



MUD FLOW SENSOR (ENCODER) DPS-140(IVR)

Operation Manual

PLA140.207.020.000 RE

Rev. 01

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This Manual provides information for service personnel how to perform installation, commissioning and maintenance of the Mud Flow Sensor (Encoder) DPS-140(IVR) (hereinafter referred to as the DPS-140(IVR)).

The DPS-140(IVR) exploitation is allowed to be used by personnel who has studied this manual, set of exploitation documentation and passed safety training.

The DPS-140(IVR) is intended to control position of its paddle in the fluid flow for calculation of MUD OUTPUT drilling parameter. The sensor is made as part of the DEL-150 Drilling and Well Workover Monitoring System (hereinafter referred to as the DEL-150).

Scope of application is explosive zones of premises and outdoor facilities according to Ex-marking. The DPS-140(IVR) is manufactured in accordance with the requirements of ISO 9001:2015.

In order to exclude the possibility of mechanical damage, violation of electroplating and paint coatings, the rules of storage and transportation of the device should be observed. When studying the rules of operation, it is also necessary to be guided by the technical description and operating instructions of the DEL-150 System.

1. Technical Characteristics

Name of parameter	Value
Output signal	Digital
Communication protocol	Modbus
Power supply range, VDC	12...18
Ex marking, TR CU 012/2011	1ExibIIBT5Gb

Ex marking, ATEX	II2GExibIIBT5Gb
Ingress protection	IP66
Ambient temperature range, °C	-45...+65
Dimensions, mm	400 x 80 x 400
Weight, kg	3.3
Service life, min., years	10

2. Explosion Safety During Operation

Explosion protection is provided by an intrinsically safe electrical circuit ("I" type of explosion protection).

3. Requirements for Keeping Equipment Specifications that Cause its Explosion Safety

During operation, it is forbidden to break the seals and open the DPS-140(IVR) enclosure.

When the MU-150 / MU-150E / MK-140 unit of the DEL-150 System is switched on, it is forbidden to connect and disconnect cables, power cable and grounding conductors. In case of malfunctions, it is necessary to turn off the MU-150 / MU-150E / MK-140 unit and disconnect the power cable from the power source. Then replace the faulty DPS-140 with a serviceable one by connecting it according to the documentation (operation manual for the DEL-150).

During operation, check the condition of communication cables periodically. If a violation of the protective layer on the cable lines is detected, replace the damaged cable immediately.

Do not allow sealing violations. If a damage is detected, replace the faulty equipment.

Ensuring explosion safety during operation is according to the safety regulations, applicable to the equipment with which (or as part of which) the equipment is used.



ATTENTION!!! During operation, it is necessary to monitor the equipment status and its cables. In case of any mechanical damage of the equipment or any of the cables connected, further operation is strictly prohibited!

4. Installation

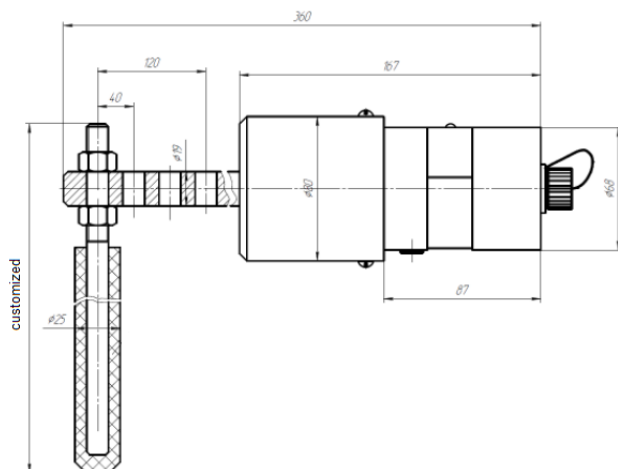


NOTIFICATION. Installation and further commissioning of the equipment should be carried out only by qualified specialists.

