

2023



# TP-140D, TP-140D(M) Pressure Transducer Operation Manual

PLA 140.202.000.000RE

Ver. 2.02





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# 1. Description and work

## 1.1. TP-140D Description and work

### 1.1.1. TP-140D Purpose

TP-140D Pressure Transducer is aimed for operating:

- in Ex 1 Zone regarding Safety regulations in oil and gas industry;
- In open air under climatic conditions of macroclimate regions with moderate and cold climate in operation temperature range from -45 to +65 C

### 1.1.2. TP-140D Sensor modifications and their technical characteristics

- TP-140D Pressure Transducer (Fig. 1) as part of the DEL-150 complex is used to control process pressures in pipelines or hydraulic cylinders of drilling and repair equipment.
- TP-140D (VBI) Pressure Transducer as part of the DEL-150 complex is used to measure pressure and recalculate at torque according to the torque table data from the pressure of the hydraulic key. Additionally, a switching box (Fig. 2) is used to connect a contactless sensor (VBI M30) (to change the scaling when gears switching).
- The pressure transducer TP-140D (M) (Fig. 3) as part of the DEL-150 complex is used to control process pressures and fluid temperature in the manifold pipelines. The sensor is made of stainless steel for use in aggressive environments. The sensor is made according to the standard of quick detachable connection 2'.
- The pressure transducer TP-140D (MA) (Fig. 4) as part of the DEL-150 complex is used to control process pressures and fluid temperature in manifold pipelines. The sensor is made of stainless steel for use in aggressive environments with an additional standard current output of 4 ... 20 mA. The sensor is made according to the standard of quick detachable connection 2'.

### 1.1.3 Technical characteristics

Table 1 – TP-140D Main technical characteristics and parameters

№ position	Technical characteristics	Value	Measure Unit
1	Highest measured pressure limit*	40/60/100	MPa
2	Lowest measured pressure limit	0	MPa
3	Max acceptable basic percentage error,% (VPI)	±1,5	%
4	Calibration interval	12	month
5	Operating temperature range	-45 ... +65	°C
6	Ex rating EAC	1ExibIIBT4Gb	
7	Ex rating ATEX	II2GExibIIAT3Gb	
8	Interface connection with Control Module	RS-485	
9	Standard analog output (for TP-140D(MA))	4...20	mA
10	Rated supply voltage	12 ... 18	V
11	Ingress protection, GOST14254-2015	IP 66	
12	Resistance to mechanical influence GOST R 52931-2008 Resistance to climatic influence GOST 52931-2008	L3 Д3	
13	Cable length	1...100	m
14	BRS dimension (for TP-140D(M))	2	inches

\* If necessary for TP-140D(M) pressure limit can be increased or decreased via width membrane changing

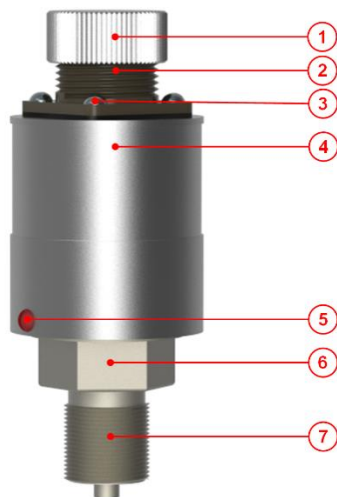
Table 2 – Dimensions, sensors weight

No position	Device	Dimensions, mm	Weight, kg
1	TP-140D Pressure Transducer	Ø45x106	0,5
2	TP-140D(VBI) Pressure Transducer	Ø45x106	0,5
3	TP-140D (M) Pressure Transducer	Ø90x120	1,5
4	TP-140D (MA) Pressure Transducer	Ø90x160	1,8

#### 1.1.4. TP-140D Content

TP-140D Pressure Sensor consists of an enclosure with an integrated tensometric bridge and an electronic circuit including:

- filters;
- analog-to-digital converter;
- digital-to-analog converter for TP-140D (MA)
- microprocessor;
- non-volatile memory for recording and storing calibration data;
- supply voltage stabilization circuit;
- intrinsically safe at the power input;



1. Connector cover;
2. Connector takedown screw;
3. Connector 2RTT20B4SH6V1V\*;
4. Sensor cover;
5. Sensor cover takedown screw;
6. Hex drive enclosure for tong;
7. Connecting thread (M20×1.5);

\* for 140D(VBI) connector SHR20P5ESH10

Figure 1. TP-140D Physical configuration

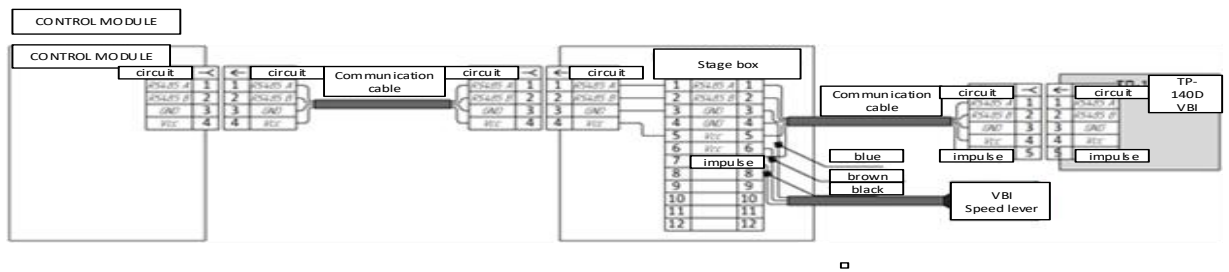
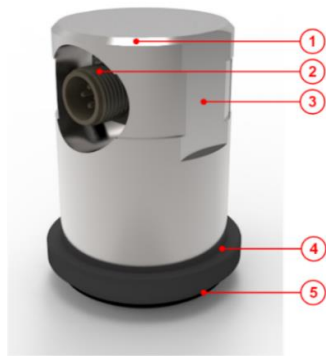
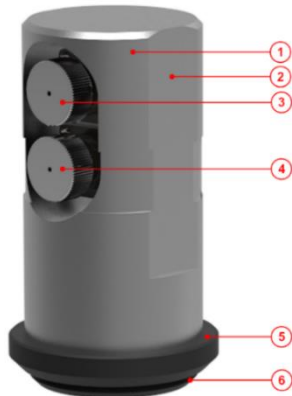


