



Pig Detector DSES

Operating Manual

820-0013



Technology of the Future...Protection for today

Content

1. Introduction	3
2. Designation.....	3
3. Technical characteristics	5
1.1. Basic technical characteristics	5
1.2. Additional technical characteristics	6
1.3. Explosion protection of detector	7
4. Detector description and principle of operation	8
5. Industrial safety rules	10
6. Installation and connection of DSES detector	10
6.1. Tools and equipment needed for installation	10
6.2. Pre-installation of the detector DSES	12
6.3. Explosion protection during installation	12
6.4. Pipe preparation	14
6.5. Detector DSES installation	15
6.6. Detector DSES connection.....	16
6.7. Performance checking of DSES.....	18
7. Software DSES <i>configurator v1.0.</i>	19
8. Possible Malfunctions and Troubleshooting	23
9. Service maintenance.....	24
10. Component part and delivery set	24
11. Transportation and storage regulations.....	25
12. Marking and sealing.....	26
13. Acceptance certificate	27
14. Certificate of Conservation	28
15. Packing certificate	29
16. Disposal requirements	30
17. Manufacturer's warranty	30
Appendix A. DSES Overall dimensions drawing	31
Appendix B. Cable gland installation drawing	32
Appendix C. Digital Output Protocol Settings	33
Appendix D. DSES Connection Scheme.....	35
Appendix E. Explosion protection drawing.....	36
Appendix F. Name plate drawing	36
Appendix G. Mounting Kit.....	37
Record of Revisions	38

1. Introduction

1.1. This operation manual (OM) is a document confirming the main parameters and technical characteristics of the Pig detector DSES (hereinafter - DSES), guaranteed by the manufacturer of ESP Safety Inc.

1.2. OM is intended to familiarize with the device and the principle of operation of DSES, as well as sets the rules for its operation.

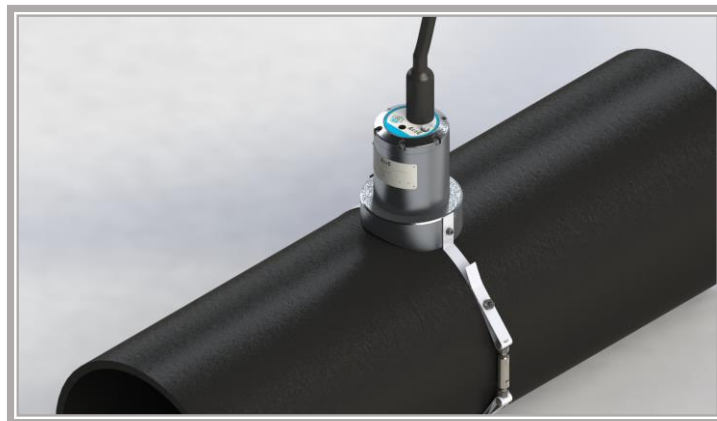
1.3. Before you start using DSES, you must carefully read this operating manual.



ATTENTION! DSES should only be used for the following purposes and under the conditions defined in this manual. Any external modification of the device, incorrect connection to the automatic process control system, non-observance of installation rules, use in a defective form, or use of equipment not included in the delivery during installation - entails the termination of the warranty.

2. Designation

The DSES detector is designed to detect and record the passing of PIG (hereinafter referred to as the PIG) the DSES installation points on the pipe by processing signals from the registration channels and transmitting data to the automatic process control system about the passage of the PIG. According to the principle of operation, DSES is contact device and is intended for installation directly on the body of the oil and gas pipeline on covers, in open sections of the pipeline and underground. The detector is mounted on the pipe body vertically with a magnetic clip or horizontally with a mounting clamp.



Field of applications are explosive zones of rooms and outdoor installations according to explosion protection marking, IEC 60079-14-2011 (IEC 60079-14), chap. 7.3 and other regulatory documents governing the use of electrical equipment in hazardous areas.

DSES field of applications:

- oil, gas and gas condensate fields;
- gas pre-treatment and liquefaction plants;
- coastal technological complexes;

- gas distribution units (GDU) of underground natural gas storages in hazardous areas, where there is a risk of the formation of explosive mixtures;
- rooms related to hazardous areas and outdoor installations according to explosion protection marking, 60079-14-2011 (IEC 60079-14), chap. 7.3, and other regulatory documents governing the use of electrical equipment in hazardous areas.

The main functions of the detector DSES:

- registration of the level of acoustic noise in the range of 100 ... 250 kHz (acoustic channel);
- registration of an electromagnetic signal of a transponder with a frequency of 22 Hz (electromagnetic channel);
- registration of fluctuations of a constant magnetic field (magnetic channel);
- processing signals from the registration channels and detecting the passage of a PIG based on the received data;
- transmission of a signal about the passage of the PIG into the automatic process control system:
- explosion-proof housing;
- as automated as possible and works in real time with the output of information on the passage of the PIG and the transfer of information to the automated process control system and control room.
- high efficiency of fixing the moment of passage of the PIG at the control point and
- high reliability of control;
- low probability of false triggering of the detector and skipping the PIG;
- the operation of the detector is not affected by changes in the parameters of the pumped medium (temperature, viscosity, density), pumping modes (pressure, flow), and - density and thickness of deposits on the inner surface of the pipe;
- the detector provides structural integrity of the pipeline;
- the detector does not require maintenance;
- the detector has a self-diagnosis function;
- installation is possible at a depth of the pipeline from 1.8 to 3 m;
- detection of the PIG moving through the pipeline in a wide speed range.

3. Technical characteristics

3.1. Basic technical characteristics

Detector Dimensions (<i>without mounting base</i>)	165 x 100 mm
Pipe mounting base size Ø from 100 to 300 mm	Ø 138 mm
Repeatability	Detector has repeatability less then 1%
Detector weight (<i>mounting base included</i>)	no more than 6 kg
Operating temperature	-60°C to + 85°C
Current consumption	no more 150 mA
Power supply	24 V (in the range of 18 to 32 V)
Transponder signal registration, frequency	22±1 Hz
Acoustic noise range	from 100 to 240 kHz
Output signals: - analog - digital ¹ - «dry contact» relay - HART ²	4 – 20 mA Normal operation output = 4.00mA +/- 0.01mA Fault output = 1.82 +/- 0.02mA PIG Passage = 18.00mA +/- 0.1mA RS-485
Temperature: - storage - transportation	from -50°C to +50°C from -50°C to +50°C
Pipe surface temperature	-100°C to +290°C
Explosion protection marking	IEExdb IIC T4 Gb
Ingress protection(IP)	IP66 / IP68
Life time	10 years

¹ The detector has a digital signal at the output for transmission through a standard RS-485 communication channel in the ModBus RTU protocol, via the USART communication channel (it is only a technological channel)

² HART- optional

3.2. Additional technical characteristics

- 3.2.1. The detector receives and records fluctuations of a constant magnetic field
- 3.2.2. In terms of protection against dust and water, the design of the detector corresponds to the degree of protection IP 66/68.
- 3.2.3. The detector remains operational when exposed to high ambient humidity of 95 (± 3)% at a temperature of 35°C, in the conditions of use and transportation, without moisture condensation
- 3.2.4. Operating ambient temperature from minus 60 °C to + 85 °C with relative humidity up to 100% at a temperature of 35 °C and atmospheric pressure from 84 to 117.3 kPa
- 3.2.5. The detector is resistant to electrostatic discharges, Hardness degree 3 with a voltage pulse value of 2 kV, with a performance criterion of functioning A
- 3.2.6. The detector is resistant to conducted noise induced by radio frequency electromagnetic fields with a test voltage of U_0 3V with a modulated signal with an amplitude of a sinusoidal voltage of 1 kHz frequency with a modulation depth of 80% with a performance criterion of A
- 3.2.7. The detector is resistant to damped oscillations
- Test voltage when applying noise according to the "wire-to-ground", 2 kV;
 - Test voltage when applying noise according to the "wire-to-wire", 1 kV
- with performance criteria A
- 3.2.8. The detector is resistant to external magnetic fields, constant or variable with the mains frequency with a continuous magnetic field of 30 A / m and short-term magnetic field with a duration of 1-3 sec and 300 A / m with a performance criterion of A
- 3.2.9. The detector corresponds in terms of resistance to seismic influences with an intensity of 9 points on the MSK - 64 scale.
The detector corresponds in terms of resistance to seismic influences with an intensity of 9 points on the MSK - 64 scale according to the seismic safety group 0 The detector does not interrupt operation during and after the seismic impact.
- 3.2.10. The detector is resistant to a pulsed magnetic field with a pulsed magnetic field strength of 300 A/m with a performance criterion of A
- 3.2.11 The detector is resistant to sinusoidal vibration
- 3.2.12. The detector remains operational when exposed to direct mechanical shock with an energy of 1.9 J
- 3.2.13. The detector is resistant to electromagnetic interference.
- 3.2.14. The detector is resistant to dips, short interruptions and changes in the supply voltage for 10 ms
- 3.2.15. The detector remains operational when exposed to radio frequency electromagnetic fields in accordance with a hardness degree of 4 electromagnetic fields of -30 V / m in the frequency range from 80 MHz to 2.4 GHz, with a performance criterion A.
- 3.2.16. The detector is resistant to nanosecond pulsed interference with a degree of rigidity of 3 with a performance criterion of A:
- 2 kV power ports,
 - ports of input - output of signals, data transmission, control 1 kV
- with performance criteria A
- 3.2.17. The electrical insulation between the shorted output conductors of the detector and the

housing can withstand for 1 min a sinusoidal alternating voltage of 0.5 kV at a frequency of 50 Hz at an ambient temperature of (25 ± 10) °C and a relative humidity of 80%

