



LOAD SENSOR DN-130V

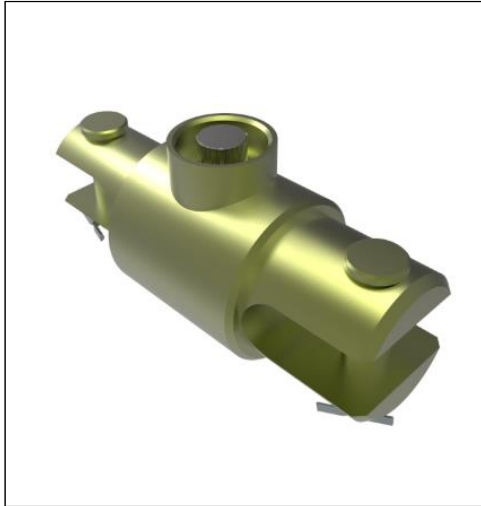
Operation Manual

PLA140.201.000.000 RE

Rev. 01

LOAD SENSOR DN-130V

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This Manual provides information for service personnel how to perform installation, commissioning and maintenance of the Load Sensor DN-130V and its modifications (hereinafter referred to as the DN-130V).

The DN-130V exploitation is allowed to be used by personnel who has studied this manual, set of exploitation documentation and passed safety training.

The DN-130V is intended to measure the load force in the rope during make-up procedures for TONG LINEPULL or TONGS TORQUE parameters calculation as well as to control load force in the rig's guy lines for providing GUY-LINE parameter values. The sensor is made as part of the DEL-150 Drilling and Well Workover Monitoring System (hereinafter referred to as the DEL-150).

The DN-130V has the following modifications:

- DN-130V is the wired sensor;
- DN-130V(R) is the wireless sensor.

Scope of application is explosive zones of premises and outdoor facilities according to Ex-marking. The DN-130V 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
Minimum measurement limit, kN	5

Name of parameter	Value
Maximum measurement limit, kN	400
Accuracy, %FS	±3.0
Output signal	Digital
Communication protocol	Modbus
Power supply range (DN-130V), VDC	12...18
Power consumption (DN-130V), max., Wt	0.75
Power supply from the battery (DN-130V(R)), VDC	3.6
Battery lifespan, min., months	12
Ex marking, TR CU 012/2011	1ExibIIBT4Gb
Ex marking, ATEX	II2GExibIAT3Gb
Ingress protection	IP66
Ambient temperature range, °C	-45...+65
Dimensions (DN-130V), mm:	Ø95 x 235*
Dimensions (DN-130V(R)), mm:	Ø103 x 300*
Weight (DN-130V), kg:	3.8*
Weight (DN-130V(R)), kg:	6.1*
Service life, min., years	8
Recommended calibration interval, months	12

* depends on the DN-130V or DN-130V(R) model

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 DN-130V housing.

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 DN-130V 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. Operating Principle

The DN-130V converts mechanical deformations (tension) of the sensor’s elastic element into an electrical signal proportional to deformations via strain gages Then, using data from non-volatile memory entered during calibration, the DN-130V calculates the applied force value. The result is converted into a digital code and transmitted by commutation cable or over the radio channel to the MU-150 / MU-150E / MK-140 unit of the DEL-150 System for recording and viewing.

5. Installation



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

Before installing the DN-130V, it is necessary to make sure that:

- Basic dimensions at the processing facilities correspond to the dimensions of the DN-130V (see Fig. 1);
- Fixing bolts and screws are present;
- There is no damage of the connector insulation;
- There is no external damage of the components;
- There is no damage of insulation of the signal cable.

Disregard of this instruction may lead to a serious failure of the DN-130V.