Figure 2. A layout for installing TP-140D(VBI)



1. Sensor enclosure;
2. Connector;
3. Place for tong (**Do not try to unscrew!**)
4. Rubbing piece for nut “BRS-2”
5. Ring seal.

Figure 3. TP-140D(M) Physical configuration



1. Sensor enclosure;
2. Place for tong (**Do not try to unscrew!**)
3. Connector (current 4...20 mA)
4. Connector (digital RS-485)
5. Rubbing piece for nut “BRS-2”
6. Ring seal.

Figure 4. TP-140D(MA) Physical configuration

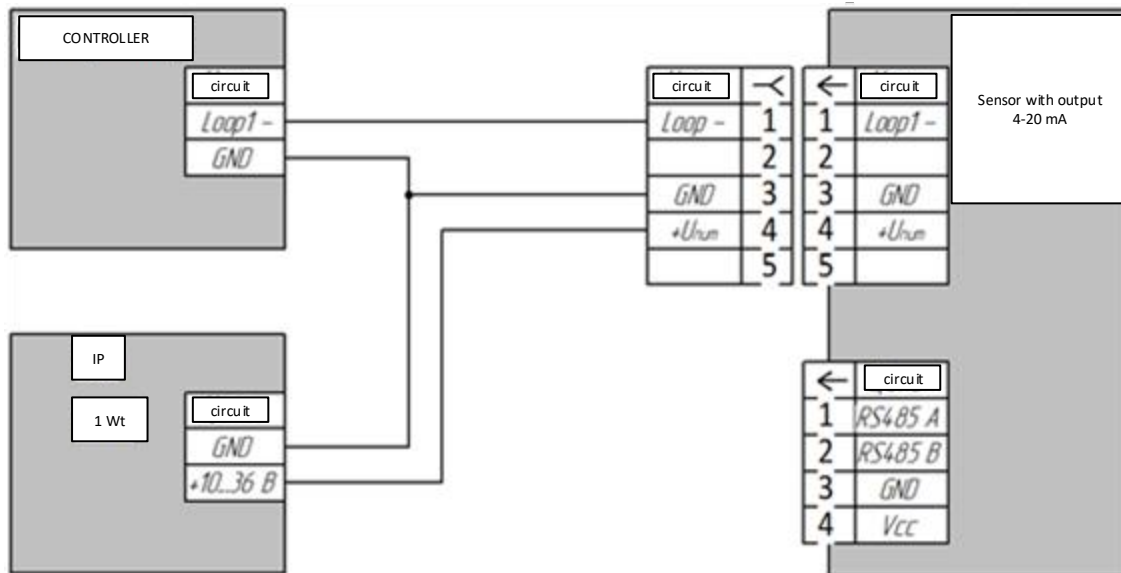


Figure 5. TP-140D(MA) Installing layout with output 4-20 mA to outside controller

The verification and calibration of TP-140D pressure transducer is performed at the manufacturing plant or a specialized plant using certified test equipment.

Calibration interval is 12 months. After calibration and calibration of sensors, standardization and certification bodies issue a certificate on calibration of an established sample (Fig. 6).

Федеральное бюджетное учреждение «Государственный региональный центр стандартизации, метрологии и испытаний в Республике Татарстан» (ФБУ «ЦСМ Татарстан») Регистрационный номер: аттестата аккредитации № RA.RU.311394

**СВИДЕТЕЛЬСТВО О ПОВЕРКЕ**  
№ 9700854

Действительно до 02.02.2018 г.

Средство измерений **Преобразователь давления ТП-140Д, регистрационный номер 35490-12**

в Федеральном информационном фонде сведений об измерительных средствах и средствах измерений (если в составе средства измерений входят несколько автономных измерительных блоков, то приводятся их перечень и заводские номера)

**отсутствует**  
серия и номер знака государственного образца (если таковой серии и номер имеются)

заводской номер **3719**

поверено **в соответствии с описанием типа**  
наименование, наименование документа, на основании которого поверено средство измерений (если предусмотрено методикой поверки)

поверено в соответствии с **"Рекомендация ГСИ. Преобразователи давления ТП-140Д и ТП-140Д(М). Методика поверки"**  
наименование и обозначение документа, на основании которого поверено средство измерения

с применением эталонов: **СИ, на 00,0000**  
наименование, тип, заводской номер, регистрационный номер (для весовых, габаритных, измерительных средств, применяемых при поверке)

при следующих значениях влияющих факторов: **Температура окружающего воздуха 20,1 °С, относительная влажность 49,8 %, атмосферное давление 99,0 кПа**  
наименование фактора, нормированная и взвешенная методика поверки с указанием их значений

и на основании результатов первичной поверки признано соответствующим установленным в описании метрологических требований и пригодным к применению в сфере государственного регулирования обеспечения единства измерений.