3.2.18. The insulation resistance of the detector between the shorted output conductors and the housing is:

- 20 MΩ at a temperature of (25 ± 5) °C and relative humidity up to 80%;
- 5 MΩ at a temperature of the upper limit of operation of 90 °C;
- 1 MΩ at a relative humidity of 93% at a temperature of 40 °C

3.2.19. MTBF of 35,000 hours

3.3 Explosion protection of the detector DSES

3.3.1. Explosion protection of the Echo detector of type of protection "d" marked IExdb IIC T4 Gb achieved by:

3.3.2. Enclosing live parts of DSES in an explosion-proof enclosure, with slotted explosion protection at the interface between parts and assemblies of an explosion-proof enclosure, capable of withstanding the pressure of the explosion and preventing its transfer to the surrounding explosive atmosphere. The mating of parts in the drawings is indicated by the word "Explosion" indicating the acceptable explosion protection parameters: maximum width and minimum length of cracks, surface roughness forming flameproof joints, number of complete intact continuous thread threads, axial length and thread pitch for threaded flameproof joints;

3.3.3 Limitation of the temperature of heating the outer parts of the detectors (no more than 135 °C);

3.3.4. Cable seals in the cable entry with a special rubber ring;

3.3.5. Protection against self-unscrewing of all bolts securing parts that provide explosion protection DSES, as well as current-carrying and grounding clamps with spring washers or locknuts;

3.3.6. The presence of a warning inscription on the cover of the Echo case "**Do not open when energized!**";

3.3.7. Grease protection on all surfaces marked with the word "Explosion".

4. Detector description and principle of operation

Structurally, the detector is made in a metal Ex “d” type enclosure (stainless steel), a cylindrical shape. The housing consists of two compartments. The first, main compartment, is designed to accommodate the acoustical-mechanical components of the ultrasonic receiver (tangential concentrator-transducer), inductance coil, and controller circuit board. The second, input compartment, is designed to connect the field cable through the cable entry to the terminal board. Parts of the main and introduction compartment are interconnected via screw connections. There is also a cover on the entry compartment for access to the entry compartment and disconnection of the field cable. The lid is attached to the opening compartment by means of a screw connection (or by means of a threaded connection in case the necessary tightness is not ensured with bolts). An inspection window is provided on the cover for outputting a light signal from an LED located on the terminal board.

The detector has 3 measuring channels:

- acoustical mechanical based on a piezo sensor;
- electromagnetic based on an oscillatory circuit;
- magnetic channel based on a Hall sensor or inductor.

1. Cable gland
2. Ground bolt
3. LED indicator
4. DSES enclosure
5. Mounting base
6. Coupler clamp

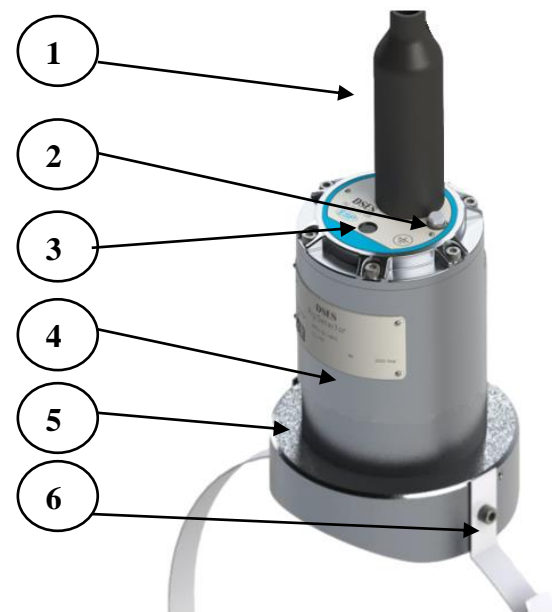


Figure 1. DSES Detector

Acoustic noise in the ultrasonic range 100 ... 250 kHz created by a moving object is captured using a metal hub pressed against the surface of the pipe and a piezoelectric sensor rigidly mounted on the hub. The signal from the sensor passes through an amplifier with an adjustable gain, a high-pass filter, and enters the microcontroller. The microcontroller performs analog-to-digital signal conversion with a sampling frequency and Fourier transform, which allows for spectral analysis. The software estimates the frequency range of the signal, the shape and nature of the change in the spectrum, the duration of the observation, and concludes that the signal exceeds a generalized threshold value. The electromagnetic signal of a low-frequency transmitter, optionally mounted on objects, with a frequency of 22 Hz is received by an antenna built into the detector. The signal is

amplified, passes through a low-pass filter, which allows to cut off the noise of industrial networks with a frequency of 50 Hz, and also enters the microcontroller. Fluctuations of a constant magnetic field caused by the movement of permanent magnets, also optionally mounted on objects, are detected by the same built-in antenna as a signal with frequencies from fractions to units of Hz. The microcontroller performs analog-to-digital conversion of the signal from the antenna with a sampling frequency of 100 Hz and Fourier transform. Further, the signals are processed similarly by ultrasound and the software concludes that threshold values are exceeded. The conclusion about the passage of the object is made when thresholds are exceeded by at least two channels - acoustic (permanent) and electromagnetic or magnetic. The presence of one or another signal depends on the design of the object. The levels of generalized threshold values are set by setting a number of parameters for each channel separately using special software.

5. Industrial safety rules

5.1. The persons who have studied this operating manual and who have passed safety training and have a qualification group for electrical safety can work with the DSES detector.

5.2. To use the DSES detector in the presence of mechanical damage of the enclosure is strictly prohibited.

5.3 Installation and operation of the equipment's power supply facilities must comply with the rules and standards of the Electrical Installation Rules.

5.4 When working with DSES, safety prevention rules must be carried out in accordance with applicable rules and requirements.

Attention!

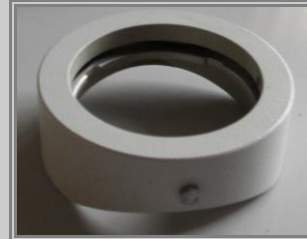


It is not allowed to open DSES in an explosive atmosphere with the power supply turned on. Attempting to open the electronic unit may lead to a violation of the installation of components and parameters, and possibly serious damage.

6. Installation and connection of the detector

6.1 Tools and equipment needed for installation.

Mounting base



Perforated clamp

It is delivered from the factory in the amount of 2 pcs. from 60 cm to 3 m long each.

Fastened by a tightening screw



Attention! Mounting clamps can be specially prepared at the manufacturing plant for a specific pipe diameter. The customer must inform the pipe diameter when placing an order or send a completed questionnaire.



Detector DSES



Attention! The DSES detector is supplied as standard with display module.

The DSES detector can also be supplied as standalone optionally with armored cable gland and a 3m cable.



6.2. Pre-installation of the DSES detector

Before installation, carry out an external inspection of the detector. It is necessary to ensure:

- absence of damage, dints, chips on the detector body
- integrity of the LED window on the cover;
- the cable gland must be securely attached into the detector;
- the heat shrink tubing should fit snugly against the cable entry and locknut;
- Ex marking of explosion protection DSES and warning inscription on the body;
- the presence of all fasteners (bolts, nuts, washers) in accordance with the project for the placement of DSES at the site.

6.3. Explosion protection during installation.

6.3.1. Installation of DSES should be carried out in accordance with the approved design procedure for the placement of monitoring equipment at the site in which it is used.

6.3.2. It is recommended that the connection of the DSES detector located in the hazardous area with an external device installed in the hazardous area be carried out using a control armored cable.

The cable gland design provides a double seal to ensure unloading of the cable, to protect it from being squeezed, including damage to the structure of the cable sheath and conductors, as well as to ensure that the cable is secured from being pulled out.

6.3.3. When installing DSES, it is necessary to check the external state of the explosion protection elements: presence / absence of faces or damage on the interface surface of the housing and base parts.

Installation of detectors at the sites should be carried out in accordance with the design plan for the placement of the system in which they are used, approved in the established manner.

Before installing DSES, it is necessary to carry out an external inspection of the device, especially pay attention to:

- marking of explosion protection of DSES and a warning inscription;
- the absence of faces or damage on the interface between the housing parts and the base of the detector;
- no damage of enclosure;
- the presence of all fasteners;
- the presence of an intact seal on the DSES housing.

6.3.4. Removable parts should fit as tight as the structure allows.

6.3.5. Cable sealing on the cable entry must be carried out in the most thorough manner, since the explosion-proof concept of the DSES input compartment hardly rely on this.

6.3.6. DSES is installed on pipe with a mounting base and using bolts from the tool kit and accessories.

6.3.7. The DSES housing must be grounded using an external grounding clamp. The external ground conductor must be thoroughly cleaned and its connection with the external ground clamp must be protected from corrosion by applying grease.

6.3.8. The cable entry is assembled and sealed using a heat-shrink tubing or other rubberized coating at the factory. DSES is supplied to the customer with a screwed-in sealed cable entry and a cut cable. Cable length - at least 3 meters.