Before installing the DPS-140(IVR), it is necessary to make sure that:

- Basic dimensions at the processing facilities correspond to the dimensions of the DPS-140(IVR) (see Fig. 1);
- Fixing bolts and screws are present;
- There is no damage of the connector insulation;

- Disregard of this instruction may lead to a serious failure of the DPS-140(IVR).



Examples of the DPS-140(IVR) installation depending on the application are provided on Fig.2 and Fig.3.

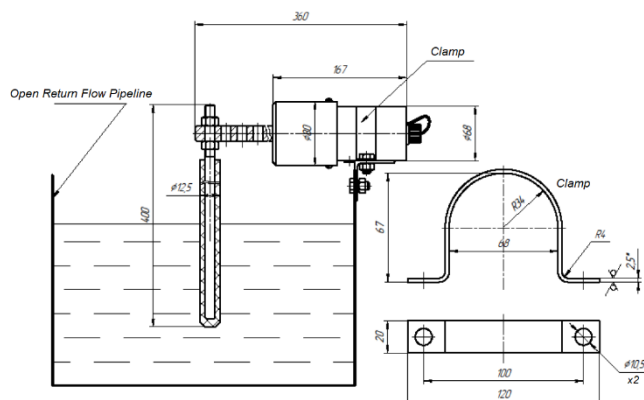


Figure 2. The DPS-140(IVR) installation example (in the open return flow pipeline)

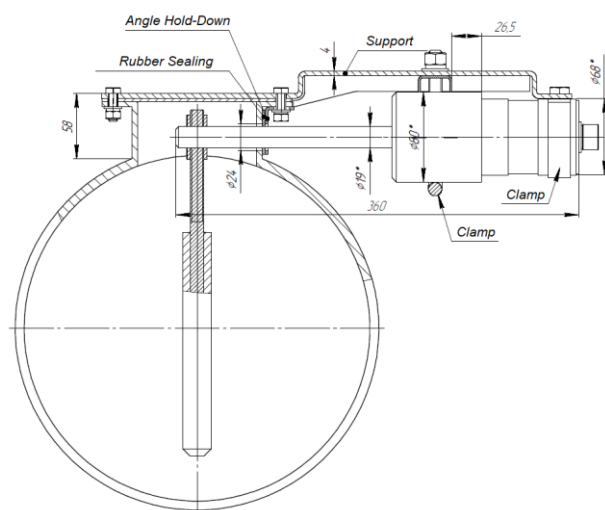
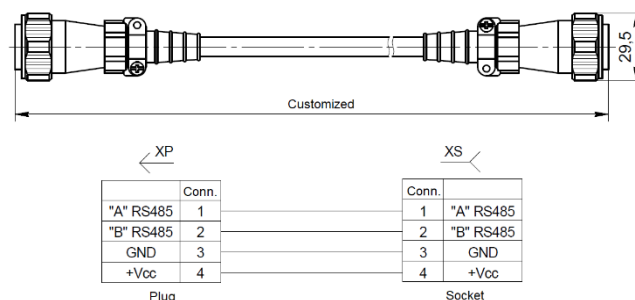
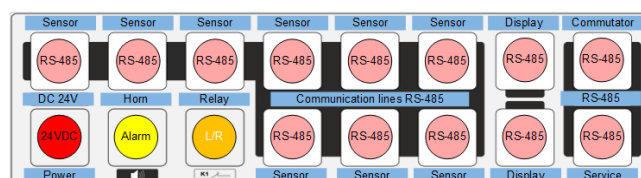


Figure 3. The DPS-140(IVR) installation example (in the closed return flow pipeline)

The WY20/WY20 universal commutation cable from the supplied package (see Fig. 4) is used for connection of the DPS-140(IVR) to the MU-150 / MU-150E / MK-140 unit of the DEL-150 System.



The cable from the DPS-140(IVR) is connected to any of the connectors of the MU-150 / MU-150E / MK-140 unit marked "RS-485" / "Sensor" (see Fig. 5).