Знак поверки

Начальник филиала  
должность руководитель подразделения

Поверитель

Дата поверки 02.02.2017

Figure 6. Certificate of calibration



### 1.1.5. Design and functioning

TP-140D pressure transducer converts mechanical deformations into an electrical signal proportional to deformations. Then, using data from non-volatile memory, made during calibration, calculates the pressure value. The result is converted into a digital code and transmitted over the communication line.

The measured value of the load on the RS-485 communication channel is transmitted to the control module MU-150 for recording data and transmitting them for display on the indicator of the Display Module.

### 1.1.6. Measuring instrument and tool

During installation, start-up and operation no special measuring tools are required.  
For installation and maintenance of TP-140D, standard tools of a specialist are used.

### 1.1.7. TP-140D Ex rating

Intrinsic safety (Ex attribute) **1ExibIIBT4Gb** (ATEX **II2GExibIIAT3Gb**) TP-140D is provided with an intrinsically safe electrical circuit (ib).

It can be used in hazardous areas of outdoor installations (chapter 7.3 PUE) corresponds to zone 1, the group of explosion-proof electrical installations **IIA**, temperature class **T3** according to the Safety Regulations in the oil and gas industry, approved by Rostekhnadzor.

Table 3 – Ex marking

TP-140D and TP-140D(M), TP-140D(MA) Pressure Transducer (EAC)	<b>1ExibIIBT4Gb</b>
TP-140D and TP-140D(M), TP-140D(MA) Pressure Transducer (ATEX)	<b>II2GExibIIAT3Gb</b>

### 1.1.8. Marking and sealing

Markings applied to the enclosure components of the electronic dynamometer TP-140D include the following data:

1. Trademark or name of the manufacturer;
2. Type of product;
3. Serial number and year of manufacture;
4. Marking of explosion protection;
5. Special sign of explosion safety;
6. The range of ambient temperatures during operation;
7. Name of the certification body and the number of the certificate of conformity.

Other data may also be used, as required by regulatory and technical documentation, which the manufacturer must reflect on the label.

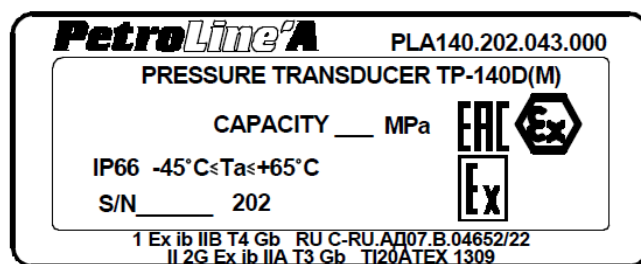


Figure 7. Marking example

Device enclosures which contain electronic circuits and electromechanical components are sealed to prevent unauthorized access. The repair is made by the manufacturer or a specialized enterprise (Appendix 4), which has been delegated the authority to repair.

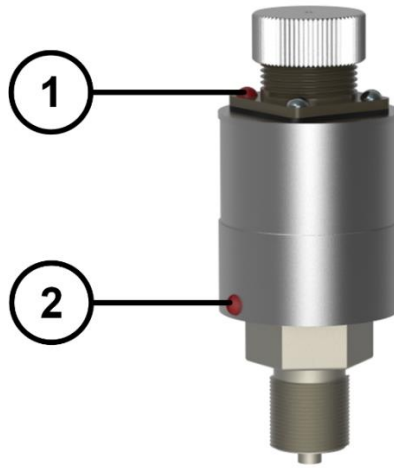


Figure 8. Sealing examples

### 1.1.8.1. Packaging

For transportation of TP-140D as part of the DEL-150 complex, boxes made of plywood with metal carrying handles are used.

## 2. Usage

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### 2.1. Operational constraints

#### 2.1.1 Ex rating in operating

To operate TP-140D is allowed for personnel who have studied this manual and have passed the appropriate instructions and have the necessary tolerances for work in hazardous areas.

When operating the complex, it is necessary to be guided by:

- chapter 3.4 POT R M-016-2001 "Safety Regulations for the operation of electrical installations";
- the current rules of electrical installations
- requirements of pp this guide.



**It is necessary to control device conditions and communication cables while operating. If there are any mechanical damages of the DEL-150 and communication cables between them you should stop using them.**

While operating it is forbidden to damage seals and open all devices included in the complex of electronic dynamometer DEL-150..

It is forbidden to connect and disconnect the connectors of connecting cables and grounding conductors with the dynamometer on.

In case of malfunctioning, replace the faulty device with a good one, connecting it according to the documentation. After replacement, check the reliability of the connections and grounding of the modular buildings to the weight of the lift.

During operation, periodically check the status of communication cables. If a violation of the protective layer on the cable lines is detected, immediately turn off the power supply and replace the damaged cable.

Do not allow the violation of the sealing devices. If faults are detected, switch off the power supply and replace the faulty device.

If mechanical damage is found, remove the faulty device and send for a repair.