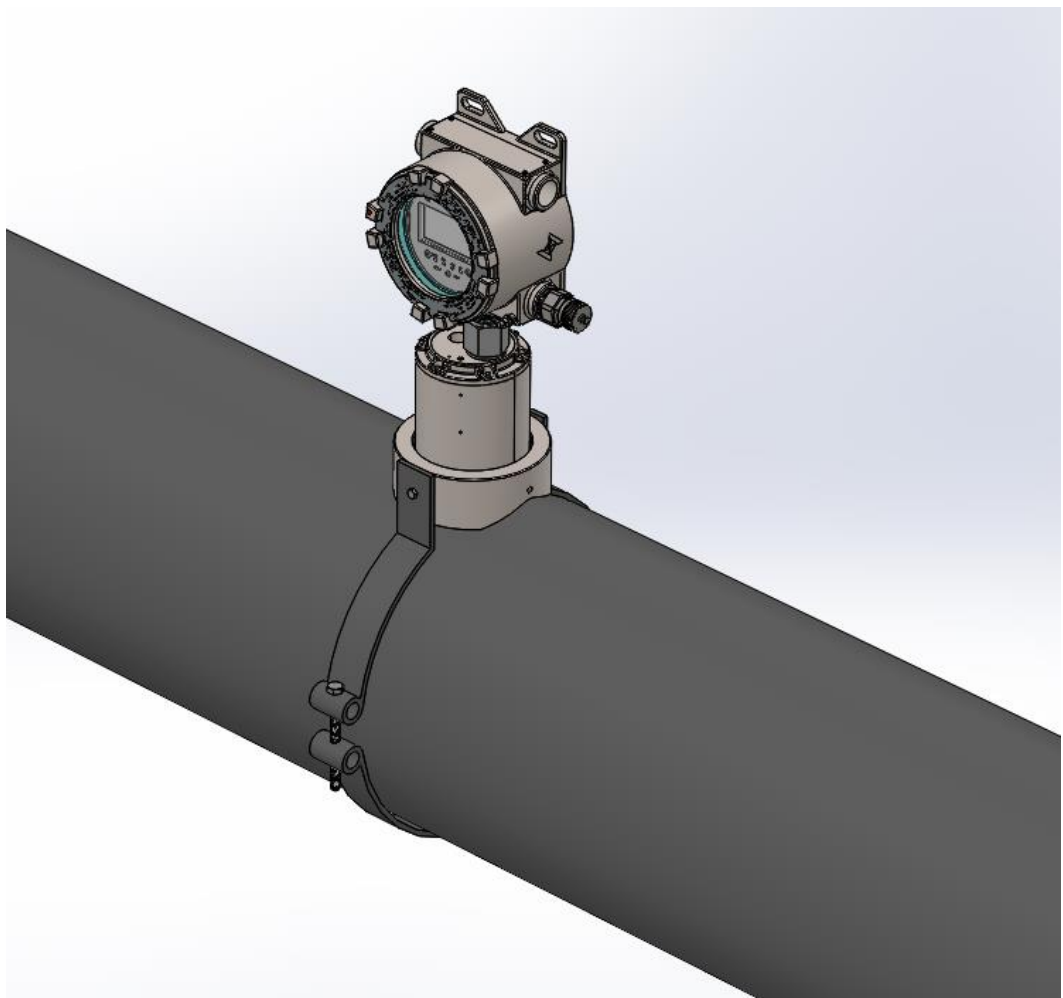
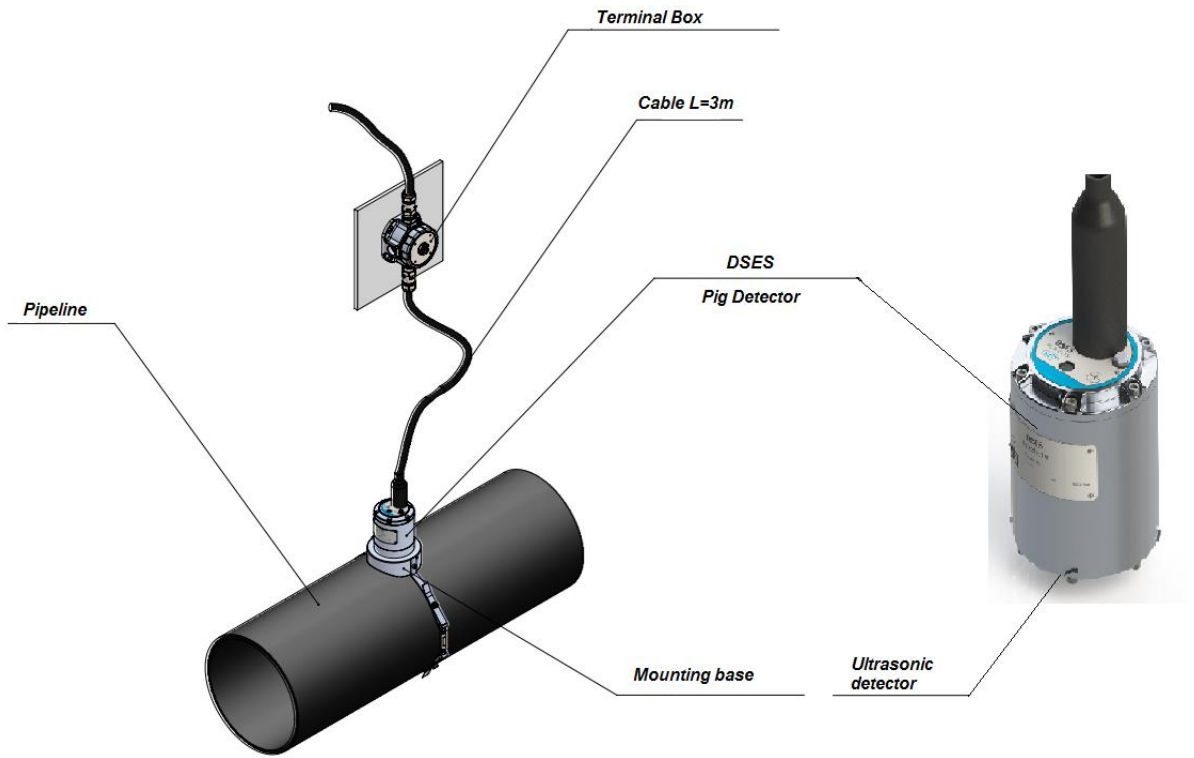
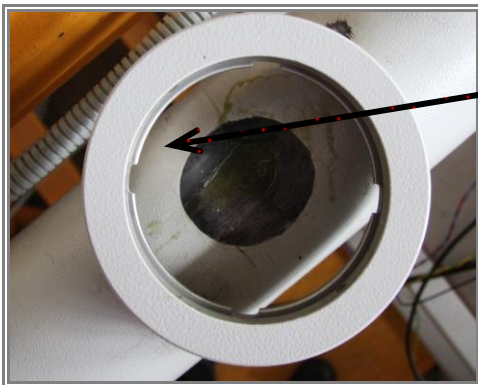


Figure 2. DSES installation on the pipe (standalone version vs. display version)

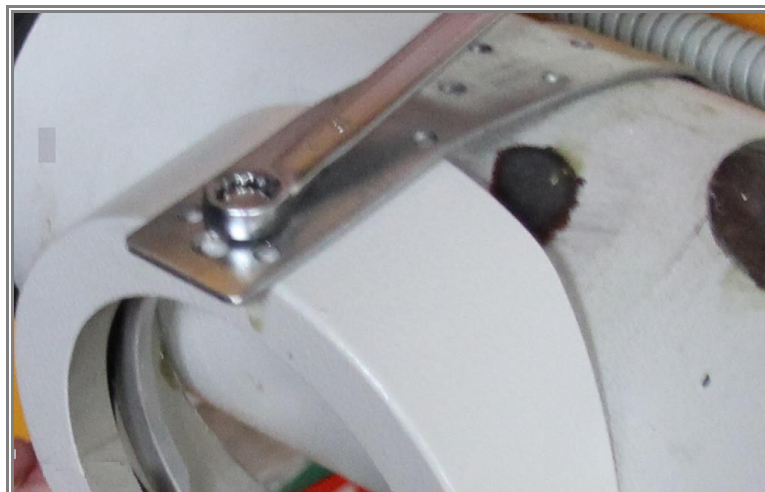
6.4. Pipe preparation.

- 6.4.1. Determine the installation location of the detector. The DSES housing is mounted on the pipe using a mounting plate. The mounting plate is fastened with the clamp included in the delivery.
- 6.4.2. Remove thermal insulation/coating at the installation location of the clamp. Insulating material is removed completely from the entire pipe surface in a circle, the required width, to provide enough contact with the sensor.
- 6.4.3. Strip the place on the pipe measuring 10 x 10 cm to the metal on which the sensor will be installed. For cleaning, you can use the skin / abrasive material for metal surfaces. There should be no paint or other protective layer at the place of installation.



To strip a surface on a pipe until metal surface is exposed

- 6.4.4. Determine the required size of the coupler clamp and cut it in accordance with the diameter of the pipe. It is recommended to cut the tape so that one of them is shorter than the other and the turnbuckle is located on the side of the pipe with fasteners, which will facilitate access to it for rigid fixation.
- 6.4.5. Fixed a clamp on one side of the mounting base with 2 bolts.



6.4.6. Install on the pipe and fix the second clamp with 2 bolts.



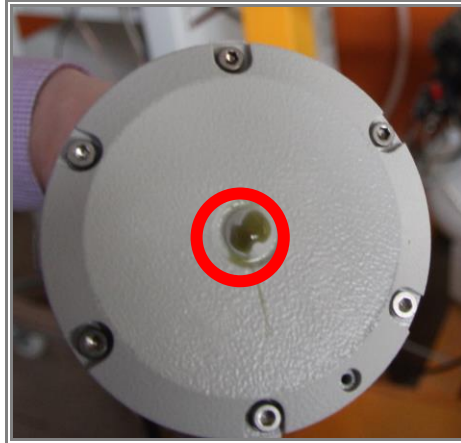
6.4.7. Tighten with a wrench of 12 the grub screw. The mounting base must not scroll or move. There should be no gaps at the junction of the mounting base to the pipe.



