ZETLAB
Simple solutions of complex tasks

DIGITAL ACCELEROMETERS
ZET 7052-N, ZET 7152-N

USER MANUAL

LLC "ETMS"

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1 Designation and technical characteristics

1.1. Designation of digital transducers

Digital transducers of linear acceleration of ZET 7x52-N series are intended for measurement of the acceleration applied to the package of the transducer (accelerometer) and conversion of the measured values into a digital signal for the purpose of further data transmission in digital format. The digital transducer is represented by a vibration sensor with an integrated triaxial sensing element, that is used for conversion of constant component of the acceleration into a digital code for the three mutually transverse axes (X, Y, and Z). Then there is calculated the constant component of the vibration acceleration. The values of vibration velocity and vibration displacement are calculated automatically by means of the integrated processor.

Digital transducers of ZET 7x52-N series can be applied separately or within the structure of a distributed measuring network used or measurement of general and local vibration (in industrial, civil, and communal facilities). The digital transducers can be easily mounted on the controlled object, since there is no need to use any external primary transducers.

1.2. Operational environment

Digital transducers of ZET 7x52-N series have an industrial product version and are intended for use in adverse operational environments with considerable mechanical and vibrational loads. It is also allowed to use the digital transducers of ZET 7x52-N series in explosion-hazard environments (the digital transducers have the marking *0ExiaIICT6X*).

It is allowed to use the digital transducers in explosion-hazard environments in accordance with explosion-proof mark 0ExiaIICT6 X.

Operational environment of the digital transducers is specified in Table 1.1.

Table 1.1 Operational environment of ZET 7x52-N

Parameter	Value
Ambient air temperature, ºC	-60…80
Relative air humidity, %	Max 98[1]
Atmospheric pressure, mmHg	495-800

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[1] at the ambient temperature of 35 ºC.

1.3. Technical specifications

Basic technical specifications of the digital transducers are listed in Table 1.2 and 1.3

Table 1.2 Technical specifications of ZET 7x52-N

Parameter	Value	
	ZET 7052-N	**ZET 7152-N**
Power supply voltage, V	9…24	
Consumed power, W	0,5	
Type of integrated primary transducer	Triaxial accelerometer	
Measured parameter	Linear acceleration Vibration acceleration Vibration velocity Vibration displacement	Linear acceleration Vibration acceleration Vibration velocity Vibration displacement Angle
Frequency range, Hz	From DC up to 400 – linear acceleration From 3 up to 400 From 10 up to 400	
Measurement modes	Averaged (0,1; 1; 10 sec)	Averaged Instant
Sampling frequency, Hz	10	10, 50, 100, 200, 400, 800
Data interface	RS-485	CAN 2.0
Exchange protocol	Modbus RTU	−
Dimensions, mm	140x55x30	
Weight, gr	300	

Table 1.3 ZET 7x52-N: characteristics of the measured parameters

Name of the parameter	Bandpass	Measurement range	Measurement error
Linear acceleration, m/s^2	−	-140…140	1%
Vibration acceleration, m/s^2	3…400 Hz	0,1…100	3%
	10…400 Hz	0,1…100	
Vibration velocity, mm/s	3…400 Hz	1…1500	6%
	10…400 Hz	0,5…1500	
Vibration displacement, mm	3…400 Hz	0,05…65	10%
	10…400 Hz	0,02…65	
Tilt angle for axes X and Y, degrees (only for ZET 7152-N)	−	-90…90	1%

Note:

The primary transducer integrated into digital accelerometer ZET7x52-N produces the data in digital code format. The processor receives this data and converts it into real *linear acceleration*. If (depending on the configuration of the digital transducer) it is required to obtain a different physical value (vibration acceleration, vibration velocity, vibration displacement, angle), then it is necessary to implement the algorithms of digital processing:

- ➢ HPF is used for calculation of vibration acceleration value;
- ➢ Filtration and integration are used for calculation of vibration velocity value;
- ➢ Filtration and double integration are used for calculation of vibration displacement value;
- ➢ The formulas below are used for calculation of tilt angle by axes X and Y:

Axis X: X = atan(Xg / sqrt(Yg^2 + Zg^2)) / pi * 180

Axis Y: Y = atan(Yg / sqrt(Xg^2 + Zg^2)) / pi * 180

2 External view, contacts labelling and connection diagram

2.1. External view of digital transducers

Figure 2.1 shows external view of digital transducer ZET 7x52-N. The digital transducer is mounted at the controlled object at two points: with a hole ⌀6,2 mm and a 6,2 mm groove, thus, the baseline distance of the transducer is 125±5 mm. Tie bolts or M6 anchor bolts are used for mounting of the transducer on a concrete surface. For mounting of the transducer on a steel surface, one can use M6 welded stud or M6 bolts.

Figure 2.1 External view of digital transducer ZET 7x52-N

> *It is allowed to use the digital transducers in explosion-hazard environments in accordance with explosion-proof mark 0ExiaIICT6 X.*

2.2. Digital transducers: contacts labelling

Digital transducers of ZET 7x52-N series have two four-contact plugs FQ14-4ZK-S for connection to the measuring network.

Figure 2.2 contacts of pug FQ14-4ZK-S used for connection of the digital transducers to the measuring network.

Plug of the transducer   Mating connection

Contact number	Connection to the measuring network	
	ZET 7052-N	**ZET 7152-N**
1	9…24 V	
2	RS-485 line B or «DATA-»	CAN 2.0 line «H»
3	RS-485 line A or «DATA+»	CAN 2.0 line «L»
4	GND	

Figure 2.2 Designation of contacts for connection to the measuring network

2.3. Direction of axes X, Y, Z

The digital transducer is represented by a vibration sensor with an integrated triaxial sensing element, that is used for conversion of constant component of the acceleration into a digital code by three mutually transverse axes X, Y, and Z. In the course of vibration transducer mounting at the controlled object, it is necessary to observe the direction of vibration axes.

The direction of axes X, Y, Z of the transducer ZET 7x52-N is specified in Figure 2.3.

Figure 2.3 Direction of axes X, Y, Z

2.4. Establishing a measuring line: connection diagram

In the course of measuring network development, the digital transducers of ZET 7x52-N series are connected sequentially. The resulting measuring network is further connected to PC by means of interface converter (see Table 3.1). Figure 2.4 shows a measuring network based on digital transducers ZET 7052-N.

Figure 2.4 Connection diagram

A 120 Ohm terminal resistance should be installed at the last digital transducer ZET 7x52-N at the end of the measuring network. The plug is mounted at a free (vacant) connector FQ14-4ZK-S of the last digital transducer ZET 7x52-N in the measuring network.

3   Parameters configuration: preparation

3.1.   Connection of digital transducers

Before using the digital transducers, it is necessary to connect them to PC with the use of interface converter (see table 3.1).

Note: *it is necessary to configure the interface converter into the mode providing the operation with digital transducers (see the documents "User manual: configuration of ZET 7070", and "User manual: configuration of ZET 7076").*

Table 3.1 Connection of ZET 7x52-N to interface converters

Type of digital transducer	Interface converter	PC port
ZET 7052-N	ZET7070	USB 2.0
	ZET7076	Ethernet
ZET 7152-N	ZET7174	USB 2.0
	ZET7176	Ethernet

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

3.2.   The program "Device manager"

The program "Device manager" available in the "Service" menu of ZETLAB control panel is used for configuration of digital transducers (see Figure 3.1).

Figure 3.1 ZETLAB panel

The left section of the program interface contains a hierarchy tree of the devices connected to the PC. The upper hierarchy level includes interface converter and the devices connected to the PC directly. The second level of the hierarchy displays the digital transducers connected to the particular interface converter.

If the detailed view mode is enabled, than the right section of the program interface will display 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 transducers

Note! The manufacturer reserves the right to change the software version of the digital transducer. The sequence of updates up to the current version is available in the document "Software_Service work with ZET7xxx.pdf".

4.1. Configuration of interface part of the digital transducers

Configuration of interface part of the digital transducers is conducted in compliance with the algorithm specified in the document "Configuration of interface part of intelligent modules of ZET7xxx series".