### 2.2. Preparation of TP-140D usage

While TP-140D operating it is necessary to follow p.2.2. «Operation Manual the DEL-150»

#### 2.1.1. Volume and sequence of TP-140D external check

External examination includes checking:

- state of contacts, flexible connections and leads;

- availability of mounting bolts and nuts;
- easiness of strokes and thread damage absence;
- fitting state, leading of measured media to sensitive element of pressure sensors, levels, condition of cable inputs into sensors, their sealings;
- tightness of nut fastening of sensors;
- paint quality of a sensor;

### 2.1.2. Rules and sequence of readiness checking for usage

The cable from the pressure transducer is connected to any of the “RS-485” connectors. When connected to a Control Module, check the integrity of the Control Module and cable connectors.

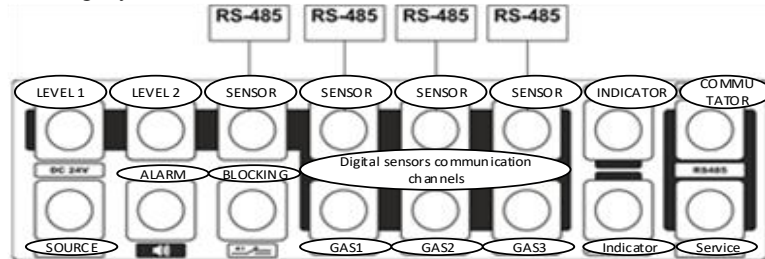


Figure 9. Control Module connectors (commutation module) for TP-140D setting

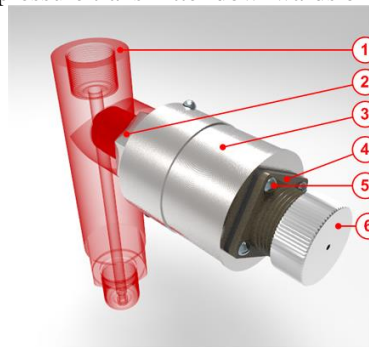
All pressure sensors manufactured by RPE «Petroline-A» LLC have a standard connector 2RTT20B4SH6V1V (block plug) and are connected with a standard cable with the exception of the TP-140D sensor (VBI) which has a plug ShR20P5ESH10 (block plug) and is connected to the control module via a commutation box.

### 2.1.3. Setting description after preparing for work:

- After the first switch on edit necessary parameters:
  - o Maximum values;
  - o coefficients;
  - o reset necessary parameters;
- After sensors replace if necessary edit operation parameters;
- Setting must be held regarding information which is in «MU-150 Operation Module».

### 2.1.4. TP-140D Texturing Instructions

- pressure transducer is installed using a tee-sized equipment of the customer, in the places of installation of standard pressure gauges, if necessary using a media separator.
- position the pressure transmitter downwards or horizontally.



1. Manometer fixing place;
2. Surfaces for tong;
3. Sensor enclosure;
4. Connector;
5. Stud Connector
6. Connector protective closer.