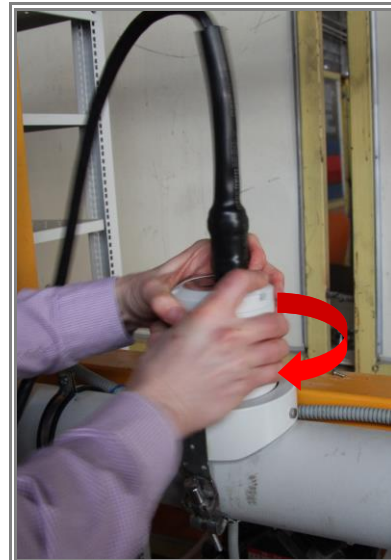
6.4.8. To ensure the best contact between the DSES body and the pipe surface, a sealant and ciatin grease are applied throughout the cleaned area, which provides the best acoustic contact with the pipe body and avoids the attenuation of ultrasonic waves during the metal-air-metal transition, as well as preserves the contact point from oxidation and corrosion.

6.5. Detector DSES installation

- 6.5.1. Apply Huskey HVS-100 to the device concentrator; it should completely cover the cone of the receiver and reach the outer diameter of the concentrator. Huskey grease provides the best acoustic contact with the pipe and avoids the attenuation of ultrasonic waves during the metal-air-metal transition, and also preserves the contact point from oxidation and corrosion.



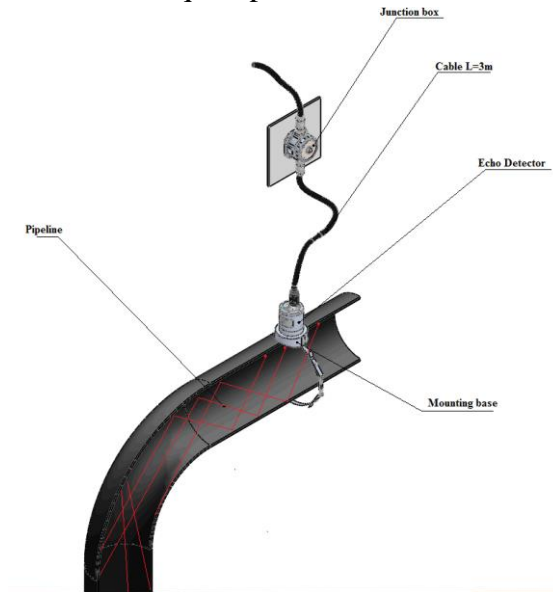
- 6.5.2. Insert the device into the slots of the mounting base and turn clockwise. The DSES housing is connected to the mounting base through a threaded connection by screwing the DSES housing into the hole. This design should provide a tight and reliable contact between the surface of the pipe and the tangential concentrator of the transducer of the ultrasonic receiver. Make sure that the mounting base is firmly fixed.



6.6. Standalone Detector DSES connection.



The DSES detector does not require any calibration or adjustment before use. DSES has a self-diagnosis function and does not require periodic checks.



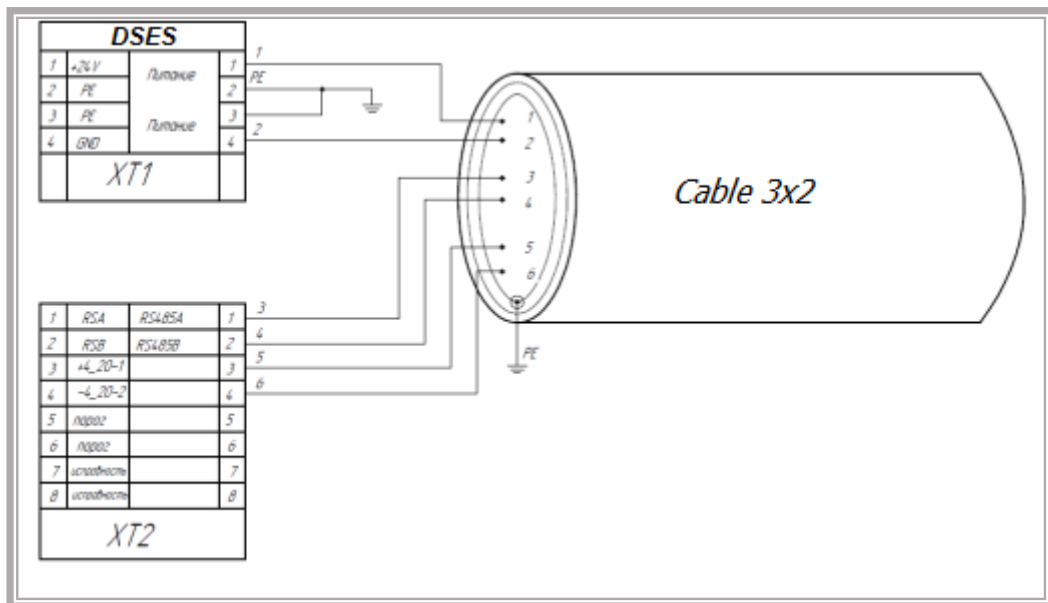
Since the Standalone DSES detector is supplied pre-assembled, the output cables are marked and correspond to the following values:

	Core 1		Power «+»
	Core 2		Power «-»
	Core 3		RS- 485A
	Core 4		RS-485B
	Core 5		+ 4-20 mA
	Core 6		- 4-20 mA
	Ground core		

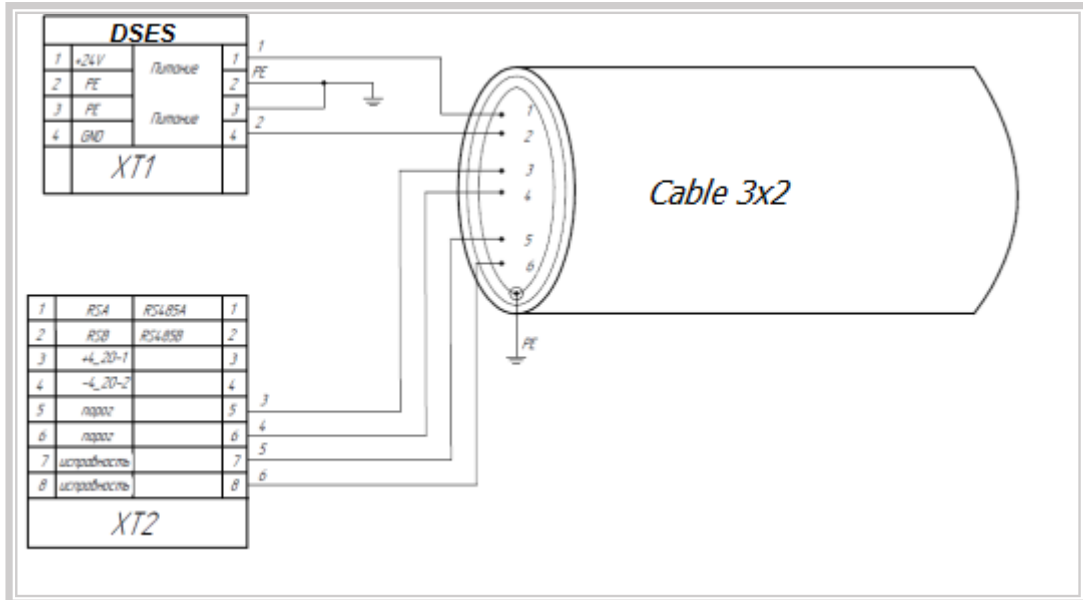


Attention! If it is necessary to remove signals from the relay outputs, the “dry contact” of the core can be reconnected to the corresponding terminals 5, 6, 7 and 8 of the XT2 connector on the terminal board.

