



PRODUCT CATALOGUE

**DRILLING AND WORKOVER
INSTRUMENTATION SOLUTIONS**

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RPE "Petroline-A" is a sustainable development since 2001

Our main products

- *Drilling and Well Workover Monitoring System DEL-150;*
- *CCTV System DEL-150(V);*
- *Mud Monitoring System DEL-150(SKR);*
- *Pulsar Flow Monitoring System "Pulsar";*
- *Automated Diesel Fuel Metering System ASUDT "Pulsar".*



*More than
20 service
centers*



*More than 250
specialists with
profiled
education*



*Unique
patented
products*



*More than 15000
equipment
per year*



*10 000 sq.m
of warehouse
facilities*

Our geography

Drilling and Well Workover Monitoring System are operated by the leading Companies of Oil&Gas Industry from Russia, CIS countries and other.



Russian Federation



Belarus



Kazakhstan



Uzbekistan



Kyrgyzstan



Azerbaijan



Turkmenistan



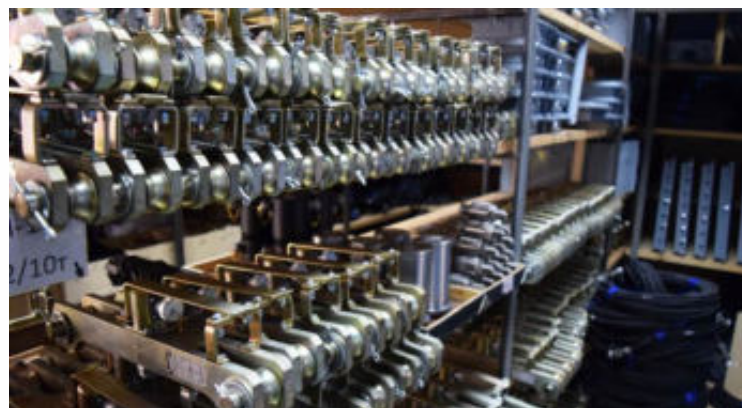
Iran



Vietnam



We have the ISO 9001:2015 certified quality management system in place.



Ready equipment in the warehouse.

Drilling and Well Workover Monitoring System DEL-150

DEL-150 is aimed to control parameters of technological operations while drilling, workover operations, mud logging in oil and gas industry in various and harsh environmental conditions on at different drilling and well workover rigs.

DEL-150 complies to requirements of the CU TR 012/2012 and ATEX standards for explosion-proof protection of equipment.

Usage

Explosive areas of indoor and outdoor installations according to the EX-marking, GOST IEC 60079-14-2013, EN 60079-0:2012+A11:2013, EN 60079-11:2012, EN 60079-15:2010, governing the use of electrical equipment located in the hazardous area and connected by intrinsically safe external circuits with electrical devices installed outside the hazardous area.

Functional features of the system:



Data Collection

- Wire communication with Toolpushers's PC;
- Wireless communication with Toolpushers's PC;
- Manual load to portable data storage device;
- Wired connection to the customers's LAN;
- Wireless connection to the customers's LAN;
- GSM-data transfer.



Example of Drilling and Well Workover System DEL-150 installation on the rig.

Drilling and Well Workover Monitoring Parameters

- Hook load
- Weight on bit

DN-130, DN-130(A), DN-130(R) Load Sensor
DN-130V, DN-130V(R) Load Sensor

- StandPipe pressure

TP-140D, TP-140D(R) Pressure Sensor
TP-140D(M) Pressure Sensor
TP-140D(MA) Pressure Sensor

- Pit volume
- Total Volume

U-150 Level Sensor

- Rotary table torque
- Rotary table rpm

DKM-140(R) Torque/RPM Sensor
DN-130V(C) Load Sensor

- Rotary table torque (by pressure)

TP-140D, TP-140D(R) Pressure Sensor

- AKB-4 Tong Torque

DN-130V(K) Load Sensor

- Easy Tong Torque

DN-130, DN-130(A), DN-130(R) Load Sensor
DN-130V, DN-130V(R) Load Sensor

- Power Tong Torque

DN-130V, DN-130V(R) Load Sensor
TP-140D, TP-140D(R) Pressure Sensor
TP-140D(4R) Pressure Sensor

- Flow Out

IVR-140 Mud Return Flow Sensor

- Track Chassis/Mast Inclination

PS-150(I) Inclinometer

- Block height
- Trip Velocity
- ROP
- Hole Depth
- Bit position
- Line Wear

DPS-140(P) Encoder
DPS-140(A) Encoder
DPS-140(I) Encoder
DPS-140(V) Encoder
DPS-140(I) Proximity Sensor

- Flow In
- Pump SPM
- Pump strokes

PS-150 Signal Converter with
DVI Proximity Sensors

- LEL
- H₂S Concentration

GSV-1I Methane Sensor
GSV-1E Hydrogen sulfide Sensor

- Mud temperature (inlet/outlet)

DTE-140(G) Digital temperature Sensor
TP-140D(M), TP-140D(MA) Pressure Sensor

- Mud density

DPR-140 Mud density Sensor

- Ambient temperature

DTE-140 Digital temperature Sensor

- Wind Velocity

DSV-150 Wind Velocity Sensor

- Extra parameters

Customer current Sensors 4-20 mA

Control Modules MU-150, MU-150E

MU-150, MU-150E are the core of the DEL-150 drilling and well workover monitoring system. It offers convenient settings and configuration options.

The module performs primary control of the data capture, display, transfer, measurement, and measured variable deviation alarms.



It transfers data between the system modules. The modular architecture allows the system to be extended by installing extra sensors, indicators and other modules.

MK-140 Commutation modules are used to extend the DEL-150 system configuration.