For functional test of the DPS-140(IVR) it is necessary to connect the sensor to the MU-150 / MU-150E / MK-140 unit, to turn power on and to make sure that the parameter MUD OUTPUT is displayed on the MU-150 / MU-150E EL screen (see Fig. 6).

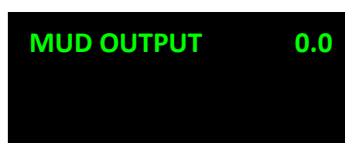
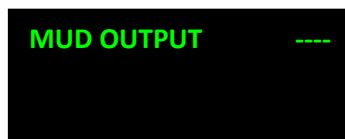


Figure 6. Readings on the Control Module display in operating mode

If the connection with the DPS-140(IVR) is lost, the symbol "- ----" opposite the parameter MUD OUTPUT is displayed on the MU-150 / MU-150E EL screen (see Fig. 7).



In case of loss of communication with the DPS-140(IVR) it is

necessary to carry out actions in the following order:

- 1. Checking of the integrity of the commutation cable;
- 2. Reconnection of the DPS-140(IVR) cable to the free connector of the MU-150 / MU-150E / MK-140 unit marked "RS-485" / "Sensor";
- 3. Checking of the presence of the parameter in the related menu's list of the Control Module;
- 4. Replacement of the cable;
- 5. Checking of the presence of the parameter in the related menu's list of the Control Module;
- 6. Replacement of the DPS-140(IVR);
- 7. Checking of the presence of the parameter in the related menu's list of the Control Module.

8. Setting of the DPS-140(IVR)

When the sensor installation is completed, it is necessary to turn on the MU-150 Control Module and to enter the setting mode using the MU-150's keyboard (see Fig. 8).

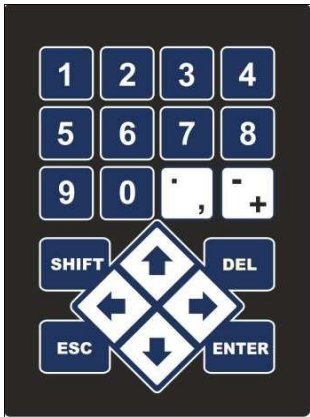


Figure 8. The MU-150 Control Module keyboard

Proceed in the following order to reach out required parameter:

- 1. Unblock the keyboard by pressing **SHIFT** + **ENTER** simultaneously;
- 2. Enter OPERATING PARAMETERS menu by pressing **SHIFT** + **3** simultaneously;
- 3. Use **DOWN** , **UP** and **ENTER** to select required parameter. To return to the previous menu, use **ESC** .

	SUM FLOW MUD FLOW IN MUD OUTPUT MUD VOLUMES
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With the absence of fluid flow in the return pipeline fix zero value by pressing 	MUD OUTPUT, % 0 % 0000.00 100 % 0000.00
When mud pumps are running in the working mode fix 100% value by pressing If pumps' working mode is changed, it is required to set 100% value again for proper indication of the MUD OUTPUT parameter	MUD OUTPUT, % 0 % 0000.00 100 % 0000.00

9. List of Critical Failures and Possible Issues in Maintenance Leading to Equipment Failures and Actions to Prevent these Failures (troubleshooting)

Incorrect power supply can lead to equipment failure.

Incorrect set maximum values for parameters can lead to incorrect operation of the external controlled equipment if the maximum level for the controlled parameter is exceeded.

A short circuit or a break circuit in the power and communication lines of the sensor, may cause loss of communication with the sensor with the following failures: lack of parameter data, symbols "???" or "----" instead of parameter data, lack of data on other parameters.

In case of failure of the sensor or Control Module, it is necessary to check the equipment technical condition according to the Clause #7 of this Operation Manual. If troubleshooting did not lead to proper operation, it is necessary to stop operation and replace with obviously serviceable equipment. Defective equipment should be sent for repair to the manufacturer or to the specialized authorized service center.

In case of failures that can lead to emergency situations, it is necessary to replace the equipment that has failed. If necessary, disable additional external devices.