Note: it is necessary to assign a unique device address for each digital transducer of the measuring network – the address is set 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 different addresses. The addresses of the devices are set in the range from 3 up to 63.

Note: digital transducers ZET 7x52-N consist of three channels (the names of the channels by default are as follows: «Axis X», «Axis Y», «Axis Z»), that correspond to the three measuring axes. When assigning the addresses of the devices, it is necessary to bear in mind that the channels of digital transducers ZET 7152-N have three addresses in the measuring network, while the channels of digital transducers ZET 7052-N are assigned a common address.

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

The digital transducer consists of three channels (the names of the channels by default are as follows: «ZET7x52-X», «ZET7x52-Y», «ZET7x52-Z»). It is possible to change the parameters of the digital transducers only in the tab of X channel. As the parameters of X channel are changed, the system automatically applies the corresponding changes to all other channels.

4.2.1. The tabs «Axis X», «Axis Y» and «Axis Z»

The "Properties" menu of digital transducer ZET 7x52-N contains three identical tabs: «Axis X», «Axis Y» and «Axis Z» for each of the three measuring channels. Each of the tabs contains information about the particular measurement channel. The tab "Axis X" contains information about the parameters specified in the table 4.1.

Table 4.1 Parameters of the tabs «Axis X», «Axis Y», «Axis Z»

Parameter	Possibility of configuration	Admissible values	Description
Current measured value (in measurement units)	–	Within the measurement range	Displays the measured value of the selected channel at the moment of tab activation.
Refresh rate, Hz	–	–	Corresponds to the current sampling frequency of the channel.
Measurement unit	–	g m/s^2 mm/s mm °	Corresponds to the current measurement unit. The parameter depends on the value assigned for the parameter "Measured physical value" of the "Settings" tab.
Name of the axis	Yes	Any sequence of symbols (max 32)	The parameter is set arbitrary. For the 1-st channel it is recommended to use a name containing the symbol "X" (and symbols "Y" and "Z" for the 2-nd and the 3-d channels respectively).
Minimal value (in measurement units)	–	–	The section contains the minimal possible value that can be measured with the digital transducer by this channel. The parameter depends on the particular measured physical value.
Maximal value (in measurement units)	–	–	The section contains the minimal possible value that can be measured with the digital transducer by this channel. The parameter depends on the particular measured physical value.
Reference value for calculations in dB	–	–	Displays the reference value necessary for calculation of the measured value in dB.

Sensitivity (in measurement units)	–	–	Displays the sensitivity value (this parameter is not applicable to the digital transducers of ZET 7x52-N series)
Sensitivity threshold (in measurement units)	–	–	The parameter specifies measurements precision.

