and deep structures (foundations, piles, etc.).

The seismometer consists of three identical sensing elements and a measuring module placed inside of a single casing. The sensing elements receive low-frequency mechanical oscillations by three mutually transverse axes (X, Y and Z) and convert them into analog signal. The measuring module digitizes the analog signal and sends the digital data via CAN 2.0 interface.

The synchronization mechanism of CAN network enables automated synchronization of ZET 7156 seismometers with the precision up to 10 μ s (depending on the length of measuring line and the number of digital transducers).

Digital short period seismometers ZET 7156 are used in stationary structural health monitoring systems and allow to control intrinsic oscillations of buildings (structures) and corresponding damping decrements. ZET 7156 can also be used for leak detection, vibration impact control, and for the prevention of false alarm notifications of the control system.

1.2. Operational environment

Digital short-period seismometers ZET 7156 have industrial product version and are intended for use in adverse operational environments. This allows to expose them to considerable mechanical and vibrational loads.

Operational environment parameters of ZET 7156 are specified in Table 1.1.

Table 1.1 Operational environment of ZET 7156

Parameter	Value
Ambient air temperature, °C	-40...80
Relative air humidity, %	Max. 98 ¹
Atmospheric air pressure, mmHg	495-800

¹ at the ambient temperature of 35 °C.

1.3. Technical specifications

Basic technical specifications of digital seismometers ZET 7156 are specified in Table 1.2.

Table 1.2 Technical specifications of ZET 7156

Parameter	Value
Measured physical value	Vibration velocity
Number of Axes	3 (X, Y, Z)
Frequency range, Hz	From 0,3 up to 500
Measurement range, mm/s	0,0002...20
Issued values	Instant
Type of integrated primary transducer	Geophone
Sampling rate, Hz	50, 100, 200, 500, 1000
Data interface	CAN 2.0
Power supply voltage, V	9...24
Consumed power, W	0,5
Dimensions (without mounting plate), mm	80x70x70
Weight, gr	1200

2 External view, contacts labelling an connection diagram

2.1. External view of digital seismometers

Figure 2.1 shows external view of digital seismometer ZET 7156. The transducer is attached to the controlled object with the use of mounting plate (the mounting plate is included into the delivery scope). The mounting plate has four 4 mm holes. It is necessary to observe the directions of mounting axes of the seismometer when attaching it to the controlled object. The directions of vibrational axes are specified at the package of the digital seismometer.

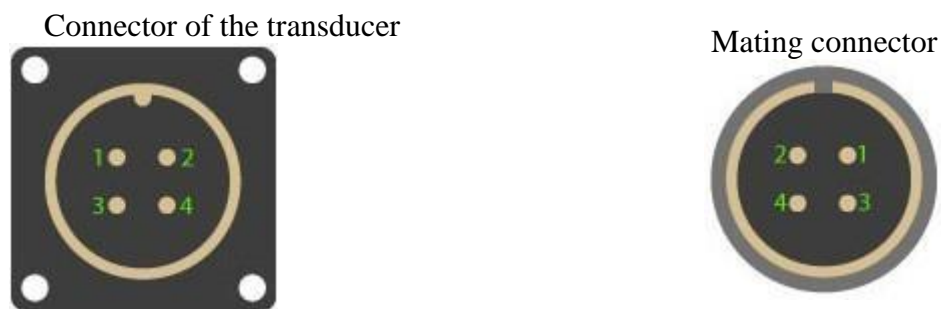


Figure 2.1 External view of seismometer ZET 7156

2.2. Digital seismometers: contacts labelling

Digital transducers of ZET 7156 series have two 4-contact connectors FQ14-4ZK-S for connection to the measuring network.

Figure 2.2 shows contacts labelling of the connector FQ14-4ZK-S, which is used for connection of measuring transducers to the measuring network.



Contact number	Connection to the measuring network
	ZET 7156
1	9...24 V
2	CAN 2.0 line «H»
3	CAN 2.0 line «L»
4	GND

Figure 2.2 Contacts labelling for connection to the measuring network

2.3. Establishing measuring circuit: connection diagram

In the course of measuring network development, the digital transducers ZET 7156 are connected sequentially. The resulting measuring chain of the transducers is connected to the PC via interface converter (see Table 3.1). Figure 2.3 displays a measurement network based on digital transducers ZET 7156.