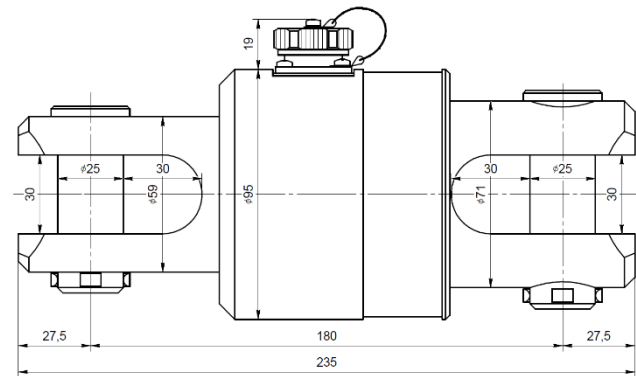


Figure 1. Example of the DN-130V overall dimensions

The sensor is mounted between arm and working (holding) rope of the easy tong for TONG LINEPULL or TONGS TORQUE measurements. It is necessary to maintain angle between working rope and axis of the easy tong 90° for accurate measurement (see Fig. 2). Rope must lie in a plane perpendicular to the axis of the pipes being made up. It is recommended also to turn the DN-103V with the connector facing down in order to avoid its damage.

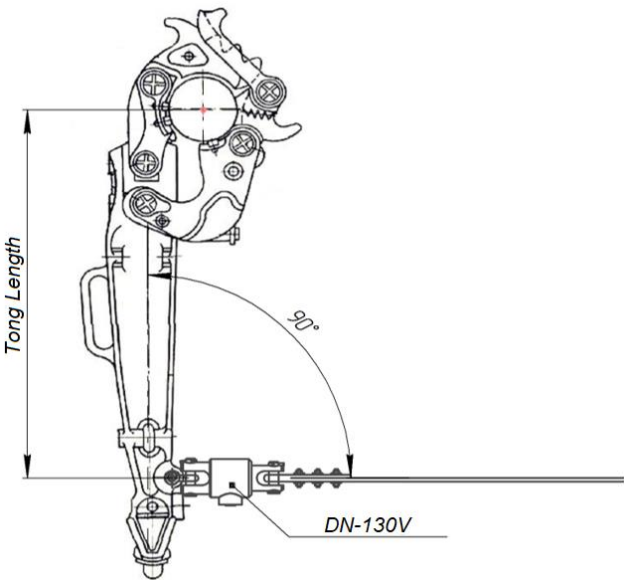


Figure 2. Installation of the DN-130V on the easy tong rope

The wireless modification of the DN-130V(R) communicates with the MU-150 / MU-150E / MK-140 unit of the DEL-150 System via the PS-150(RK) / PS-150(R1) Signal Transducer for the TONG LINEPULL or TONGS TORQUE measurements and via the PS-150(RM) Signal Transducer for the GUY-LINE measurements. Signal Transducer is connected by the WY20/WY20 universal commutation cable to the MU-150 / MU-150E / MK-140 unit and is installed at a distance in line of sight from the DN-130V(R) of no more than:

- 5 meters for PS-150(R1);
- 15 meters for PS-150(RK);
- 25 meters for PS-150(RM).

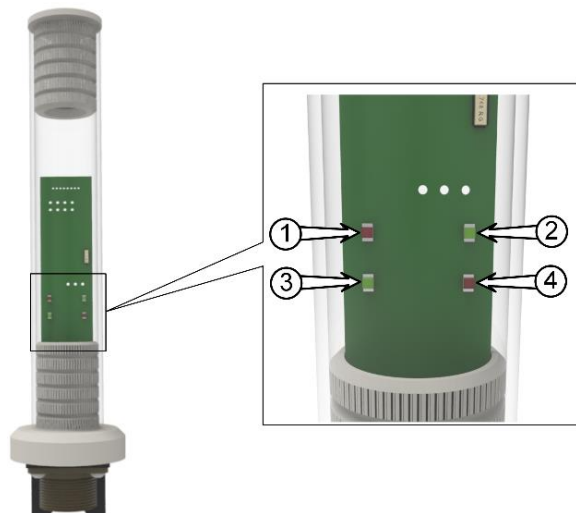
5.1. The PS-150(RK) / PS-150(R1) Signal Transducer

The PS-150(RK) / PS-150(R1) is made in a transparent enclosure, which allows to see LEDs located on the board when the transducer works (see Fig. 3).