Key benefits

- Flexible module configuration to meet the Customer's requirements.
- Control module screen displays detailed information:
 - current sensor readings;
 - sensor status;
 - thresholds exceeding;
 - GSM modem operation and status.
- Convenient settings and configuration options:
 - multiline screen;
 - extended menu;
 - Russian and English alphabets are supported;
 - the MU-150 keypad is used to set up the built-in GSM modem;
 - remote indicator color can be adjusted by Control module.
- GSM modem as standard:
 - support for double GPRS mobile networks;
 - support for several Customers' servers;
 - data acquisition, storage, analysis, archiving on a Customer's server;
 - remote built-in GSM modem configuration.
- A built-in Ethernet module:
 - network cable connection;
 - network Wi-Fi connection.
- Availability to connect additional display modules to display additional parameters and back up information.

Technical characteristics

Voltage range, V	23-27
Max power, W	50
Number of electroluminescent screen lines	4
Number of devise connectors	13
Rated output sensor voltage, V	12,8
Interface with PC connection and external digital sensors	RS-485
RS-485 baud rate, bit/sec	57600
PC RS-485 baud rate, bit/sec	115200
Communication protocol	Modbus
Ex marking, IEC	2ExnA[iaGa][ibGb]IIBT4GcX
Ex marking, ATEX	II3GExnA[iaGa][ibGb]IIBT4Gc
Dimensions, mm	362x250x130

Key Features

- Direct connection to a touch screen panel PC to display current sensor readings;
- Internal non-volatile memory capacity is 200 measurings;
- Extended built-in non-volatile memory up to 8 Gb;
- External memory module capacity 16 Gb;
- Operating and data service data accessible for 6 months;
- Ability to work without external drive;
- Data links to the peripheral devices are electrically isolated (enhanced system immunity to interference);
- 4-20 mA channels are available;
- A wireless communication with Toolpusher's PC is available;
- DEL-150 sensor readings are available for the 3rd Party instrumentation systems;
- Functional compatibility with DEL-140 hardware.

Commutation Modules MK-140, MK-140(M4)

MK-140 and MK-140(M4) Commutation Modules. These are extensions for the DEL-150 system configuration. They are made to meet the Customer's technical needs.
MK-140 Commutation Module is the best connection option of 9-11 sensors.



MK-140(M4) Commutation module is the best option to connect of 1-3 remote sensors.



Capabilities

- Intrinsically safe power supply of the sensors, digital transducers and other devices installed in Ex areas;
- Connecting a control module to extra devices (sensors, remote Indicators, transducers, actuators);
- Commutation modules can be connected in series.

Technical characteristics

	MK-140	MK-140(M4)
Voltage range, V	18-30	22-30 220
Max power, W	50	30
Number of supported devices (number of connectors)	12	4*
Rated output sensor voltage, V	14,8	14,8
Communication interface to PC and external Digital sensors	24	24
Interface with computer connection and external digital sensors	RS-485	RS-485
RS-485 baud rate, bit/sec	57600	57600
Communication protocol	Modbus	Modbus
Max RS-485 line length to digital sensors, m	on request	on request
Max dimensions, mm	362x250x130	190x66x243
Ex marking, IEC	2ExnA[iaGa][ibGb]IIBT4GcX	
Ex marking, ATEX	II3GExnA[iaGa][ibGb]IIBT4Gc	

**One of connectors is used for communcation with Control Module.*

The Commutation module configuration matches the specified number of digital, analog sensors and interlock relays.

Commutation Module MK-140 (GAZ)

MK-140 (GAZ) Commutation module is a stand-alone device that meets oil and gas safety regulations.



MK-140 (GAZ) is a device that aimed to work with gas Sensors.



Capabilities

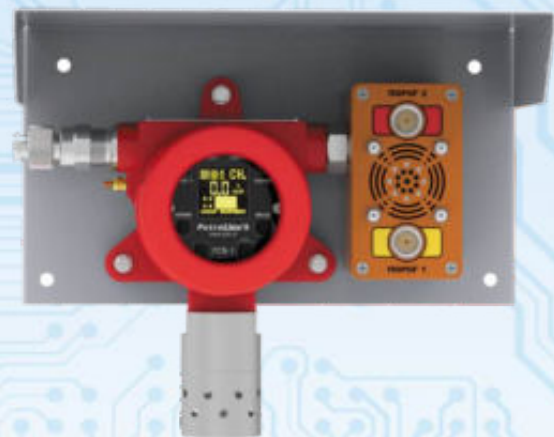
- Intrinsically safe power supply of sensors, digital transducers and other devices installed in Ex areas;
- Status monitoring for connected and registered peripheral devices;
- Displaying current measurement channel readings on standard visual display units;
- Settings thresholds for the measurement channels;
- Audible alarm activation when the thresholds are exceeded;
- Quick audible alarm deactivation;
- Annunciator activation when the thresholds are exceeded;
- External actuator verification mode;
- External safety actuator control;
- Sending data to DEL-150 Control module for subsequent recording;
- Indicating connection status to DEL-150 Control module.

Technical characteristics

Voltage range, V	23-27
Max power, W, no more	50
Rated output RS-485 voltage, V	14,8
Max number of connected sensors	8 (10)
Max number of thresholds, no more	2
Communication Interface	RS-485
Communication protocol	Modbus
Max dimensions, mm	362x250x130
Ex marking, IEC	[ExibGb]IIA
Ex marking, ATEX	II3GExnA[iaGa][ibGb]IIBT4Gc

MK-140 (GAZ) can be equipped with sensors (gas analyzers) to control different gas concentrations (flammable gases, Hydrogen sulfide and etc.).

GSV-1 Post with a Combined Annunciator



Post GSV-1 with a audible and visual annunciator is designed for continuous automatic measurement of concentration, for example, methane (CH₄) in the air of the working area with the possibility of giving light and sound alarms at two thresholds, for example, 20 % LEL and 50 % LEL. The post can be supplied with any gas sensor from the GSV-1 product line. The sensor can be supplied with a digital or analog output and work both in the DEL-150 system and in systems from other manufacturers.

Capabilities

- Interchangeability of gas sensors of the same type;
- Availability of analog output signal 4-20 mA;
- Operation with two thresholds;
- The presence of a built-in self-diagnosis function of the gas sensor.