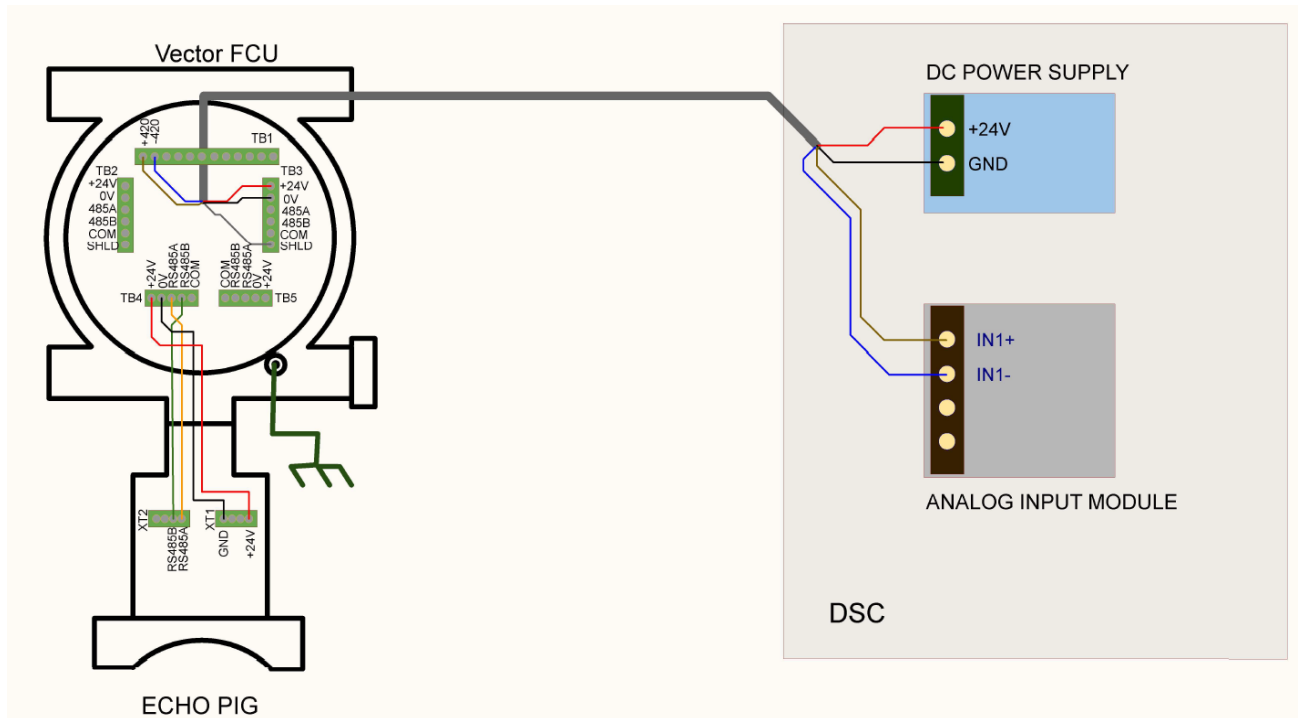
6.6.1 Connection diagram of the DSES detector via 4-20 mA and RS-485 analog outputs.
Factory Standard execution.



6.6.2. Connection diagram of the DSES detector via a "dry contact" relay.



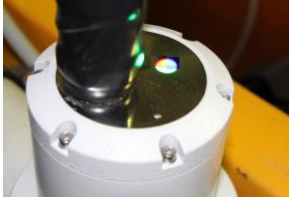
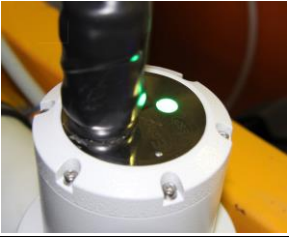
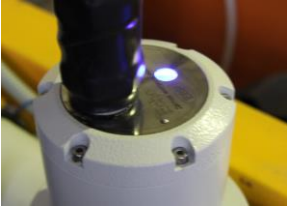
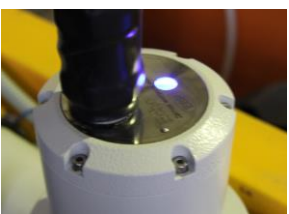


6.6.3 Connection diagram of the DSES detector with display



6.7. Performance checking of DSES.

6.7.1. The DSES detector has a self-diagnostic function and does not require periodic performance checks.

6.7.2. LED indicator on detector's cover displays the operating modes of the device:

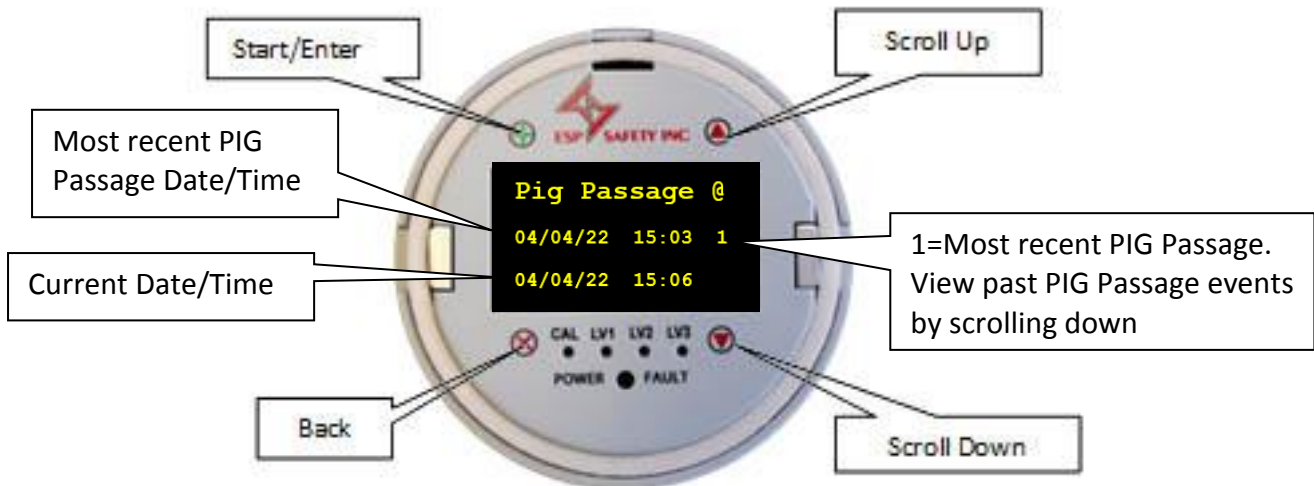
	<p><i>Detector has contacted.</i> After power-up, the LED indicator is recounted in different colors - red, green, blue, orange.</p>
	<p><i>Self-diagnostic mode.</i> The green indicator lights up. The self-diagnosis mode is carried out by the detector once an hour.</p>
	<p><i>Operating mode.</i> The blue indicator is on - the self-diagnostic is completed - the device is in operating mode.</p>
	<p><i>RS-485 software communication.</i> The blue indicator flashes.</p>
	<p><i>PIG detector pass fixation mode.</i> The red indicator is on.</p>
	<p><i>Malfunction.</i> The orange indicator is on.</p>

6.8 PIG Display Operation & Menu Structure

6.8.1 Display Operation

When used in conjunction with a magnetic wand (P/N 611-0005), the PIG display may be used to perform several basic configuration functions. Four touch points for the magnetic wand surround the display. The functions of the touch points are as follows:

Start / Enter – selects a function to be performed
Back – cancel a pending function or exit the current function

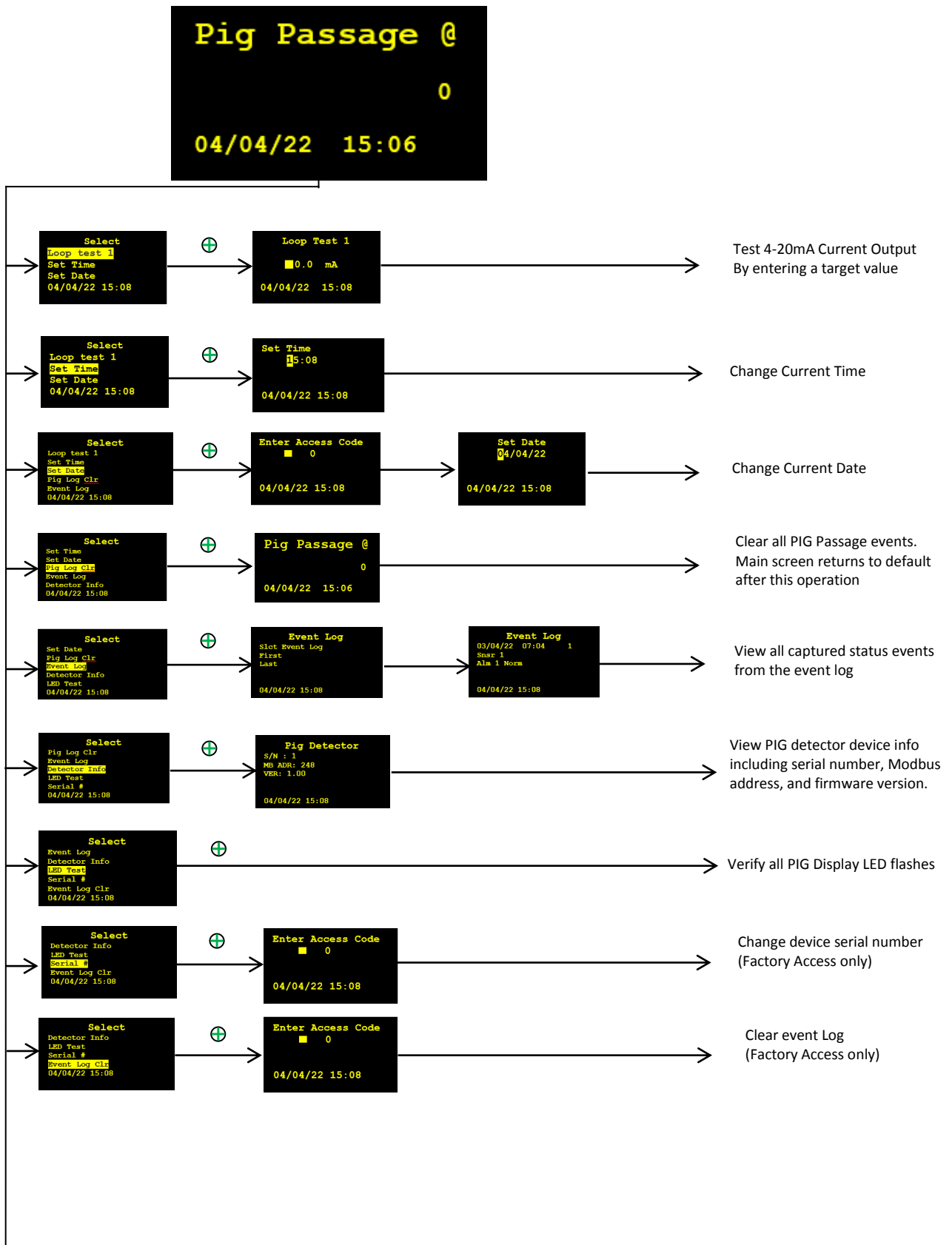


Scroll Up – View next PIG Passage Date/Time or selects the item above the current one.
Scroll Down – View previous PIG Passage Date/Time or selects the item below the current one.
 If the magnetic wand is placed on the "SCROLL UP" or "SCROLL DOWN" touch point and held there, the display will scroll approximately every 0.5 seconds.