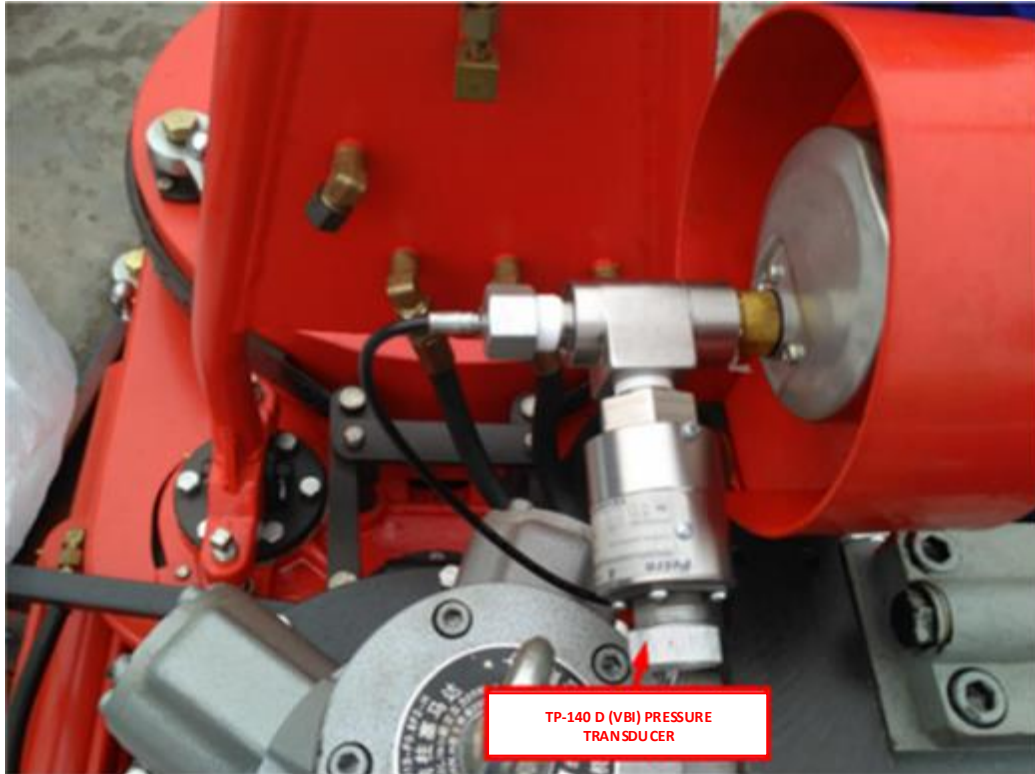
Figure 10. TP-140D Equipment enclosure

### 2.1.5. TP-140D(VBI) Texturing Instructions

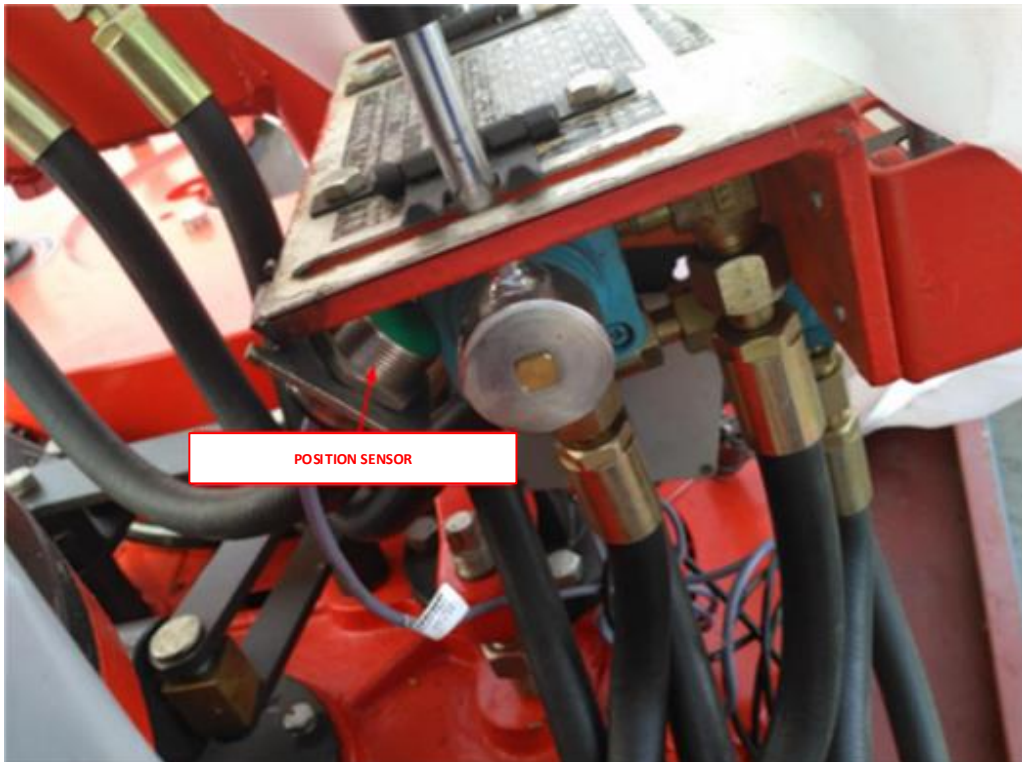
- pressure transducer is placed with using a T-connector made regarding the customer’s dimension, at the place of logging on hose wrench of standard manometer (see figure 11);
- a lever position sensor is installed in a place that allows operation without damage at a distance of no more than 5 mm from the movable part of the gear lever of the figure 11 view 2;
- commutation box is convenient to place on the tong lowest surface as you can see at figure 11 type 3;



**Note: The readings of the pressure gauge when idling (when the rotor rotates) may differ from the readings of the torque meter. Therefore, calibration should be checked when the rotor is braked (there is no flow of working fluid through the hydraulic motor) by changing the pressure in the hydraulic system.**



View №1



View №2



View №3

Figure 11. TP-140D(VBI) Example for working with 2 speeds on power tong ZQ-203/100

#### 2.1.6. TP-140D(M) and TP-140D(MA) Texturing Instructions

- 13 Pressure Transducer is placed at cone-shaped sealing BRS (2") and fasten with a wrench as you can see at figure 13;
- it is recommended to avoid strokes to pressure transducer enclosure while BRS fastening wrench;
- in order to avoid connector contamination, one has to mounter sensor with a connector down;
- do not divert towards the likely finding of people.



To prevent the failure of the pressure sensor during the operations of purging and pressure testing of the manifold, it is necessary to replace the sensor by the plug (Fig. 12). Failure to comply with these requirements leads to the cancellation of the manufacturer's warranty obligations for the restoration of TP-140D (M) and TP-140D (MA) pressure sensors.

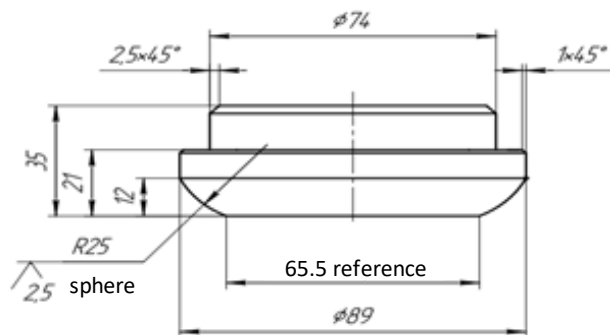
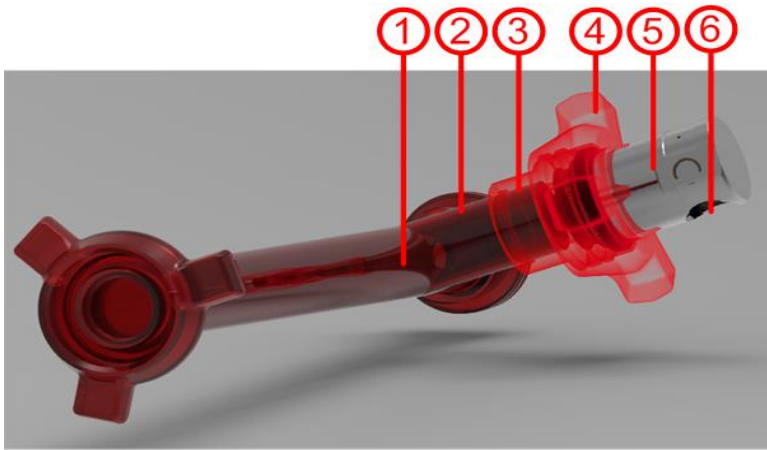