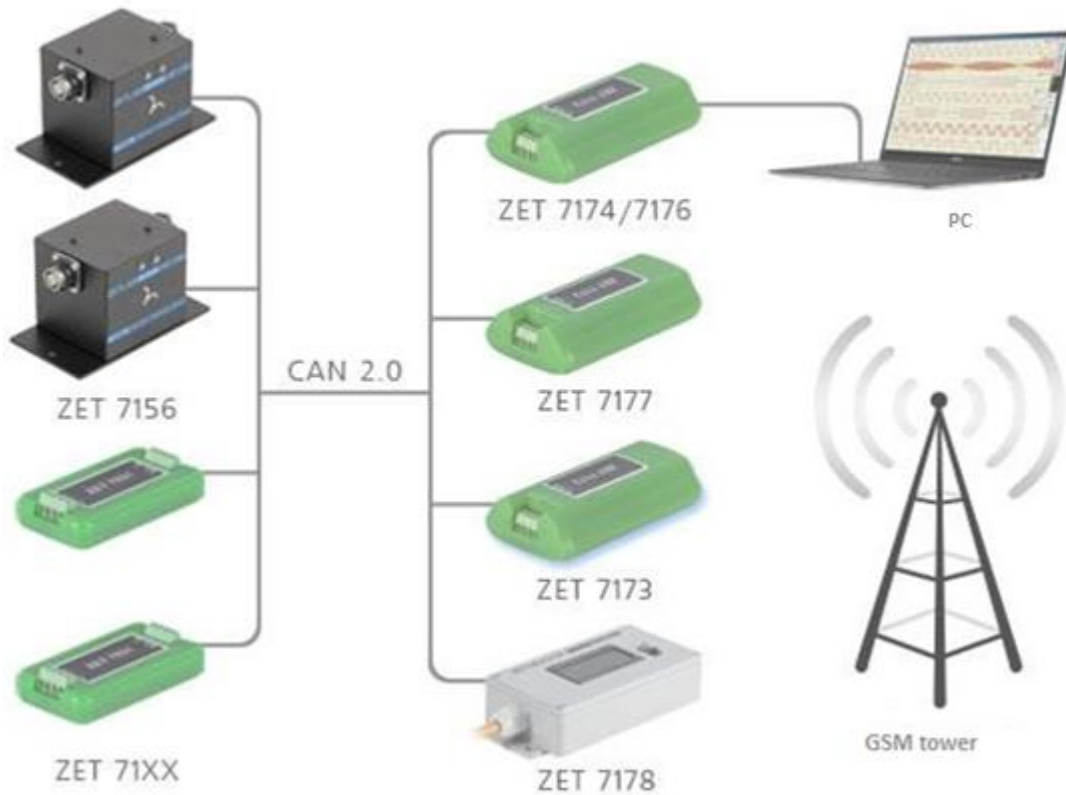


Figure 2.3 Connection diagram

It is necessary to install 120 Ohm terminal resistance at the last digital transducer ZET 7156 at the end of the measuring network. The terminal resistance is installed at free (vacant) connector FQ14-4ZK-S of the last digital seismometer ZET 7156 in the measuring line.

3 Parameters configuration: preparation

3.1. Connection of digital seismometers

Prior to using the digital transducers, it is necessary to connect them to PC by means of interface converters – see Table 3.1.

Note: it is necessary to configure the interface converters into the modes, that provide operation with the digital transducers (see the documents “Configuration of ZET7070, User manual”, “Configuration of ZET 7076, User manual”).

Table 3.1 Connection of ZET 7156 to interface converters

Type of digital transducer	Interface converter	PC port
ZET 7156	ZET7174	USB 2.0
	ZET7176	Ethernet

The PC to be used for configuration of the digital transducers should have Windows OS and ZETLAB Software installed.

3.2. The program “Device manager”

The program “Device manager” available in “Service” tab of ZETLAB panel (Figure 3.1) is used for configuration of digital transducers.