The status line on the display shows the following information:

- current month, day, and (2 digit) year in mm/dd/yy format
- the current time in hh:mm 24 hour format
- The most recent PIG Passage Date: month, day, and (2 digit) year in mm/dd/yy format
- The most recent PIG Passage Time in hh:mm 24 hour format

6.8.2 PIG Display Menu Structure



7. Software DSES configurator v1.0.

7.1. To configure, adjustment and visualize the operating parameters of the DSES detector, the *DSES configurator v.1.0* software (included in the package) installed on the PC.

The program is intended for:

- viewing parameters and visualizing operating modes of the device in real time with the ability to save the measured parameters;
- changes in the communication parameters of the device connected via RS485;
- changing operating modes;
- functional checks.

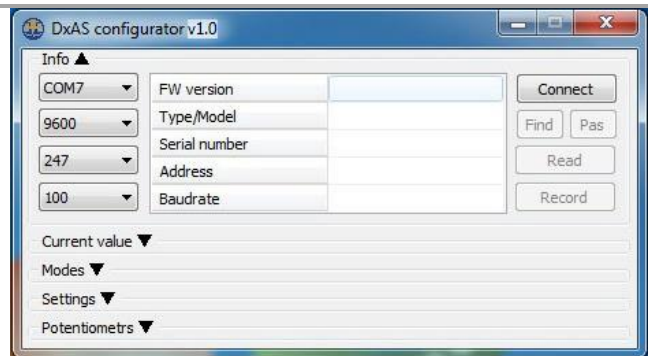
The *DSES Configurator v.1.0* program is installed on the computer by copying or can work directly from a USB-drive.

7.2. The procedure for working with the program *DSES configurator v1.0*.

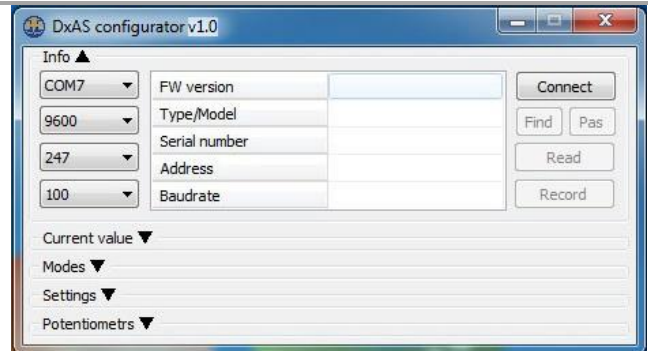
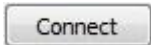
7.2.1. Open the *DxAS Configurator v1.0* program on the desktop by clicking on the program icon.



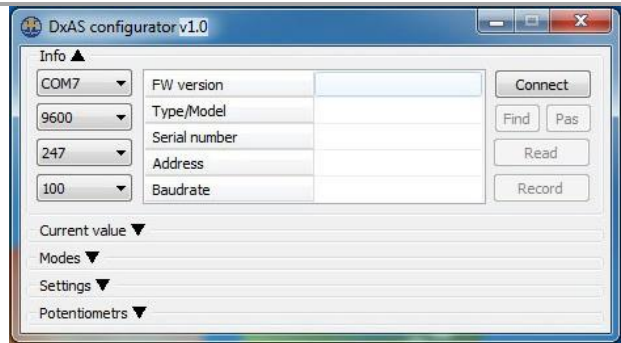
7.2.2. In the open program window, select COM port to COM7, connect the detector. Before establishing communication with the device in the program, only the panel of connection parameters and information is available.



7.2.3. In the open program window, click on the "Connect" button



7.2.4. After connecting the detector, click the “Read” button.



7.2.5. After establishing communication with the detector, the program interface will change to the *Echo configurator v1.0*.

Additional settings panels are available for adjustments.

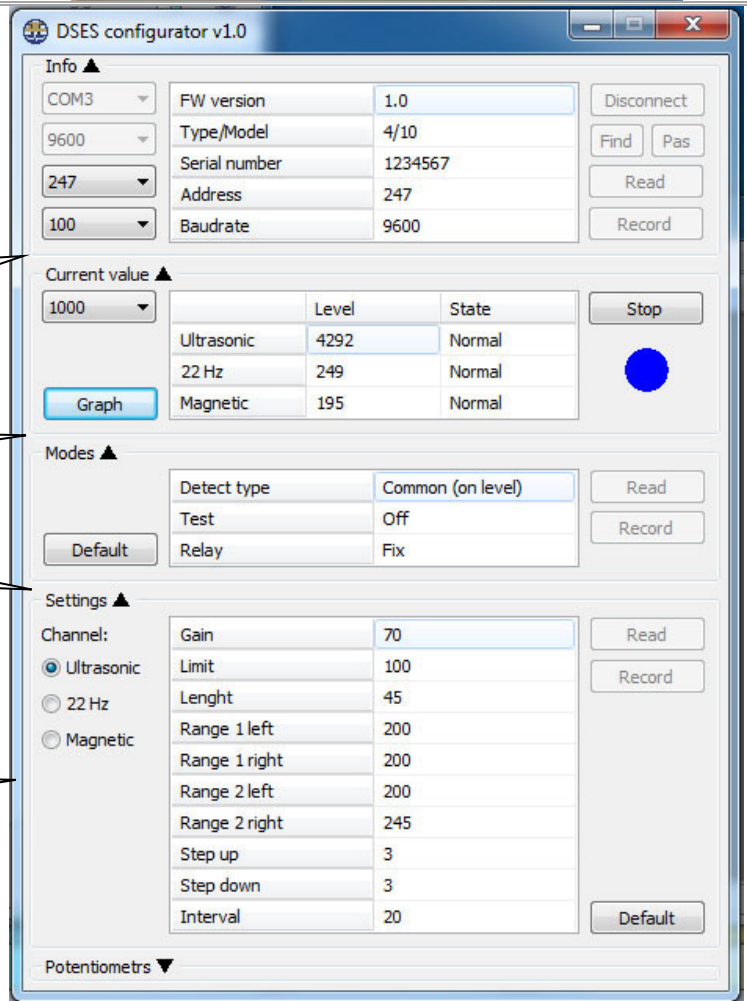
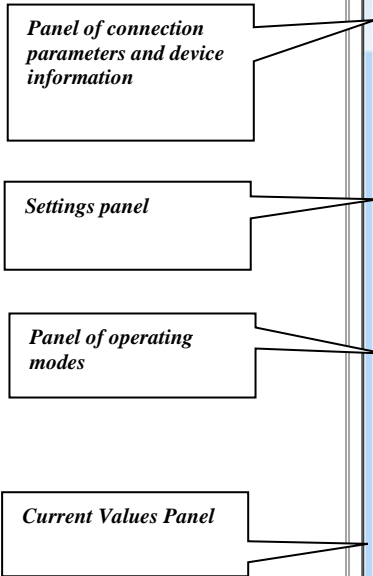


Figure 3. Program interface DSES configurator v1.0

7.2.6. Description of the program interface:

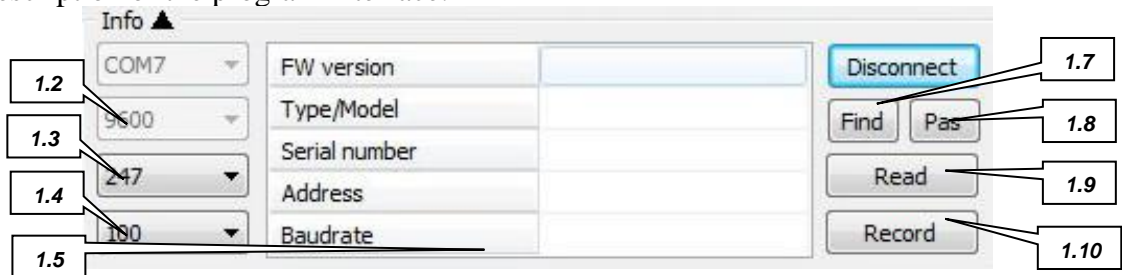


Figure 4. Panel of connection parameters and device information

1.1 COM port number through which communication is carried out.

- 1.2 The exchange rate with the device.
- 1.3 MODBUS address of the device the program is accessing.
- 1.4 Response delay, in milliseconds.
- 1.5 Instrument Information I / O Table.
- 1.6 Button to enable or disable communication through the selected COM port.
- 1.7 Button to start the process of automatic device search for all (1-247) addresses. In case of a successful search, the address of the device found will remain in the corresponding field.
- 1.8 Button to enter the access key to additional device settings.
- 1.9 Instrument Read Button
- 1.10 Detector Information Record Button