Figure 12. Plug





1. Mainline;
2. Leadaway pipe;
3. Cone slot;
4. Screw nut;
5. Sensor;
6. Connector.

Figure 13. TP-140D(M), TP-140D(MA) Equipment Example

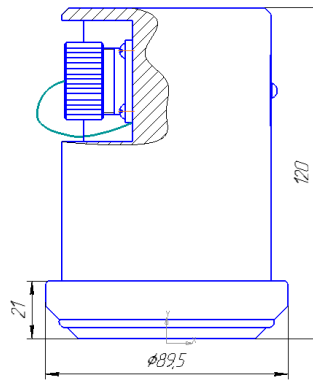


Figure 14. TP-140D(M) Transducer Pressure adjusted dimensions

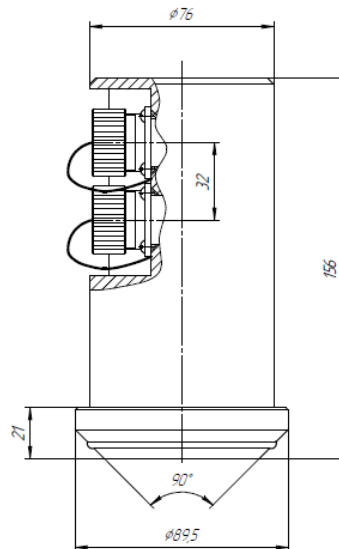


Figure 15. TP-140D(MA) Transducer Pressure adjusted dimensions

**2.1.7. Contractions accepted in the DEL-150 system for parameters displaying on control module screen and display module of TP-140D.**

Table 4 – Sensor contractions.

PARAMETER*	CONTRACTION	ADDRESS	SENSOR	ALTERNATIVE
Hook load	Load	15	TP-140D	
Hydraulic tong pressure	HT pressure	16	TP-140D	
Mud pressure on input	MP on Input	17	TP-140D(M), TP-140D(MA)	TP-140D
Hydrorotar torque	Ротор момент [Д]	18	TP-140D	
Hydrorotar tong	HT torque [Д]	19	TP-140D(VBI)	
Mud pressure on input 2	MP on Input2	20	TP-140D(M), TP-140D(MA)	TP-140D
Hydrotong pressure 2	ГК давление	22	TP-140D	
Mud pressure on output	MP on output	47	TP-140D(M), TP-140D(MA)	TP-140D
Mud pressure on input 3	MP on Input 3	217	TP-140D(M), TP-140D(MA)	TP-140D

\*A list of parameters can be extended.

## 2.2. TP-140D Usage

### 2.2.1. TP-140D Usage Steps

- Switch on a device;
- Checking of connected devices;
- Checking of sensor values;
- Edit necessary parameters.

### 2.2.2. A view of connected devices list on control module display MU-150

There is availability to see the connected devices. Constrained list of equipment (sensors, blocking card, indicators) and bus address on RS 485 (figure 6) is depicted at the list.

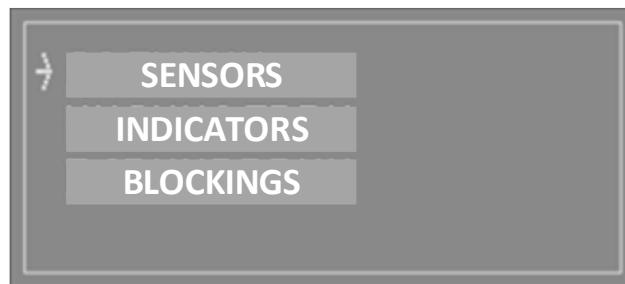


Figure 16. Connected devices

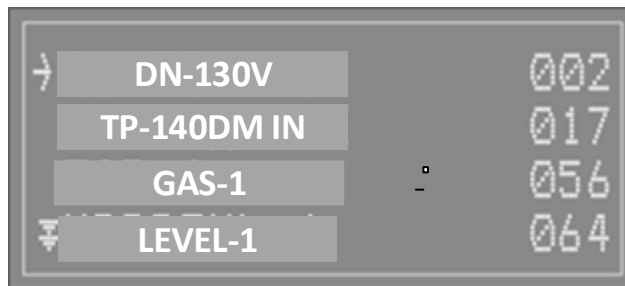


Figure 17. Sensors

Table 5 – Sensor address on the bus RS-485.

№	Connected sensors	Display view MU-150	dec
1	Hook load sensor	TP-140D:N	015
2	Tong torque pressure sensor	TP-140D:GK	016
3	Mud pressure on input sensor	TP-140D:VH	017
4	Rotary pressure sensor	TP-140D:GR	018
5	Tong torque pressure sensor (with coefficient)	TP-140D:VBI	019
6	Mud pressure on input 2 sensor	TP-140D:VH2	020
7	Tong torque pressure 2 sensor	TP-140D:GK2	022
8	Mud pressure on output 2 sensor	TP-140D:OUTPUT	047

There is a list of devices. Further the list can be updated with a reference to appearing of new positions.