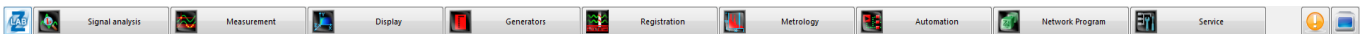


Figure 3.1 ZETLAB panel

The left section of the program window contains a hierarchy tree of devices connected to the PC. The top level of the hierarchy displays the interface converters and the devices, that are connected to the PC directly. The next level of the hierarchy displays devices, that are connected to a particular interface converter.

In the case if detailed view mode is enabled, the right section of the program window displays a chart with basic parameters of the measuring channels.

To select the digital transducer to be configured, double-click its name. (Additional information is available in the document “ZETLAB Software. User manual”).

4 Configuration of digital seismometers

Note! The Manufacturer reserves the right to change the software version of the digital transducer. The sequence of software updates up to the current version is described in the document “Software_Service work with ZET7xxx.pdf”.

4.1. Configuration of interface part of digital seismometers

Configuration of the interface part is conducted in accordance with the algorithm specified in the document “Configuration of interface part of intelligent modules of ZET 7xxx series”.

Also, please, note, that it is necessary to specify unique address for each instrument in the measuring network in the field “Address (node) from 2 up to 63” of the “Information” tab. In order to secure normal operation of the measuring network, make sure that all the devices in the measuring network have unique addresses. The addresses of the devices should be set in the range from 3 up to 63.

Note: digital seismometers ZET 7156 consist of three channels (the names of the channels by default are as follows: «Axis X», «Axis Y», «Axis Z»), which correspond to the three measuring axes. When assigning the addresses of the devices, please note, that the channels of digital transducers ZET 7156 have three addresses in the measuring network.

4.2. Designation and contents of the tabs used for configuration of measuring part of the digital transducers

Digital transducer consists of three channels (the names of the channels by default are as follows: «ZET 7156-X», «ZET 7156-Y», «ZET T7156-Z», which correspond to the three measuring axes of the transducer vibration). It is possible to change the parameters of the digital transducer only in the tab of the first channel (axis X). As the parameters of the first channel are changed, the parameters of the other channels are adjusted automatically (except for the parameter “Name of the transducer” – this parameter is configured in the “Properties” menu of each of the transducers).

4.2.1. “Measurements” tab

The tab “Measurements” contains information about the parameters specified in the Table 4.1.

Table 4.1 Parameters of the “Measurements” tab

Parameter	Possibility of configuration	Admissible values	Description
Current measured value (in measurement units)	–	Within the measurement range	Displays the measured value for a particular channel at the moment of tab activation
Refresh rate, Hz	–	–	Corresponds to the value set in the parameter “Sampling rate” of the “Settings” tab.
Measurement unit	–	mm/s μm/s	Corresponds to the current measurement unit. Depends on the value set in the parameter “Measurement unit” of the “Settings” tab.
Name of the transducer	Yes	Any sequence of symbols (max 32)	The parameter is set arbitrary.
Minimal value (meas. unit)	–	–	The section displays the minimal possible value, that can be measured by the digital transducer at a particular channel.
Maximal value (meas. unit).	–	–	The section displays the maximal possible value, that can be measured by the digital transducer at a particular channel.
Reference value for calculation, dB	–	–	Displays the reference value necessary for calculation of the measured value in dB.
Sensitivity (in meas. units)	–	–	Displays the sensitivity value (this parameter is not applicable to digital transducers of ZET 7156 series)
Sensitivity threshold	–	–	The parameter specifies accuracy of measurements.

Figure 4.1 shows an example of “Measurements” tab.