The PS-150(RK) / PS-150(R1) has the following technical characteristics:

Name of parameter	Value
Frequency range, GHz	2.4
Output power, mW	15
Power supply range, VDC	12...18
Ex marking, TR CU 012/2011	1ExibIIBT5Gb
Ex marking, ATEX	II2GExib[ib]IAT3Gb
Ingress protection	IP65
Ambient temperature range, °C	-45...+65
Dimensions, mm	Ø25 x 238

Name of parameter	Value
Weight, kg	0.2



1. TxD – wireless data sending to the sensor;
2. RS-485 – data exchanging by RS-485;
3. RxD – wireless data exchanging;
4. Fault – software error

Figure 3. The PS-150(RK) / PS-150(R1) Signal Transducer

5.2. The PS-150(RM) Signal Transducer

The PS-150(RM) has the following technical characteristics:

Name of parameter	Value
Frequency range, GHz	2.4
Power supply range, VDC	12...18
Ex marking, TR CU 012/2011	1ExibIIBT5Gb
Ex marking, ATEX	II2GExib[ib]IAT3Gb
Ingress protection	IP65
Ambient temperature range, °C	-45...+65
Dimensions, mm	115 x 60 x 90
Weight, kg	0.4

6. External Electrical Connections Installation

The WY20/WY20 universal commutation cable from the supplied package (see Fig. 4) is used for connection of the DN-130V or the Signal Transducer PS-150(RK) / PS-150(R1) / PS-150(RM) to the MU-150 / MU-150E / MK-140 unit of the DEL-150 System.



ATTENTION!!! During installation, it is strictly prohibited to fix the commutation cable to the easy tong working rope.

The cable is connected to any of the connectors of the MU-

150 / MU-150E / MK-140 unit marked "RS-485" / "Sensor" (see Fig. 5).

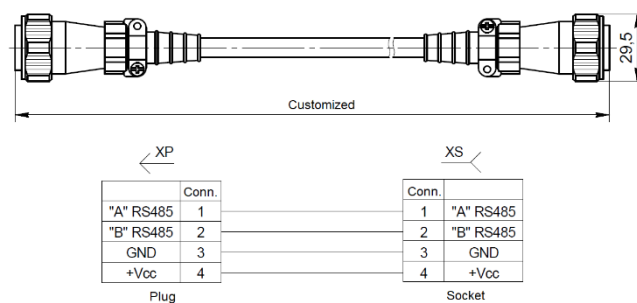


Figure 4. WY20/WY20 universal commutation cable

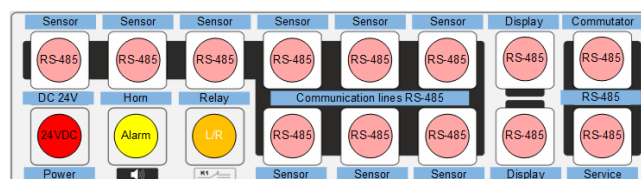


Figure 5. The MU-150 / MU-150E / MK-140 unit's connectors "RS-485" / "Sensor" for the DN-130V connection

7. The DN-130V Functional Test

For functional test of the DN-130V 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 TONGS TORQUE is displayed on the MU-150 / MU-150E EL screen (see Fig. 6).