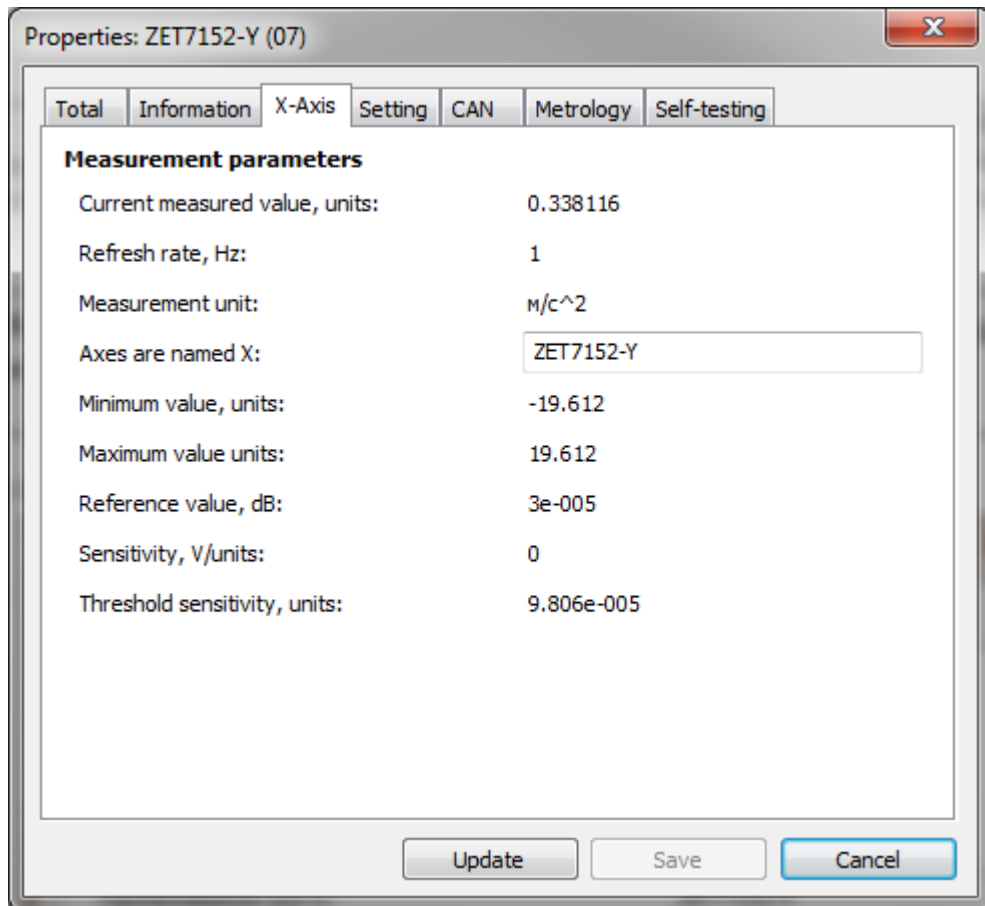Figure 4.1 shows an example of the tab «Axis X».

Figure 4.1 Tab «Axis X»

4.2.2. "Settings" tab

The "Settings" tab contains information of the parameters specified in Table 4.2.

Table 4.2 Parameters of the "Settings" tab

Parameters	Possibility of configuration	Admissible values	Description
Sensor type	No	230,…,…	Inner information of the primary transducer type.
Refresh rate, Hz	Yes	10	Sampling frequency of the digital transducer ZET 7052-N
		10	Sampling frequency of the digital transducer ZET 7152-N (if the "Averaged" option is selected for the parameter "Issued value")
		10, 50, 100, 200, 400, 800	Sampling frequency of the digital transducer ZET 7152-N (if the option "Instant" is selected for the parameter "Linear acceleration" – issued value).
		800	Sampling frequency of the digital transducer ZET 7152-N (if the option "Instant" is selected for the parameters "Vibration acceleration", "Vibration velocity", and "Vibration displacement").
HPF	Yes	3 Hz 10 Hz	The filter clearing the frequencies below the cut-off frequency. It is disabled if the option "Linear acceleration" is selected for the parameter "Measured physical value".
LPF 100 Hz	Yes	Off. On.	The filter clearing the frequencies above the level of 100 Hz. It is disabled if the option "Linear acceleration" is selected for the parameter "Measured physical value".
Measured physical value	Yes	Linear acceleration Vibration acceleration Vibration velocity Vibration displacement Angle*	Selection of the issued data type. It is used by the digital transducer for conversion of the measured physical values. * - the physical value "Angle" can only be measured with the digital transducer ZET 7152-N.

Measurement unit	No	m/s^2 g mm/s mm °	The specified measurement units are used for identification of physical values, that are used for measurements. The parameter depends on the value specified in the parameter "Measured physical value" of the "Settings" tab.
Issued value	No	averaged	Data issued by the digital transducer ZET 7052-N.
	Yes	averaged instant	Data issued by the digital transducer ZET 7152-N.
Measurement interval, s	Yes	0.1, 1, 10	The time necessary for calculation of the parameter "Issued value" – "Averaged". The parameter is represented by digital filtration – it is used for averaging of the digital transducer readings for the selected time interval.