Design Features

- Compact placement of devices;
- Annunciator doesn't require an additional power supply;
- Informative display of the gas sensor;
- Sensor's enclosure color according to the type of component being determined;
- The presence of a compact protective visor to protect against splashes within wellhead area.

Gas Sensors GSV-1E, GSV-1I

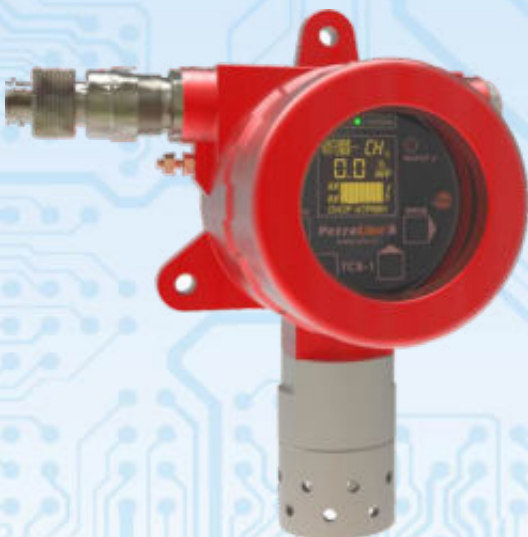
GSV-1E is explosion-proof sensor intended for continuous measurement of the H₂S gas concentration in working area.

Sensor can be supplied along with digital or analogue output, or simultaneously with both outputs.



GSV-1I is explosion-proof sensor intended for continuous measurement of the CH₄ gas concentration in working area.

Sensor can be supplied along with digital or analogue output, or simultaneously with both outputs.



Capabilities

- Sensors interchangeability;
- Operation in Ex zone;
- Availability of built-in function of self-diagnostics.

Design features

- IP67 Ex enclosure;
- Ex enclosure with a deep lid to protect a display from specks;
- Informative display;
- Colour of enclosure depends on type of the determined gas;
- Presence of protective lid to protect from specks in wellhead area.

Technical characteristics

Voltage range, V (DC)	15
Max power no more, W	2
Rated input sensor voltage, V (DC)	12-28
Relay-operated signaling communication (SPDT)	2
Output signal RS-485	Modbus
Output signal of current loop, mA	4-20
Max Voltage commutation relay, V (DC), max	30
Max Current commutation relay, A (DC), max	2
Ex marking, IEC	1Exd[ib]IICT5X
Ex marking, ATEX	II2GExdbibIICT5Gb
Lifecycle, year	10

H₂S Measurement Cell Specification

Gas transducer type	Electrochemical
Gas	Hydrogen Sulphide
Analyte	H ₂ S
Analyte range	0-40,0 mg/m ³ 0-28,0 ppm
Accuracy, %: - Range from 0 to 10,0 mg/m ³ - Range from 10,0 to 40,0 mg/m ³	±2,0 mg/m ³ (±1,4 ppm) ±20 % error

CH₄ Measurement Cell Specification

Gas transducer type	Infrared
Gas	Methane
Analyte	CH ₄
Analyte range	(0 - 2,2) % vol. (0 - 50) % LEL
Accuracy, %	±0,22 % vol. (±5 % LEL)

Gas Sensors Combined GSV-1K

Combined stationary explosion-proof Gas Sensor **GSV-1K** is designed for continuous automatic measurement of the concentration of methane (CH₄), hydrogen sulfide (H₂S) in the air of the working area. The Sensor is supplied with a digital output. An analog signal of 4-20 mA provides data on the concentration of one gas of choice. The choice is made in the Gas Sensor menu.



Technical characteristics

Voltage range, V	15
Max power no more, W	2
Rated input sensor voltage, V (DC)	12-28
Relay-operated signaling communication (SPDT)	2
Output signal RS-485	Modbus
Output signal of current loop, mA	4-20
Max Voltage commutation relay, V (DC), max	30
Max Current commutation relay, A (DC), max	2
Calibration interval, months	12
Ex marking, IEC	1Exd[ib]IICT5X
Ex marking, ATEX	II2GExdbIICT5Gb

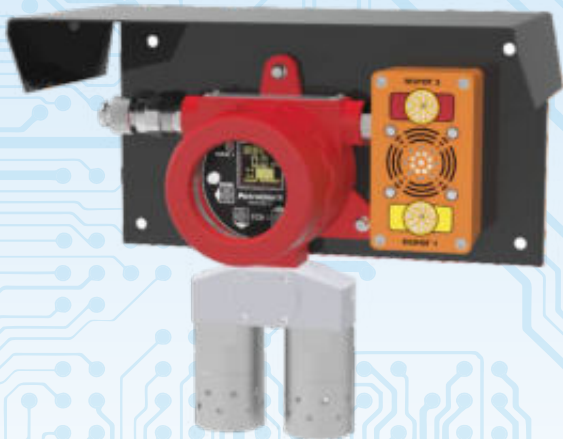
H₂S Measurement Cell Specification

Gas transducer type	Electrochemical
Gas	Hydrogen Sulphide
Analyte	H ₂ S
Analyte range	0-40,0 mg/m ³ 0-28,0 ppm
Accuracy, %: - Range from 0 to 10,0 mg/m ³ - Range from 10,0 to 40,0 mg/m ³	±2,0 mg/m ³ (±1,4 ppm) ±20 % error

CH₄ Measurement Cell Specification

Gas transducer type	Infrared
Gas	Methane
Analyte	CH ₄
Analyte range	(0 - 2,2) % vol. (0 - 50) % LEL
Accuracy, %	±0,22 % vol. (±5 % LEL)

GSV-1K Post with Combined Annunciator



The GSV-1K Post with an audible and visual annunciator is designed for continuous automatic measurement of the concentration of methane (CH₄), hydrogen sulfide (H₂S) in the air of the working area with the possibility of light and sound alarms on two thresholds. The Sensor is supplied with a digital output. An analog signal of 4-20 mA provides data on the concentration of one gas of choice. The choice is made in the Gas Sensor menu.