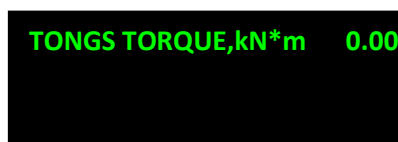


Figure 6. Readings on the Control Module display

8. Readings Issues

If connection with the DN-130V is lost, symbols "-----" are displayed opposite TONGS TORQUE parameter on the MU-150 / MU-150E EL screen (see Fig. 7):

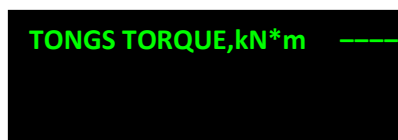


Figure 7. Readings in case of loss of communication with the DN-130V

In case of loss of communication with the DN-130V it is necessary to carry out actions in the following order:

1. Checking of integrity of the commutation cable;
2. Reconnection of the DN-130V cable to free connector of the MU-150 / MU-150E / MK-140 unit marked "RS-485" / "Sensor";
3. Checking the presence of the parameter in the related

- menu's list of the Control Module;
- 4. Replacement of the cable;
- 5. Checking the presence of the parameter in the related menu's list of the Control Module;
- 6. Replacement of the DN-130V;
- 7. Checking the presence of the parameter in the related menu's list of the Control Module.

9. Settings of the DN-130V

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).

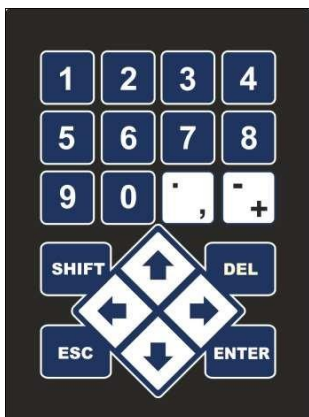
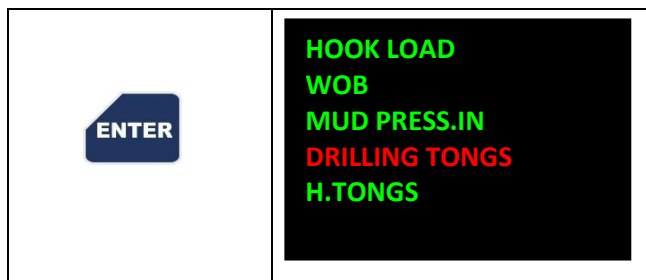


Figure 8. The MU-150 Control Module keyboard

Proceed in the following order to reach out required parameter:

1. Unblock the keyboard by pressing **SHIFT** + **ENTER** simultaneously;
2. Enter OPERATING PARAM'S menu by pressing **SHIFT** + **3** simultaneously;
3. Use **↓**, **↑** and **ENTER** to select required parameter. To return to the previous menu, use **ESC**.

9.1. Setting of TONGS TORQUE Parameter



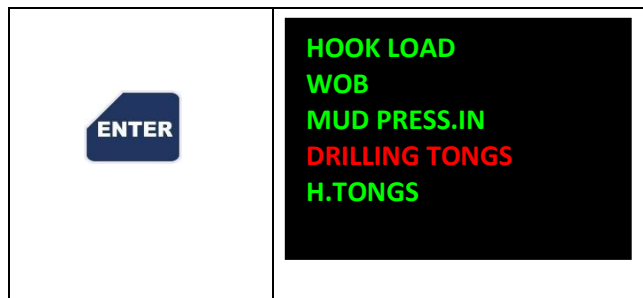
ENTER	TONGS TORQUE TONG LINEPULL AKB TORQUE TONGS TORQUE2 TONGS TORQUE3
Setup of the required settings is described below	TONGS TORQUE, lbf*ft MAX 25.000 FACTOR 000.9200 SET ZERO 0.0000 UNITS lbf*ft AIN SETTINGS MIN 000000 MAX 000100 AOUT SETTINGS MIN ____ MAX ____ ROPE OD

- **MAX** – the maximum value that is required for activating alarm and relay output. Alarm is activated when 95% of this value is reached. When 100% is reached, the assigned relay of the blocking unit of the MU-150 / MU-150E / MK-140 (if available) will change its state (i.e. it will close or open the electrical circuit of the actuator);
- **FACTOR** – Tong Length (see Fig. 2);
- **SET ZERO** – zeroing of the parameter value by pressing



- **UNITS** – units of measurements;
- **AIN SETTINGS** – setting up an analog input (for using 3rd party sensor with an analog output);
- **AOUT SETTINGS** – setting up an analog output when the PS-150(4K) Signal Transducer is connected;
- **ROPE OD** – is used when DN-130 Load Sensor is applied for TONGS TORQUE parameter calculation with two calibration tables to choose the required one.