Figure 4.2 shows an example of "Settings" tab.
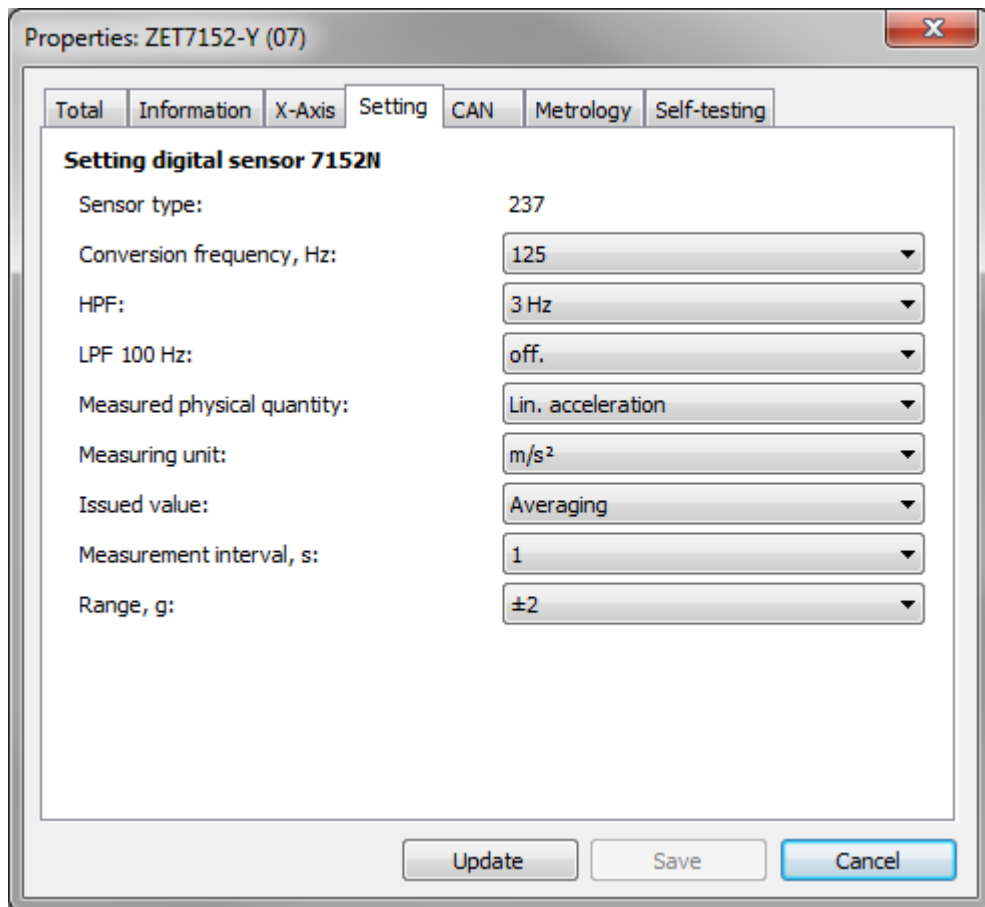
Figure 4.2 "Settings" tab

4.3. Configuration of digital transducers ZET 7x52-N

In order to conduct configuration of digital transducers ZET 7x52-N, set the frequency range to be used for data acquisition ("HPF","LPF 100 Hz") in the "Settings" tab. Depending on the particular task to be solved, select the measured physical value and the measurement time interval for the "Averaging" parameter. Depending on the particular selected physical value, the digital transducer will automatically convert the measured data. To save the parameters changes, click the key "Save".

5   LED indication: operation modes

Table 5.1 contains information about the operation modes of LED indication, which is located at the top side of the digital transducer package. Depending on the combination of blue and green LEDs signals, it is possible to control status of the device and to conduct failure diagnostics.

Table 5.1 LED indication status

LED indication status	Indication during 2 seconds	Description of LED indication operation
Selection of a device, data saving		Blue – constant indication Green – constant indication
Error (lost connection, fault operation of the transducer)		Blue – constant indication Green – indication 500 ms per 1 second
Settings by default (address 2)		Blue – constant indication Green – indication 100 ms per 2 seconds
Concealed protocol (only for RS-485)		Blue – indication 500 ms per 1 second Green – indication 100 ms per 2 seconds
Normal mode		Blue – indication 100 ms per 2 seconds Green – indication 100 ms per 2 seconds