Capabilities

- Interchangeability of Gas Sensors of the same type;
- The presence of an analog output signal of 4-20 mA;
- Working with two thresholds;
- The presence of a built-in self-diagnosis function of the Gas Sensor.

Design features

- Compact placement of devices;
- Annunciator doesn't require an additional power supply;
- Informative display of the gas sensor;
- Sensor's enclosure color according to the type of component being determined;
- The presence of a compact protective visor to protect against splashes within wellhead area.

Display Modules MI-140 Series

MI-140 (P4-P12) Display modules are multifunctional devices that provide visual display of major and secondary drilling and well workover variables on site. The display module can be configured to meet the Customer's needs.

From 4 to 18 process variables can be displayed.



MI-140(P12) Display module configuration



MI-140(P9) Display module configuration



MI-140(P8) Display module configuration



MI-140(P4) Display module configuration



MI-140(P4) Display module configuration



Capabilities

- Explosion-proof protection;
- Selectable modes.

Design Features

- Rig support mounting bracket;
- Vertical surface mounting bracket;
- Driller's control panel mounting bracket;
- Extra scale indicating Weight on Bit for drilling and fishing jobs;
- Sealed enclosure.

Technical characteristics

Displaying variables	Up to 18
Hook Load Analogue Scale Range, tf	from 24
Weight on Bit Analogue Scale Range, tf	from 4,5
Digits accuracy, sign	4
Ex marking, IEC	1ExibIIBT5GbX
Ex marking, ATEX	II2GExibIAT5Gb
Rated supply voltage, V Ingress	12-18
Max weight, kg*	
MI-140(P4)	3
MI-140(P8)	5
MI-140(P9)	6
MI-140(P12)	7
Dimensions, mm*	
MI-140(P4)	550x200x60
MI-140(P8)	550x320x60
MI-140(P9)	430x440x60
MI-140(P12)	550x440x60

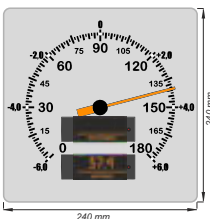
*Weight and dimensions do not include the mounting set: an anti-glare screen and a remote indicator rod mounting bracket. Max total mounting set weight is 2,5 kg.



MI-140(P4)E-2 Display module configuration



MI-140(P4)E-3 Display module configuration



Standard fields that can be placed on the MI-140(P4-P6) module front panel in any combination



Display Modules MI-140 Series

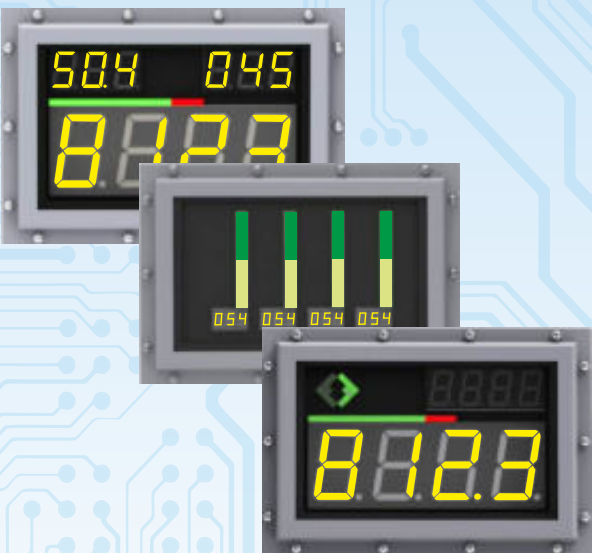
Display modules are multifunctional devices that provide visual display of major and secondary drilling and well workover variables on site. The display module can be configured to meet the Customer's needs. It is available to display from 2 to 7 process variables.



MI-140C-4E Display module configuration



MI-140C(6P)E Display module configuration



MI-140 Display module configuration



Capabilities

- Explosion-proof protection;
- Up to 7 process variables can be displayed;
- Customizable digital indication colors.

Design Features

- Rig support mounting bracket;
- Vertical surface mounting bracket;
- Driller's control panel mounting bracket;
- Extra scale indicating Weight on Bit for drilling and fishing jobs;
- Sealed enclosure.

Technical characteristics

	MI-140-4E	MI-140S(6P)E	MI-140(P2) MI-140(P3) MI-140(PU)
Displaying variables	4	7	2-4
Hook Load Analogue Scale Range, tf	from 24	from 24	-
Weight on Bit Analogue Scale Range, tf	from 4,5	from 4,5	from 4,5
Number of digits displayed	4	4	4
Ex marking, IEC	1ExibIIAT5GbX	1ExibIIAT5GbX	1ExibIIAT5GbX
Ex marking, ATEX	II2GExibIIAT5Gb	II2GExibIIAT5Gb	II2GExibIIAT5Gb
Rated supply voltage	12-18	12-18	12-18
Weight, kg	1,6	3,4	3,5
Dimensions, mm	400x320x60	400x320x60	250x190x60
Cable length, m	on request	on request	on request

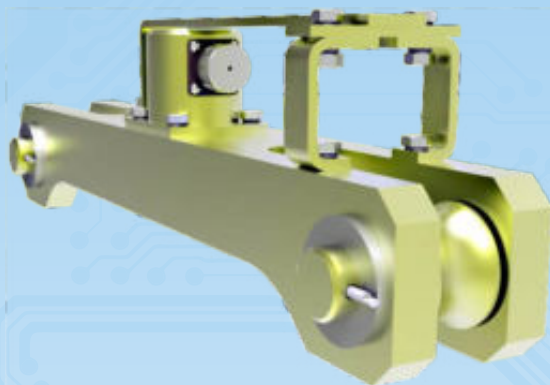
List of Process Variables

- Hook load (indicated on the primary and secondary dials);
- Weight on Bit;
- Tong torque;
- Hydraulic tong torque pressure;
- StandPipe pressure;
- Rotary table torque;
- Rotary table rpm;
- Gas concentration threshold monitoring;
- Pit Volumes;
- Flow Out;
- Trip Velocity;
- Pumps SPM;
- Ambient temperature;
- Mud Temperature;
- Flow In.