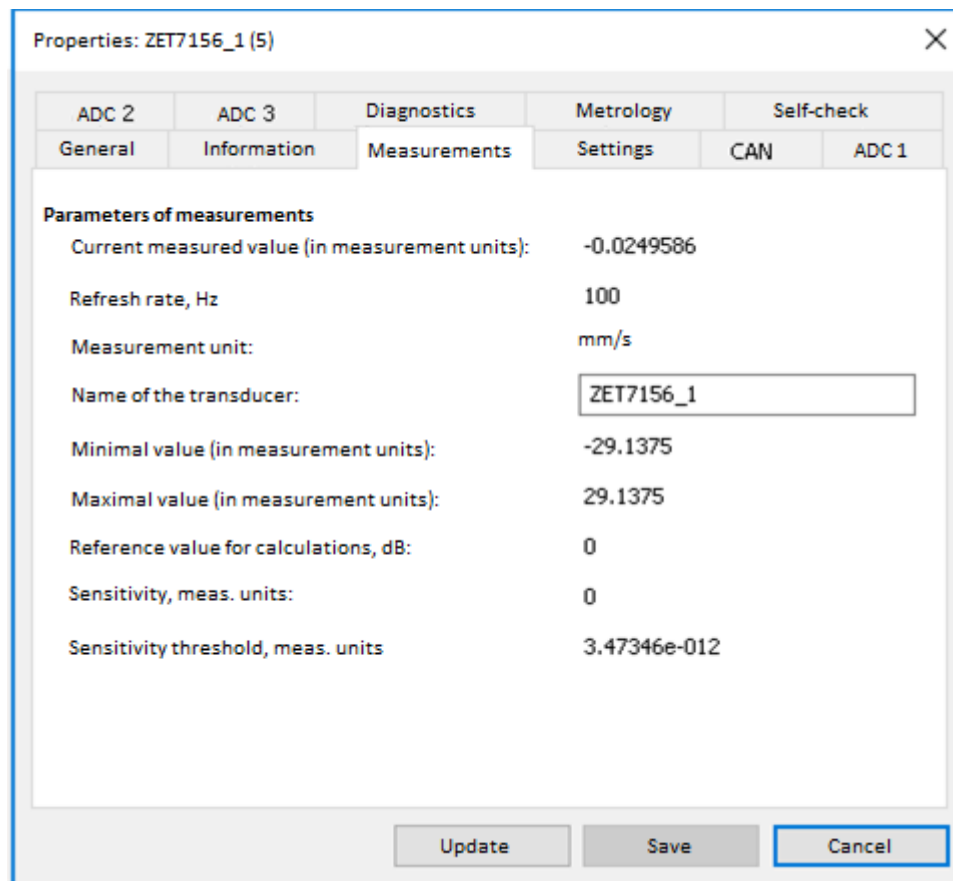


Figure 4.1 “Measurements” tab

4.2.2. “Settings” tab

The “Settings” tab contains information about the parameters specified in Table 4.2.

Table 4.2 Parameters of “Settings” tab

Parameter	Possibility of configuration	Admissible values	Description
Sampling rate, Hz	Yes	50, 100, 200, 500, 1000	Sampling rate of digital seismometers ZET 7156.
Sensitivity	Yes	–	The parameter determines sensitivity of the digital transducer. The parameter is specified in ZET 7156 product certificate.
Measurement unit	Yes	mm/s µm/s	The specified measurement units are used for identification of the physical values used for measurements performance.
Filtration	Yes	On Off	Allows to enable/ disable correction of the seismometers. The parameter is used for control of the low frequencies in the set range. The range is set by the parameters “New natural frequency” and “Natural frequency”.
Damping	Yes	–	Calibration ratio of the geophone. This parameter is specified in ZET 7156 product certificate. This parameter is only available when the “Filtration” parameter is enabled.
Natural frequency	Yes	–	The parameter is specified in ZET 7156 product certificate and determines the upper frequency of the filtration range. This parameter is only available when the “Filtration” parameter is enabled.
New natural frequency	Yes	–	The parameter determines the start frequency of the filtration range. It is not recommended to set the value more than 1 Hz. This parameter is only available when the “Filtration” parameter is enabled.
Amplification ratio	Yes	1; 8; 16; 32; 64; 128	ADC amplification ratio. The amplification ratio is selected individually depending on a particular task. The higher is the ratio, the more sensitive is the transducer (and the smaller is the measurement range).