### 2.2.3. Setting

Necessary parameters must be edited after the first switch on:

- Maximum values,
- coefficients;
- reset necessary parameters;

After replacing sensors as necessary, edit the operating parameters;

The settings should be carried out according to the information given in the MU-150 Control Module Operation Manual.

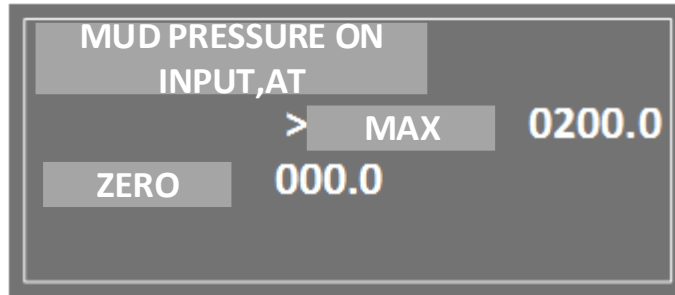


Figure 18. Parameter setting panel "Mud pressure on input"

- after transition to the line «ZERO» if necessary reset the value by pushing key combination

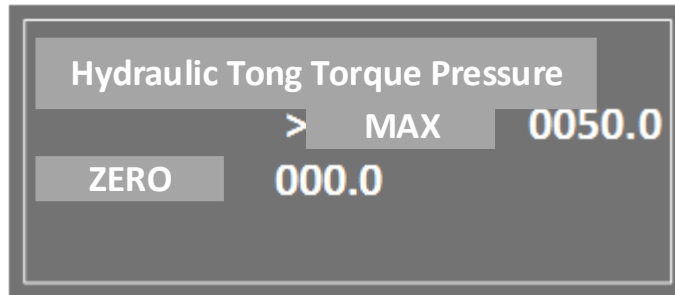


Figure 19. Parameter panel "Hydraulic tong torque pressure"

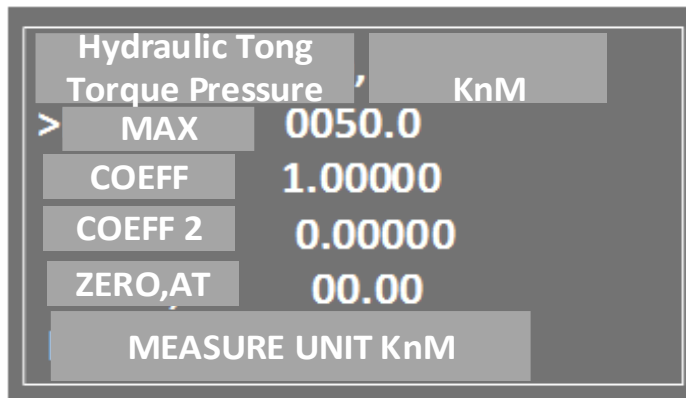


Figure 20. Parameter panel "Hydraulic tong torque pressure"

- in line "coefficient" and "coefficient 2" input value, calculated according to the dependency scale of make-up torque to pressure.





When contactless inductive switch is on, torque value is recalculated by coefficient 2.

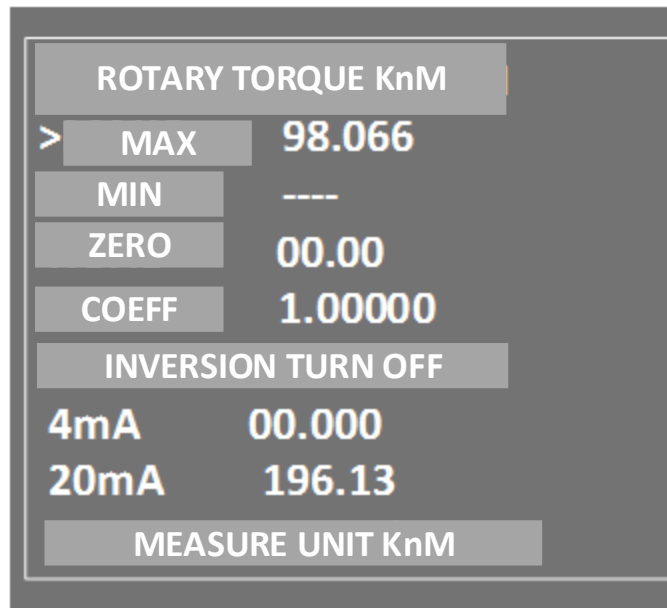


Figure 21. Parameter panel "Rotary torque by pressure"

#### 2.2.4. TP-140D possible malfunctions while usage and recommendations for decoupling them

- the malfunction of TP-140D as part of DEL-150 can be judged:
- according to indications on the display of the control module;
- according to indications in the corresponding panel of the display module;