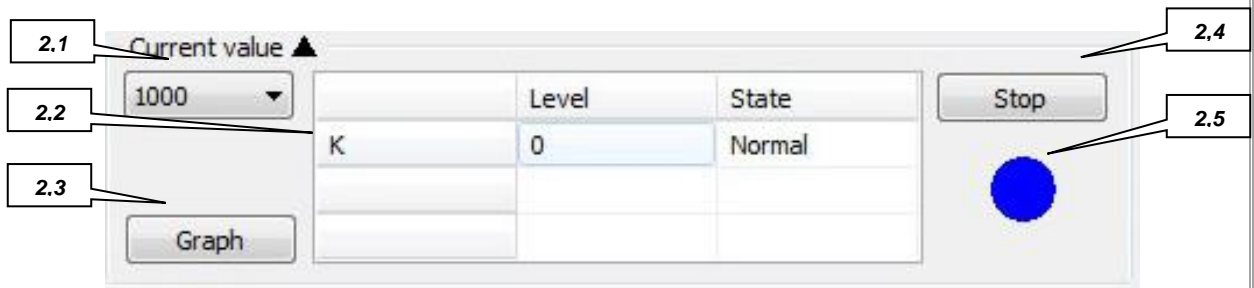


Figure 5. Current Values Panel

- 2.1 Detector polling interval set in milliseconds.
- 2.2 Output table for current detector parameters. Second column current level, third column state, depending on instrument settings.
- 2.3 Button to display a window with graphs of current values.
- 2.4 Button to start / stop reading current levels and states from the detector.
- 2.5 Icon indicating the current status of the detector LED

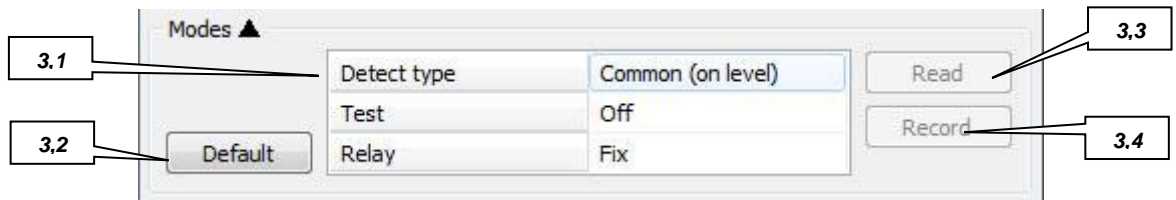


Figure 6. The panel of operating modes

- 3.1 Table of input / output information about the operating modes of the device.
- 3.2. Button for entering the default mode values (after entering, you must press the record button).
- 3.3 Button for reading operating modes.
- 3.4 Button for recording operating modes.

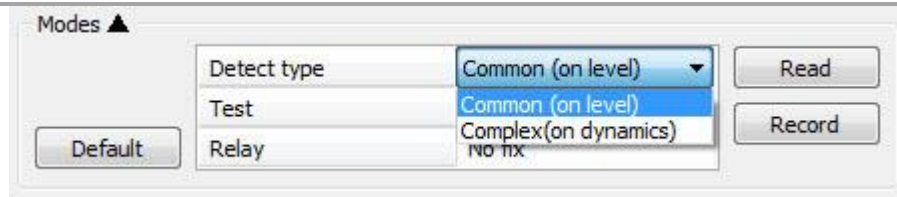


Figure 7. The panel of operating modes

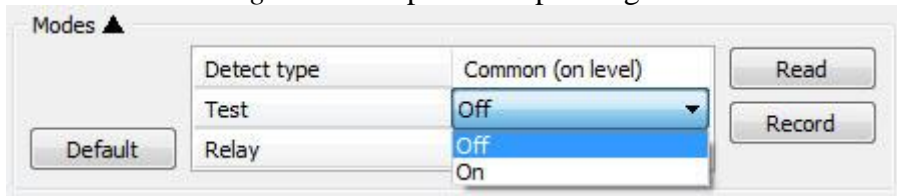


Figure 8. The panel of operating modes

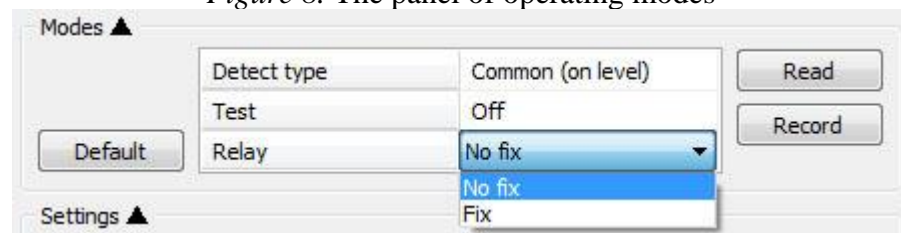


Figure 9. The panel of operating modes

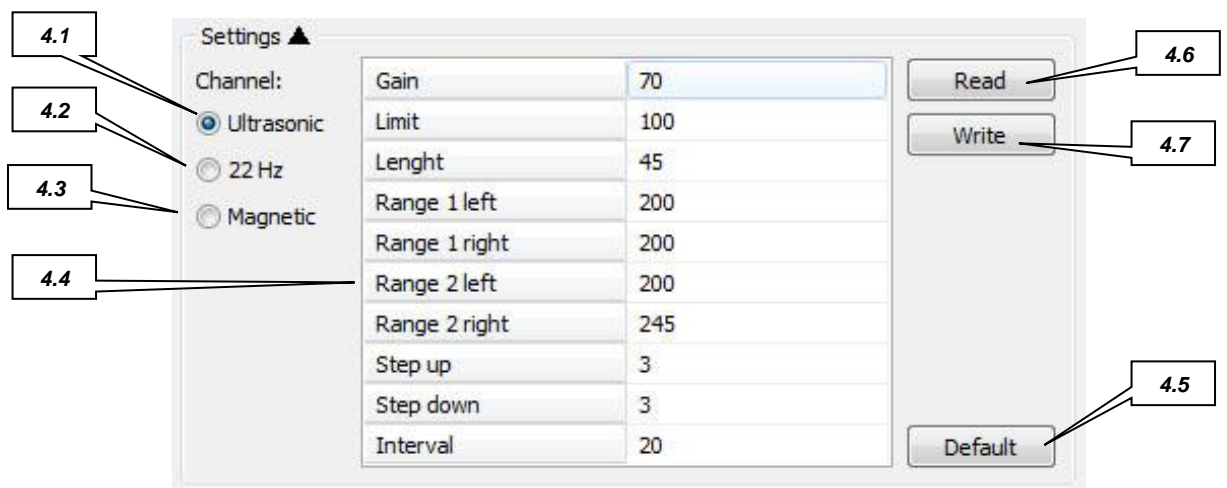


Figure 10. Settings panel

- 4.1 The choice of the first channel is ultrasonic.
 4.2 The choice of the second channel - 22 Hz.
 4.3 The choice of the third channel is magnetic.
 4.4 Table of input / output settings.
 4.5. Button for entering the default settings (after entering, you must press the record button).
 4.6 Button for reading device settings.
 4.7 Button for recording instrument settings.
 Input / output, reading / writing as well as entering the default settings is carried out ONLY for the selected channel (clauses 4.1 - 4.3).

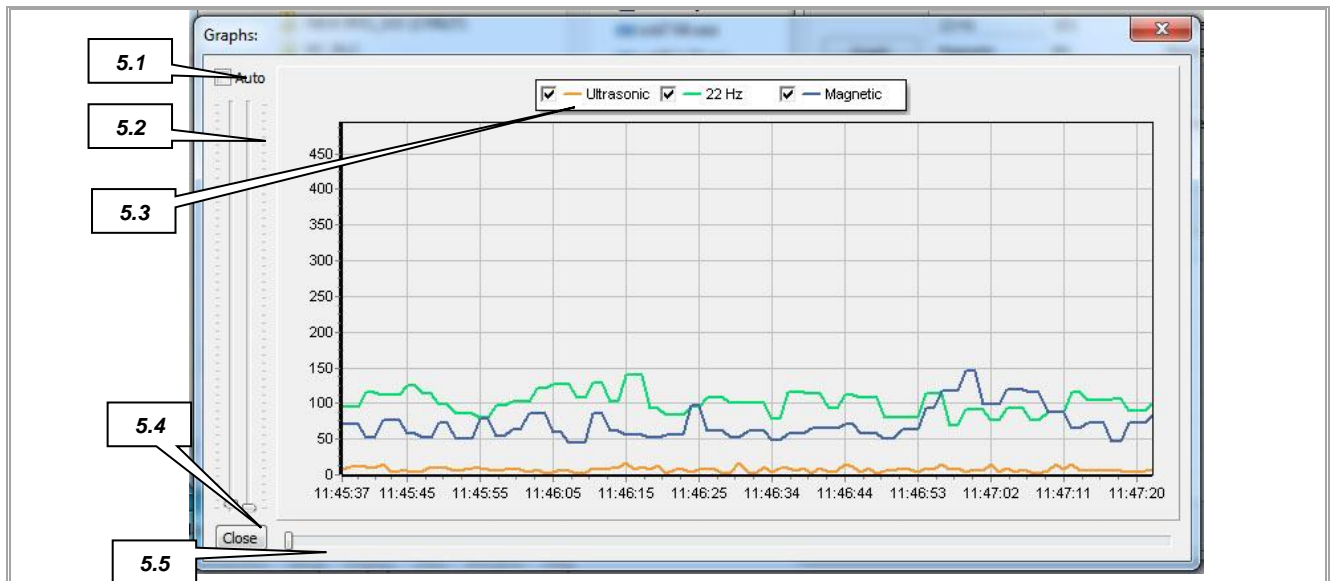


Figure 11. Additional window for graphing current parameters

5.1 Choice of automatic / manual scaling of graphs.

5.2 In the manual scaling mode, the scale along the axis of values (Y).

5.3 The legend of graphs, allows you to enable / disable the necessary channels.

5.4 Button for closing the chart window.

5.5 In the manual scaling mode - the scale along the time axis (X).

Standard scaling with the mouse is also possible (selection of rectangular areas - from left to right to enlarge and vice versa to return to the original scale).