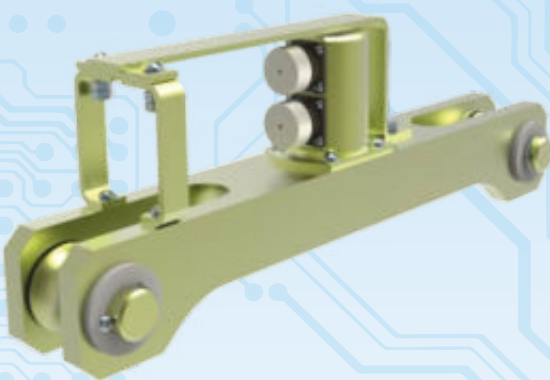
Load Sensors DN-130, DN-130(A)

DN-130 Load Sensor is used for tension measurement in the rope and provides values for such drilling parameters as Hook Load, Weight on Bit, Easy Tong Torque, Easy Tong Line Pull.

The sensor is intended to be installed either on the rig's dead line or on the easy tong line.



DN-130(A) Load sensor is DN-130 sensor modification with additional output 4-20 mA.



Capabilities

- Interchangeability of the sensors of one type size;
- Operating in Ex zone;
- Saving 2 calibrated tables in non-volatile memory of the sensor;
- Standard analog 4-20 mA output (on request).

Design features

- The advanced sensor design enables much higher Hook Load measurement accuracy compared to conventional sensors;
- Distributed load on the sensor mounted to the rope eliminates "setup error";
- No threaded connections to mount the sensor;
- DN-130/DN-130(A) Load Sensors are available for four cable sizes.

Technical characteristics

	DN-130	DN-130(A)
Rope diameter (by typesize), mm	13-38	22-38
Max measured line load, kN	50-400	100-400
Minimum measurement limit, kN	5	5
Accuracy, %FS	3	3
Calibration interval, months	12	12
Communication interface	RS-485	RS-485
RS-485 baud rate, bit/sec	57600	57600
Communication protocol	Modbus	Modbus
Inlet voltage input, V	12-18	12-18
Ex marking, IEC	1ExibIIAT3Gb	1ExibIIAT3Gb
Ex marking, ATEX	II2GExibIIAT3Gb	II2GExibIIAT3Gb
Max weight, kg, no more		
Ø 13-18	5	
Ø 22-25	8	9,5
Ø 28-32	11	12,5
Ø 35-38	15,5	16
Dimensions, mm		
Ø 16-18	310x70x111	
Ø 22-25	420x83X124	420x83X146
Ø 28-32	500x88X127	500x88X147
Ø 35-38	540x100X140	540x100X160

Analog output 4-20 mA of the DN-130(A) sensor can be used for integration in the 3rd Party instrumentation system on the rig.



Wireless Load Sensor DN-130(R)

DN-130(R) Wireless Load Sensor is used for tension measurement in the rope and provides values for such drilling parameters as Hook Load, Weight on Bit, Easy Tong Torque, Easy Tong Line Pull.

The sensor is intended to be installed either on the rig's dead line or on the easy tong line.

Wireless configuration requires installation of the PS-150(R1) or PS-150(RM) Signal Transducers.

Capabilities

- Explosion-proof protection;
- Wireless availability.

Design features

- There is no cable connection to the sensor;
- Easy installation;
- High accuracy in the direct load measurement;
- Can be equipped by shackles;
- The sensor's enclosure is made of high-strength structural polymer.

Technical characteristics

Rope diameter, mm	13-38
Max measured line load*, kN	50-400
Minimum measurement limit, kN	5
Accuracy, %FS	3
Calibration interval, months	12
Communication interface	RS-485
Baud rate via RS-485 interface, bit/sec	57600
Communication protocol	Modbus
Ex marking, IEC	1ExdbIIAT6Gb
Ex marking, ATEX	II2GExibIIAT3Gb

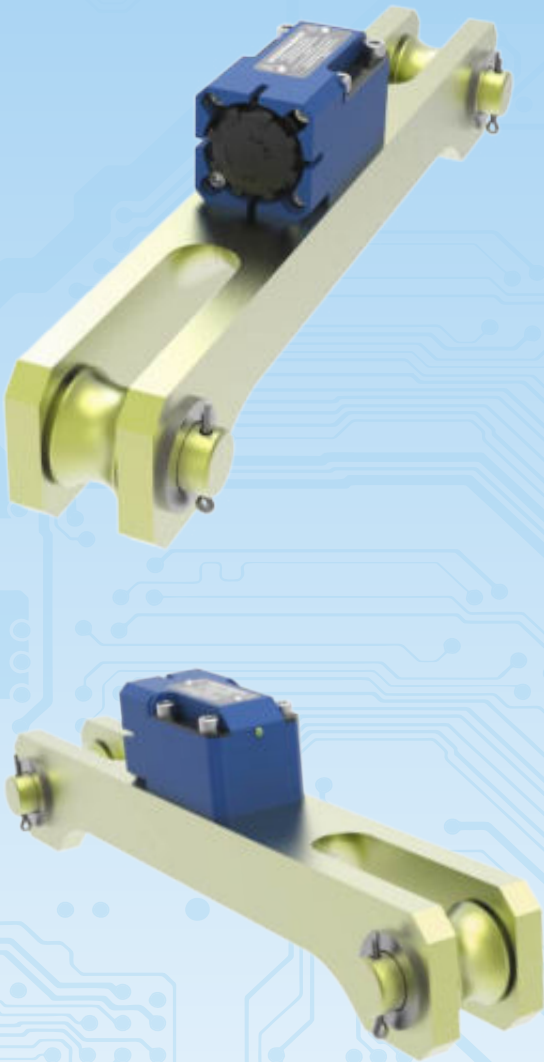
Parameters of power supply from the internal battery pack

Voltage, V, no more	3,6
Current consumption, mA, no more	2
Max power consumption P, W, no more	0,004
Max weight, kg, no more	
Ø 16-18	6
Dimensions, mm	
Ø 16-18	310x70x111

Radio communication parameters

Distance for stable wireless communication, m	5...25*
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*Depending on the signal transducer used with the sensor.