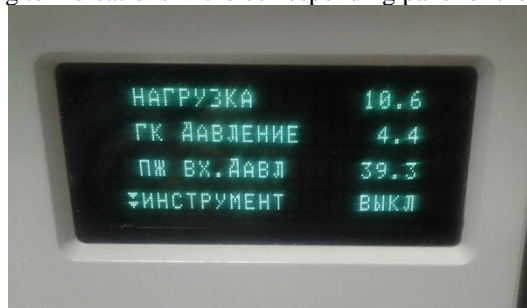


Figure 22. Readings on the display of the control module in the operating mode

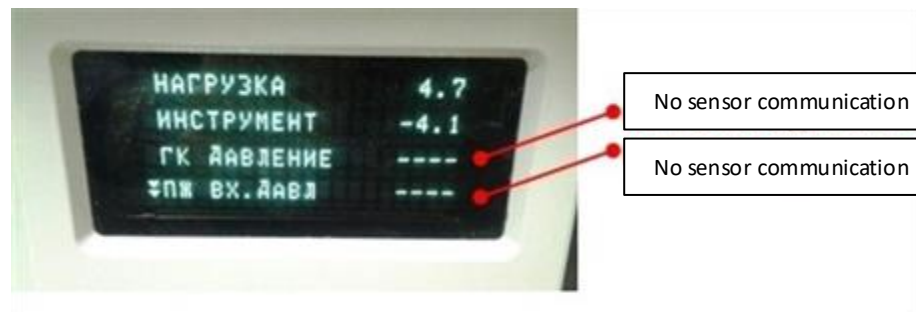


Figure 23. Readings on the display of the control module if loss of sensor connection



Figure 24. Readings on the display module in the operating mode



Figure 25. Readings on the display module if loss of sensor connection

In case of loss of communication with the sensor, it is necessary to take actions in the following order:

- check the integrity of the communication cable;
- reconnect the sensor cable to the free connector of the control module, marked “RS-485”;
- check for malfunction;
- replace the cable;
- check for malfunction;
- replace the sensor;
- check the presence of the parameter in the list of the control module.

### 2.2.5. TP-140D modes and characteristics of main operating modes

There are five modes of operation of the TP-140D:

The pressure transducer TP-140D as part of the DEL-150 can operate as a sensor.

- To measure the pressure of mud;
- To measure the pressure in the hydraulic system of the hydraulic tong;
- To measure the pressure in the hydraulic cylinder of the hydraulic breaker;

- To measure the pressure in the hydraulic system of the hydro rotor.

The system determines the assignment of sensors to the address on the RS-485 bus. (See table 6). The device address is stored in the device memory and is recorded before shipment according to the application for this product or complex.

## **2.3. Acts in emergency situations**

### **2.3.1. Failures that can lead to accidents**

In case of failures that can lead to emergency situations, it is necessary to replace the failed device.

In all cases not described in this manual, follow the Federal rules and regulations in the field of industrial safety "Safety rules in the oil and gas industry."

## **3. Maintenance**

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### **3.1. TP-140D Maintenance**

#### **3.1.1. General information**

Maintenance is divided into:

- daily maintenance;
- periodic maintenance performed after working off a certain time, and after the move (before mounting).

Operational and routine maintenance of TP-140D is performed by personnel whose duties include ensuring the operability of the complex. The list of these works includes:

- decontamination;
- check the status and control of the instrument;
- operational actions for the replacement of damaged components with the registration of acts;
- check the inclusion of blocking signals;
- registration in the form according to the forms recommended by the manufacturer of all recorded deviations, failures, work performed and other information.

#### **3.1.2. Safety measures**

When operating the complex, it is necessary to be guided by:

- Chapter 3.4 "Electrical installations in hazardous areas" PEEP;
- current regulations for electrical installations;
- this operational documentation (ED) and other regulatory documents in force at the enterprise.

During operation, it is prohibited to open all devices that are part of the electronic dynamometer DEL-150.

Work as necessary, but at least once a month:

#### **3.1.3. TP-140D Maintenance procedure**

Maintenance is carried out in the following order:

1. Purification of pollution of the sensor and indicator housings;
2. Checking the safety of seals;
3. Check the availability and durability of the installation of fasteners;

4. Cleaning of connectors and contact groups from contamination;
5. Check for visible mechanical damage;
6. Replacement and / or repair of damaged cable products;
7. Replacing damaged sensors.

Connect the connector of the control module MU-150 with alcohol-gasoline mixture (need 0.5 ml) with a soft brush;

Wash contacts with alcohol-gasoline mixture (need 3 ml) with a soft brush.



**The absence of marks on the maintenance of the Form (section "Accounting for maintenance") ATTRACTS VIOLATION OF OPERATION RULES, and the manufacturer has the right to withdraw from the warranty.**

#### **3.1.4. TP-140D Work capacity check**

- Switch on the device;
- Check the list of connected devices ;
- Check, edit work parameters;
- Check blocking and alarm work ;
- Check parameters display on indicators;

### **4. Current maintenance**

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#### **4.1. TP-140D Current maintenance**

##### **4.1.1. General information**

Maintenance is held on a manufacturer or at a specialized factory (Appendix4).

### **5. Storage**

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#### **5.1. Storage conditions**

The entire nomenclature requires careful treatment, storage in dry, clean rooms with a constant temperature. The optimal storage conditions are considered to be from 10 to 35 ° C, relative air humidity not more than 80%. Daily temperature fluctuations should not exceed 5 ° C.

Appliances arriving at the warehouses in the packaging of the factory are not unpacked, packaged on flat pallets and stacked in a stack or in the cells of the racks.

Devices sealed by the factory cannot be opened in warehouses.

Small devices and devices that come in an individual package are stored for storage in box pallets with installation in a stack.

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

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

### **6. Transportation**

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#### **6.1. Transportation requirements and conditions**

Packaged transportation is allowed by all types of closed transport. TP-140D in a package for transportation allows the impact of transport shaking with an acceleration of 30 m / s<sup>2</sup> with a frequency of beats of 100 per minute or 1500 beats with that acceleration.

### **7. Disposal**

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TP-140D is made according to requirements and standards accepted in oil and gas industry.