Figure 4.2 shows an example of “Settings” tab

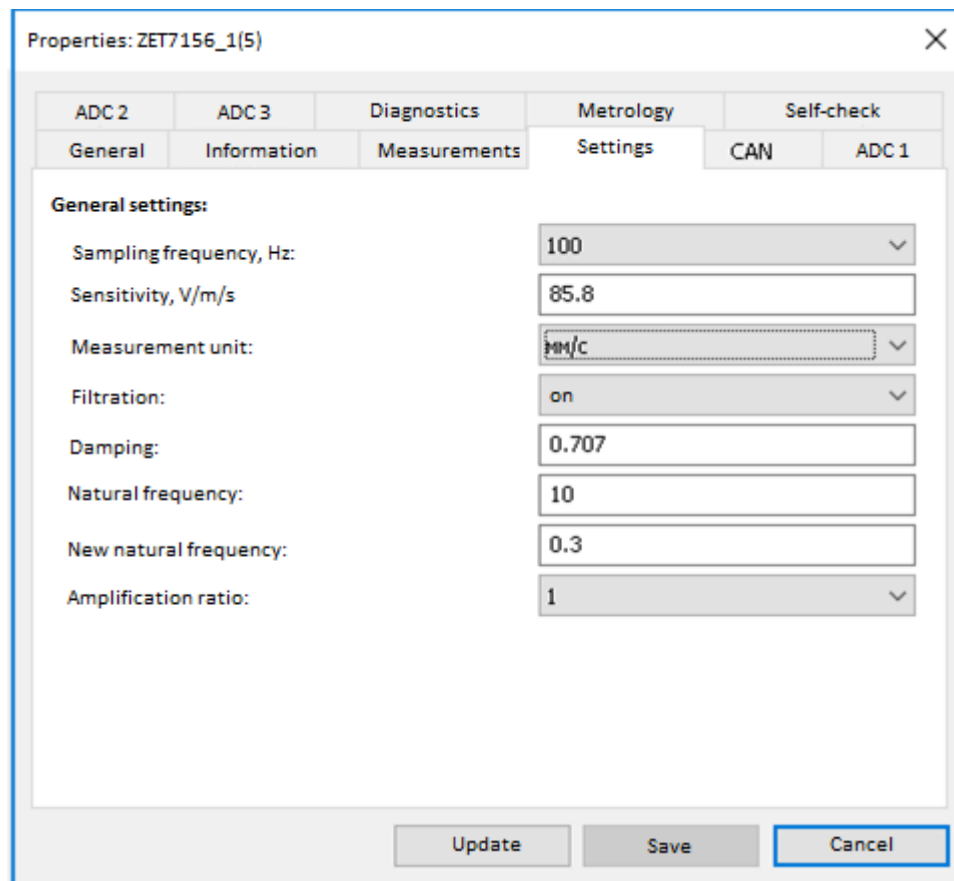


Figure 4.2 “Settings” tab

4.3. Configuration of digital seismometers ZET 7156

To configure the digital seismometer ZET 7156, select the required measurement unit in the “Settings” tab. The “Filtration” parameter allows to enable correction of the seismometer. This parameter allows to amplify low frequencies of the set range. The “New natural frequency” parameter allows to set the bottom frequency of the filtration range. The “Natural frequency” parameter is used to set the upper limit of filtration range. It is not recommended to set a value more than 1 Hz for the parameter “New natural frequency”.

Upon completion of parameters configuration in the tabs of “Properties” menu, click the key “Save”.

5 LED indication: operation modes description

Table 5.1 contains information of LED indication operation modes (LED indicators are located at the top side of the digital transducer). Depending on the combination of blue and green LED-s operation, it is possible to control status of the device and to conduct diagnostics.

Table 5.1 LED indication modes description

LED indication state	Indication during 2 seconds	LED indication mode description																
Selection of a device or data saving	<table border="1"> <tr> <td>1</td><td></td><td></td><td></td><td>2</td><td></td><td></td><td></td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> </table>	1				2												Blue – constant indication Green – constant indication
1				2														
Error (lost connection or defect of the transducer)	<table border="1"> <tr> <td>1</td><td></td><td></td><td></td><td>2</td><td></td><td></td><td></td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> </table>	1				2												Blue – constant indication Green – indication 500 ms per 1 second
1				2														
Settings by default (address 2)	<table border="1"> <tr> <td>1</td><td></td><td></td><td></td><td>2</td><td></td><td></td><td></td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> </table>	1				2												Blue – constant indication Green – indication 100 ms per 2 seconds
1				2														
Normal operation mode	<table border="1"> <tr> <td>1</td><td></td><td></td><td></td><td>2</td><td></td><td></td><td></td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> </table>	1				2												Blue – indication 100 ms per 2 seconds Green – indication 100 ms per 2 seconds
1				2														