8. Possible Malfunctions and Troubleshooting

№	Malfunctions	Possible reason malfunctions	Remedy malfunctions
1	No signal LED	Lack of supply voltage	Disconnect the base with the cable entry from the housing and verify that 24 ± 6 V is present at the terminals.
2	Steady yellow LED.	Detector malfunction	The device should be sent to the manufacturer for repair

Explosion-proof DSES components are not intended for field repair - therefore, if the product breakdown is associated with a malfunction of individual electronic components, the detector should be returned to the manufacturer for repair.

Addresses and contacts for communication are also available on the website of the manufacturer: www.espsafetyinc.com

If the product is returned to the manufacturer, a written statement must be attached with a description of the problems identified to expedite the detection of the cause of the malfunction.

9. Service maintenance

The maintenance of the DSES detector is as follows:

9.1. **Conducting an external** inspection of the Echo detector for visible external damage.

9.2. **Checking the reliability of mounting the coupler clamp** on the pipe.

9.3. **DSES detector dust and dirt removal** - once every 2 years or as necessary, if there is visible dusting on the DSES surface. Cleaning is carried out by removing dust with a brush - wipe or slightly damp coarse calico from the body. In case of contamination of the case with oil products, cleaning is carried out with calico soaked in alcohol - rectified. After rubbing with alcohol, wipe the surface again with dry coarse calico to eliminate residual contaminants. The alcohol consumption rate for one service is 10 g.

9.4. **If there is a bad contact between the detector and the pipe surface**, reapply Huskey HVS-100 grease to the device concentrator.

9.5. **The grounding** condition is checked by the tightness of the connection and the presence of grease on the contacts is concluded.

10. Component part and delivery set

10.1. Standard delivery set includes:

- 1) DSES detector with display OR DSES standalone detector with an armored cable length of 3 meters - 1 pcs.;

(For customer convenience, the Echo detector supplied with a cable shrink-wired and connected through a cable entry, enclosed in a heat-shrinkable tube)

- 2) Mounting base - 1 pcs.;

- 3) Mounting coupler clamps with perforation, fastened with a coupling bolt, 3 meters each - 2 pcs.;

(For ease of installation, it is recommended that the customer inform the diameter of the pipeline on which the detector is planned to be installed. In this case, clamps for installing the sensor can be prepared at the factory in accordance with the specified dimensions)

- 4) Operating manual 820-0013 - 1 pcs;

- 5) Detector passport – 1 pcs.;

- 6) **DSES_configurator_v1.0** software for configuration and visualization of Echo parameters,

10.2. Optional Equipment Supplied

- 1) Explosion-proof terminal box KVES is designed for cross-connection of electrical circuits of monitoring and control units operating in hazardous areas.

- 2) The network repeater-splitter PRESES is intended for use in hazardous areas as an amplifier - pulse shaper, as well as a splitter when designing long and branched communication lines via the RS-485 interface in the places of installation of technological equipment.

11. Transportation and storage regulations

DSES detectors in the manufacturer's packaging can be transported at any distance, by any means of transport. Equipment transportation conditions (including a set of necessary accessories) must comply:

- regarding the impact of climatic factors - the temperature range ($-50 \dots +70$) °C, humidity from 10% to 95% a temperature of 35°C without condensation.
- in terms of the impact of mechanical factors - with the provision of requirements for the protection of equipment during overloads.

When transporting, transport packaging with packed DSES must be protected from atmospheric precipitation. When transported by airplane, equipment should be in heated, sealed compartments. Railway wagons, containers, car bodies used for transportation of DSES, should not have traces of transportation of cement, coal, chemicals, etc. The arrangement and securing of cargo in vehicles should ensure a stable position of the cargo during transportation. Displacement of cargo during transportation is not allowed.

DSES retains its characteristics in a transport container after exposure to them following mechanical factors:

- a) sinusoidal vibration corresponding to the execution group F2 according to;
- b) hits with parameters:
 - 1) shock acceleration - up to 30 g;
 - 2) duration - 11 ms;
 - 3) the shape of the shock wave is a half-sine wave

The DSES detector does not harm the environment during transportation.

Storage conditions of DSES in the manufacturer's packaging correspond to the temperature range ($-50 \dots +50$) °C, humidity up to 98% at a temperature of 35°C.

In storage rooms there should be no dust, vapors of acids and alkalis, aggressive gases and other harmful impurities. Products in packaging containers must be stacked on racks in no more than 5 layers.

12. Marking and sealing

The PIG Detector DSES label must contain:

- a) manufacturer's trademark;
- b) symbol Echo;
- c) certification authority mark and number of certificates;
- d) Ex-marking 1Ex db IIC T4 Gb;
- e) Operating temperature range;
- f) serial number;
- g) production year.



DSES must be sealed with manufacturer's seals.

13. Disposal requirements

The materials and components used in the manufacture of the detector for passing the DSES treatment device do not pose a risk to human health, production and storage facilities, and the environment - both during operation during the service life and after the expiration of the term.

Disposal of non-operational passage detectors of a DSES treatment device can be carried out by any method available to the consumer.

14. Manufacturer's warranty

- The manufacturer guarantees compliance of the PIG Detector DSES with specified requirements, provided that the consumer complies with the operating, transportation and storage conditions established in this Operating Manual.
- The warranty period is 18 months from the date of commissioning of the Echo detector, but no more than 24 months from the date of manufacture.
- The warranty storage is set 6 months from the date of manufacture of the Echo detector.
- The manufacturer undertakes to repair the detected defects free of charge or replace the failed Echo during the warranty period.

Address of manufacturer:

ESP Safety Inc.
555 North First Street
San Jose, CA 95112
USA
Ph: 408-886-9746
Fax: 408-886-9757
Website: www.espsafetyinc.com
Email: info@espsafetyinc.com

Appendix B

Digital Output Protocol Settings

* Modbus RTU protocol support provided by basic modification

The detector is designed to detect and record the passage of an in-tube object through points at which the DSES is installed by processing signals from the registration channels and transmitting data about the passage of the object into the system.

Communication with the control panel is via a digital channel that contains all the information.

The presence or absence of detection and registration of the passage of the in-tube object and service parameters are transmitted to the upper level controller via the RS-485 interface using the MODBUS protocol. DSES supports the following types of commands:

- reading from the device. Team Code 04;
- write a word to the device. Team Code 06.

v A chart of addresses containing device status information.

Address 0x00 - contains information about the firmware version of the detector, the high byte contains the integer part of the version number (unsigned number), the low byte is the fractional part of the version number (unsigned number). Example: cell value 256 - firmware version No. 1.1.

Address 0x01 - device type. For DSES: the high byte is 4, the low byte is 10.

Address 0x02 - 16-bit register of detector status with the following information bytes:
high byte - not used.

low byte - the current state of the detector in the format XXXXXD2D1D0, where

D2: 1 - fault, 0 - normal

D1: 1 - service mode, 0 - normal

D0: 1 - detection of the passage of the scraper, 0 - normal operation of the detector.

Address 0x03 is the highest register of the signal level on the ultrasound channel.

Address 0x04 - the lowest register of signal level on the ultrasound channel.

Address 0x05 - high register signal level on the channel 22Hz.

Address 0x06 is the lowest register of signal level on the 22Hz channel.

Address 0x07 is the highest register of the signal level on the magnetic channel.

Address 0x08 - the lower register of the signal level on the magnetic channel.

Address 0x0V is the high register of the serial number of the device.

Address 0x0C is the lowest register of the device serial number.

Address 0x0D - the least significant byte contains the number (address) of the device (unsigned number).

Address 0x0E - the least significant byte determines the exchange rate on the RS-485 channel:

0x01 - 1200 baud

0x02 - 2400 baud

0x04 - 4800 baud

0x08 - 9600 baud

0x10 - 19200 baud

Address 0x0F - way to determine the passage of the scraper:

0 - simple (by level);

1 - complex (in dynamics);

2 - composite - simple (according to the combination of channels);

3 - composite - complex (according to the dynamics of the combination of channels).

Address 0x11 - register for holding the state of detection. Possible values:

0 - with infinite fixation (until the detector is restarted);

XXXX - holding time of the scraper detection signal in seconds (up to 8 hours).

To change the address of a device, it is necessary to write in the register with the address 0x0D the number of this device in the range from 0x01 to 0xF7, placing it in the low byte of the register.

To change the exchange rate of the device via the RS-485 channel, it is necessary to write in the register with the address 0x0E a code corresponding to a certain exchange rate, placing it in the low byte of the register.

0xNN01 - 1200

0xNN02 - 2400

0xNN04 - 4800

0xNN08 - 9600

0xNN10 - 19200

When the device's speed changes, the top-level controller receives a response to the command at the same speed and only after that the DSES makes a change in the device's exchange rate.

When debugging software, it is unacceptable to cyclically use the command with code 06 because registers for writing have a limited number of write cycles (10,000).

ATTENTION: reading / writing and using information from addresses not specified in this manual is not allowed

Appendix C DSES Connection Scheme