Load Sensors DN-130V, DN-130V(R)

DN-130V Load Sensor is intended for measurement of the tension applied to the rope and provides values for Easy Tong Torque drilling parameter.



DN-130V(R) Load Sensor is a wireless configuration of DN-130 sensor.

Designation of this sensor is measurement of the Easy Tong Torque as well as rig's mast Guy/Wind Load Pull.

It requires installation of the PS-150(R1) or PS-150(RM) Signal Transducers.



Capabilities

- Operating in Ex zone;
- Easy to mount, quick installation and pull line replacement if needed;
- Different tong types are supported.

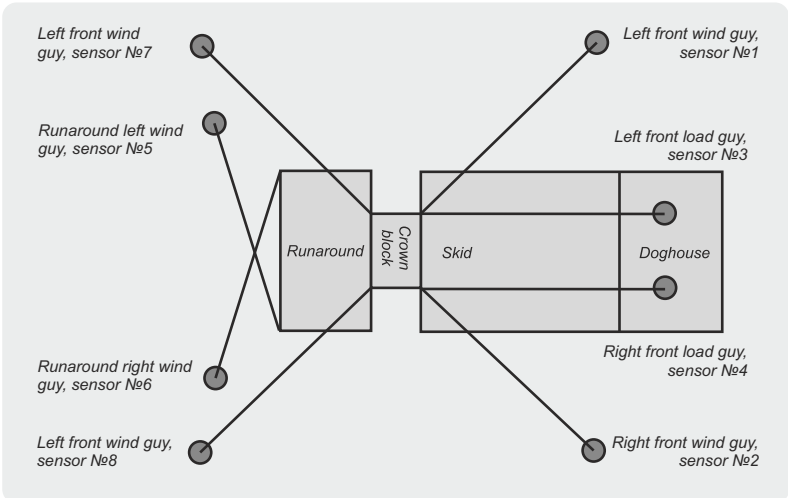
Design features

- The advanced design significantly improves accuracy.

Technical characteristics

Parameters	DN-130V	DN-130V(R)
Max measurement limit, kN	50-400	50-400
Minimum measurement, kN	5 (0,5)	5 (0,5)
Accuracy, %FS	3	3
Calibration interval, months	12	12
Ex marking, IEC	1ExibIIBT6Gb	1ExibIIBT6Gb
Ex marking, ATEX	II2GExdbIIAT6Gb	II2GExdbIIAT6Gb
Rated supply voltage, V	12-18	12-18
Weight, kg	3,8	4,5
Dimensions, mm	Ø 80x215	Ø 102x300
Cable length, m	on request	on request

Load and wind guy sensor arrangement for a mobile rig



Max. distance for stable wireless communication is 30 m.

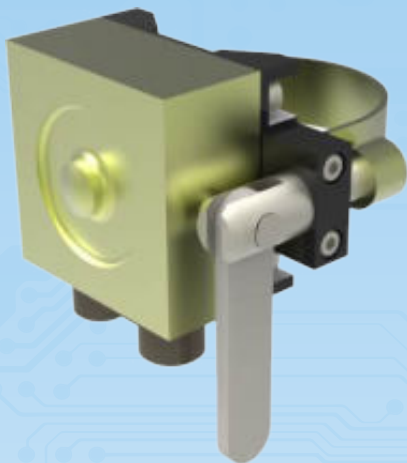


DN-130V(K) Load Sensor for AKB-4 Tongs

DN-130V(K) embedded load sensor measures the compression load in AKB-4 automated tong torque adjustment mechanism with subsequent conversion to torque.

Sensor is mounted on a regulative strip AKB-4.0, AKB-4.0-04, AKB-4.0-05, AKB-4.0-05/04.

Pressure switch is used for the tong's gear determination.



Capabilities

- Explosion-proof protection;
- A pressure switch is included.

Design features

- Sensor's unique design allows torque measurement on the AKB-4 series tongs;
- Easy to mount, quick installation.

Technical characteristics

Max measurement limit (MML), kN	5
Minimum measurement limit, kN	0,1
Accuracy, %FS	1
Sensor reacting limit, kN	0,025
Max acceptable load (accuracy is preserved after unloading)	120 % from MML
Ex marking, IEC	1ExibIAT3Gb
Ex marking, ATEX	II2GExdbIAT6Gb
Inlet voltage input, V	12-18
Dimensions, mm	130x98x40
Cable length, m	on request

Level Sensor U-150

U-150 is ultrasonic level sensor required for measurement of different types of fluids including explosive areas.



Capabilities

- Explosion-proof protection;
- Capabilities for wireless communication.

Design features

- Contactless measuring of liquid level;
- Light plastic enclosure.

Technical characteristics

Measuring range, m	0,3-3
Accuracy, %FS	1
Maximum input voltage, V	28
Maximum input current, AC	0,5
Communication interface	RS-485
Communication protocol	Modbus
Ex marking, IEC	1ExibIBT5Gb
Ex marking, ATEX	II2GExibIAT3Gb
Calibration interval, months	24
Dimensions, mm	
- with support	Ø 85x195
- without support	Ø 160x425

Pressure Sensors TP-140D

TP-140D Sensor is used for pressure measurement in pipes or another hydraulic systems of the drilling or workover rigs.



TP-140D(M) and **TP-140D(MA)** sensors are intended for installation on the different types of pipes on the rig for pressure measurement without additional separator.

Installation on "conical" type of the threaded/welded sub.