9.2. Setting of TONG LINEPULL Parameter



	TONGS TORQUE TONG LINEPULL AKB TORQUE TONGS TORQUE2 TONGS TORQUE3
Setup is similar to the previous described TONGS TORQUE parameter setup	TONG LINEPULL,tf MAX 10.000 SET ZERO 0.0000 AIN SETTINGS MIN 000000 MAX 000030 ROPE OD

10. 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 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 #8 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.

11. Maintenance Procedure

Maintenance is carried out in the following order:

1. Cleaning the sensor's housing 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

12. Changing the Battery Module Procedure of the DN-130V(R) Sensor



ATTENTION!!! The battery module is replaced only in a safe area

The battery module changing is carried out in the following order (See Fig. 9):

1. Install the DN-130V(R) on a flat horizontal surface and using a tube wrench S24 unscrew the sensor's cap;
2. Remove the spring;
3. Remove the battery module by pulling on its cap's protruding part;
4. Install a new battery module, first making sure that there are no foreign particles in the sensor and repeat the steps in reverse order.



NOTIFICATION. Detachment of the battery module does not affect the DN-130V(R) settings



ATTENTION!!! The battery cell is replaced only together with the assembly of battery module

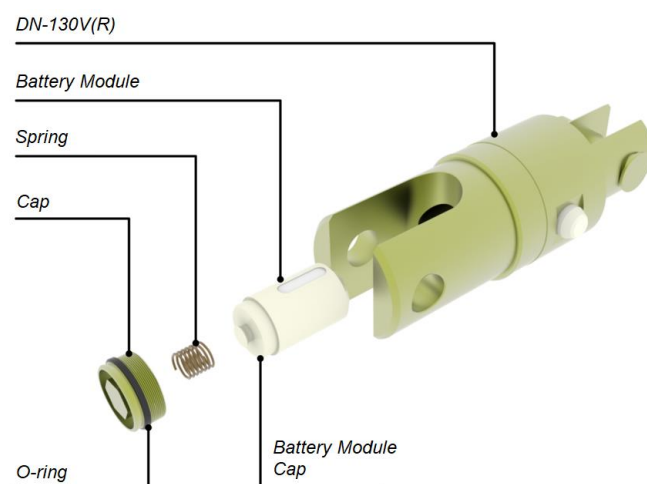


Figure 9. Changing the battery module of the DN-130V(R) sensor

13. 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.

14. Marking and Packaging

The DN-130V's nameplate includes the following components (see Fig. 10):

1. Trademark or name of the 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.

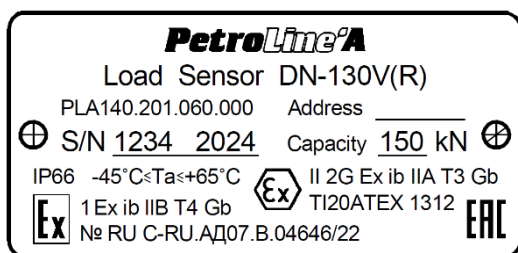


Figure 10. Example of the DN-130V marking

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 DN-130V as part of the DEL-150 System.

15. List of Components

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

16. Repair

Repair of the DN-130V 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

17. Storage

The equipment requires careful handling, storage in dry, clean rooms with a constant temperature from -50°C to +65°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

18. Transportation

Transportation of the equipment is allowed by all types of closed transport. The DN-130V 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.

19. Disposal

The DN-130V is disposed of in accordance with the requirements and norms applicable in the oil and gas industry.

20. 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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