10.Maintenance Procedure

- Maintenance is carried out in the following order:
- 1. Cleaning the sensor's enclosure from contamination;
 - 2. Checking the safety of seals (if available);
 - 3. Checking the presence and strength of the mounting components;
 - 4. Cleaning of connectors and terminals from contamination;
 - 5. Checking for the absence of visible mechanical damages;
 - 6. Replacement and (or) repair of damaged cable products;
 - 7. Replacement of damaged connectors.

The contacts of the connector should be washed with an

alcohol-gasoline mixture (need 3 ml.) using a soft brush. Connectors after cleaning and drying should be treated with Vaseline or similar lubricant. It is recommended to treat the threads on the connectors with graphite grease.



NOTIFICATION. Absence of maintenance records in the passport (section "Maintenance Records") ENTAILS VIOLATION OF THE OPERATION RULES, and the manufacturer has the right to withdraw from warranty obligations

11. Limit Conditions Parameters

In case of severe mechanical damage, leakproofness violations, seals violations, heating of parts to unacceptable temperatures, supply of unacceptable currents and voltages, change of calibration data, further use is unacceptable or impractical, or restoration of its serviceable or operable condition is impossible or impractical.

12. Marking and Packaging

The DPS-140's nameplate includes the following components (see Fig. 9):

1. Trademark or name of manufacturer;
2. Part number;
3. Name and model;
4. Serial number;
5. Manufacturing year;
6. Explosion protection marking together with certificate number;
7. Technical characteristics.

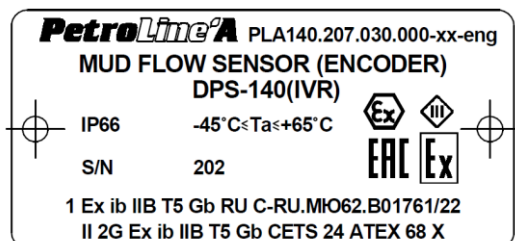


Figure 9. Example of the DPS-140(IVR) marking

Other data required by regulatory and technical documentation may also be reflected on the nameplate.

Boxes made of plywood with metal handles for carrying are used to transport the DPS-140(IVR) as part of the DEL-150 System.

13. List of Components

Full completeness is indicated in the passport for equipment released by manufacturer.

14. Repair

Repair of the DPS-140(IVR) is carried out at the manufacturer or at a specialized authorized service center.



NOTIFICATION. Absence of repair records in the passport (section "Repair Records") ENTAILS VIOLATION OF THE OPERATION RULES, and the manufacturer has the right to withdraw from warranty obligations

15. Storage

The equipment requires careful handling, storage in dry, clean rooms with a constant temperature from -50°C to +50°C and a relative humidity of no more than 80%.

The long-term storage requires conservation, according to the requirements of the equipment conservation instructions. The equipment arriving at the warehouses in the manufacturer's containers are not unpacked, packed on flat pallets and stacked or in the cells of the racks.

Factory-sealed devices are not allowed to be opened in warehouses.

Small devices and devices arriving in individual packaging are stored in box pallets with installation in a stack.

Devices and components without individual packaging should be stored in shelving cells no more than 3 rows in height with the use of cushioning materials between them.

Small devices and products arriving without packaging can be stored in small-cell racks and cabinets, while devices or products of the same type should be stored in one cell.



NOTIFICATION. Absence of storage records in the passport (section "Storage Records") ENTAILS VIOLATION OF THE OPERATION RULES, and the manufacturer has the right to withdraw from warranty obligations

16. Transportation

Transportation of the equipment is allowed by all types of closed transport. The DPS-140(IVR) in a package for transportation allows the impact of transport shaking with an acceleration of 30 m/s² with a frequency of 100 beats per minute or 1500 beats with that acceleration.

17. Disposal

The DPS-140(IVR) is disposed of in accordance with the requirements and norms applicable in the oil and gas industry.

18. Warranty Obligations

The warranty period is 12 months from the date of sale.

A full description of the warranty obligations is described in the equipment passport.

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