TP-140D(MA) configuration provides analog output 4-20 mA.



Installation on Fig.1502 type of the threaded/welded sub.



TP-140D Pressure Sensor

Capabilities

- Explosion-proof protection.

Design features

- A tee is included to install the TP-140D Sensor together with standard pressure gauge.

TP-140D(M), TP-140D(MA) Pressure Sensors

Capabilities

- Explosion-proof protection;
- The electronic correction system maintains the acceptable basic measurement error within $\pm 0,15\%$ over the entire temperature range;
- Suitable for aggressive, viscous, heterogeneous environment;
- High pressure range.

Design features

- Manifold mounted;
- Diaphragm sensor: no phase separator is required.

Technical characteristics

Parameters	TP-140D	TP-140D(M)	TP-140D(MA)
Measured pressure limit, kgf/cm ² - M20x1,5 - "cone" - "sphere"	400/600/1000	400/600 400/600/1000	400/600 400/600/1000
Minimum pressure limit, kgf/cm ²	0	0	0
Accuracy, %FS	1,5	1,5	1,5
Calibration interval, months	36	36	36
Rated supply voltage, V	12-18	12-18	12-18
Ex marking, IEC	1ExibIIBT3Gb		
Ex marking, ATEX	II2GExibIAT3Gb		
Weight, kg	0,46	1,8	2,4
Dimensions, mm	Ø 56x152	Ø 90x140	Ø 90x172
Cable length, m	on request	on request	on request

Analog output 4-20 mA of the TP-140D(MA) sensor can be used for integration in the 3rd Party instrumentation system on the rig.

Wireless Pressure Sensor TP-140D(R)

TP-140D(R) Sensor is used for pressure measurement in pipes or another hydraulic systems of the drilling or workover rigs.



Capabilities

- The control module communicate with the sensor via Signal Transducer PS-150(R) or its modifications;
- Work in an explosive area as part of the DEL-150 system.

Design features

- A tee is included to install the TP-140D(R) sensor together with standard pressure gauge.

Technical characteristics

Measured pressure limit, kgf/cm ²	400/600/1000
Minimum pressure limit, kgf/cm ²	20,1
Accuracy, %FS	1,5
Calibration interval, months	36
Rated supply voltage, no more	3,6
Ex marking, IEC	1ExdbIIAT6Gb
Ex marking, ATEX	II2GExibIIAT3Gb
Dimensions, mm	Ø 56x152
Max. distance for stable wireless communication, m	15

Wireless Pressure Sensor TP-140D(4R)

TP-140D(4R) sensor is used to measure pressure in the Power Tong's hydraulic systems with one or two hydraulic motors embedded (e.g. GKSH-1500MT Power Tong). The measured value is required then to calculate Power Tong Torque parameter. The sensor measures pressure simultaneously in four circuits (inlet-outlet).



Capabilities

- Pressure sensor is connected to the DEL-150's Control Module via PS-150(RK) Signal Transducer or its modifications;
- Long calibration interval;
- Work in explosive area.

Design features

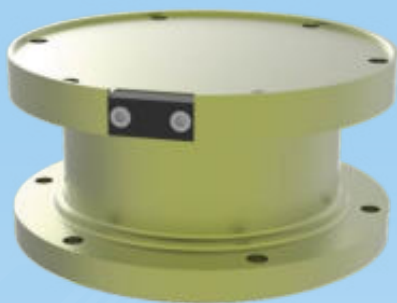
- Connection to the hydraulic system is carried out by four flexible high pressure hoses;
- The sensor's enclosure is made of high-strength structural polymer.

Technical characteristics

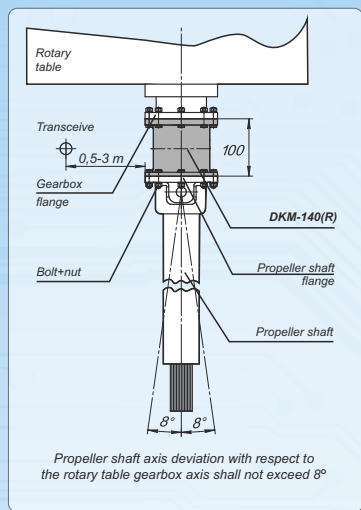
Measured pressure limit, kgf/cm ²	400/600/1000
Minimum pressure limit, kgf/cm ²	0
Accuracy, %FS	1,5
Rated supply voltage, no more	3,6
Calibration interval, months	36
Ex marking	1ExdbIIAT6Gb
Dimensions, mm	Ø 86x129
Max. distance for stable wireless communication, m	15
Battery life, months, no less	12

Torque Sensor DKM-140(R)

The wireless **DKM-140(R)** sensor measures rotary table torque and rpm in rigs with cardan shaft drives.



DKM-140(R)
Torque sensor
mounting
on a rig.



Capabilities

- Explosion-proof protection;
- Simultaneous measurement of two parameters: rotary table torque and RPM;
- Wireless channel to the Control module and the Commutation module.

Design features

- Customizable configuration to meet the Customer's needs;
- Minimum sensor height is 103 mm.

Technical characteristics

Max measured load, kN*m	7-12 (22)*
Minimum measurement limit, kN*m	0,1
Accuracy, %FS	1,5
Communication interface	RS-485
Communication protocol	Modbus
Rated battery voltage, V, no more	7,2
Battery runtime, months, no less	18
Ex marking, IEC	1ExibIIAT6Gb
Ex marking, ATEX	II2GExdbIIAT6Gb
Weight, kg	10 and more
Dimensions, mm	Ø 205x100
Max. distance for stable wireless communication, m	3-5

*More than 20 standard sizes are produced according to the parameters of the Customer's equipment.

Signal Transducers PS-150R, PS-150R1

PS-150R Transducer replaces a cable line between the MU-150 Control Module or Commutation Module and DKM-140(R).

PS-150R1 has been designed to replace the communication cable between the Control Module or Commutation Module and DN-130V(R) Load Sensor.



Capabilities

- Explosion-proof protection;
- Distance to sensor: up to 5 m.

Design features

- Light, sealed enclosure;
- Quick installation.

Technical characteristics

Frequency, GHz	2,4
Communication interface	RS-485
Communication protocol	Modbus
Rated supply voltage, V	12-18
Ex marking, IEC	1ExibIIAT3Gb
Ex marking, ATEX	II2GExib[ib]IIAT3Gb
Max weight, kg, no more	0,2
Dimensions, mm	Ø 30x150
Max. distance for stable wireless communication, m	1-5

Signal Transducer PS-150(RA)

PS-150(RA) Transducer replaces a cable line between the MU-150 Control Module and DKM-140(R) and transmits analog rotary table torque and RPM signals to other systems.



Capabilities

- Explosion-proof protection;
- Distance to sensor: up to 5 m;
- Two 4-20 mA analog outputs.

Design features

- Light, sealed enclosure;
- Quick installation.

Technical characteristics

Communication interface	RS-485
Communication protocol	Modbus
Rated supply voltage, V	12-18
Analog outputs 4-20 mA, pcs	2
Ex marking, IEC	1ExibIAT3Gb
Ex marking, ATEX	II2GExib[ib]IAT3Gb
Dimensions, mm	115x60x90
Max. distance for stable wireless communication, m	1-5

Inclinometer PS-150(I)

PS-150(I) is designed to measure the angle of inclination of various objects relative to the Earth's gravitational field.

Inclinometer is required to provide for the Drilling and Well Workover Monitoring System DEL-150 values of the Roll and Pitch parameters of bases / chassis and masts of stationary and mobile drilling rigs.



Capabilities

- Easy to operate, does not require complex settings;
- Operation in an explosive area.

Design features

- Easy installation;
- Rugged sealed, metal housing.

Technical characteristics

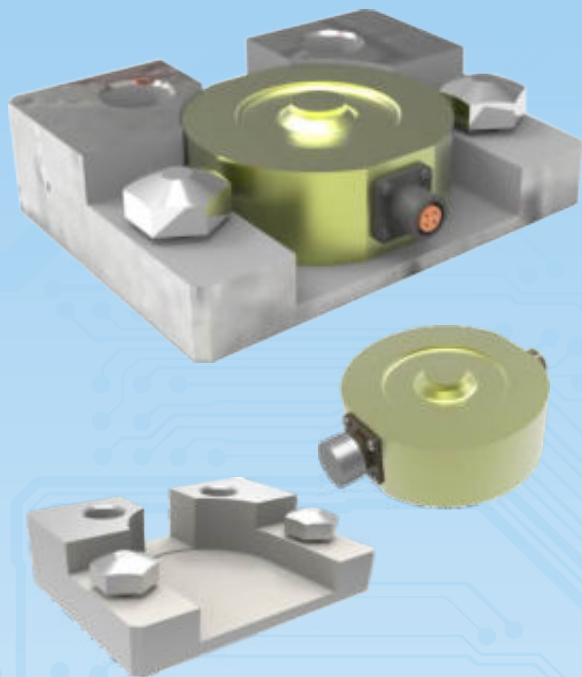
Sensitivity, degree	0,1
Communication interface	RS-485
Communication protocol	Modbus
Rated supply voltage, V (DC)	12-18
Ex marking	1ExibIAT3Gb



The inclinometer can be equipped with Display Module MI-140(I).

Load Sensor DN-130V(C)

DN-130V(C) indirectly measures chain-driven rotary table Torque by estimating vertical load component. The sensor is installed under the chain-driven rotary table's bearing block and includes proximity sensor for RPM measurement.



Capabilities

- Explosion-proof protection;
- Simultaneous measuring of two parameters: Rotary Torque and Rotary RPM.

Design features

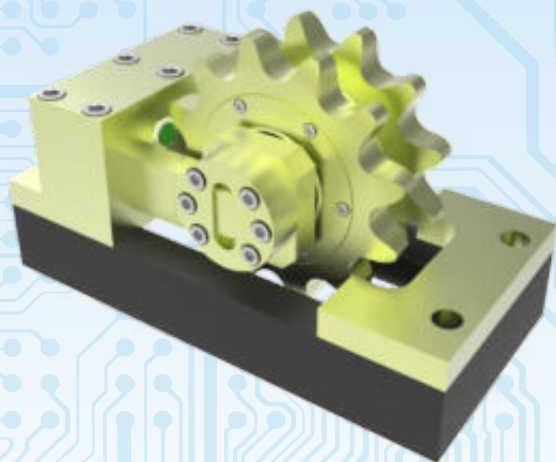
- Convenient installation under one of the intermediate drive bearing block;
- Advanced sensor collar design enables quick mounting/dismounting.

Technical characteristics

Max. measurement limit (MML), kN	50
Minimum measurement limit, kN	1
Accuracy, %FS	1
Sensor discrimination threshold, kN	0,025
Max. acceptable load (accuracy is preserved after unloading), %	120 % from MML
Communication interface	RS-485
Communication protocol	Modbus
Inlet voltage input, V	14,8
Ex marking, IEC	1ExibIIAT3Gb
Ex marking, ATEX	II2GExdbIIAT6Gb
Dimensions, mm	Ø 98x55

Torque Indicator DKM-140(C)

DKM-140(C) Indicator indirectly measures a chain-driven rotary table torque by estimating vertical load component. The sensor is installed under the rotary table chain.



Capabilities

- Explosion-proof protection;
- Simultaneous measuring of two parameters: Rotary Torque and Rotary RPM.

Design features

- Installation under the rotary chain;
- The sensor is available for single and double chains.

Technical characteristics

Max measured vertical load, kN	15
Minimum measurement level, kN	0,1
Communication interface	RS-485
Ex marking, IEC	1ExdbIIAT6Gb
Ex marking, ATEX	II2GExdbIIAT6Gb
Inlet voltage input, V	14,8
Dimensions, mm	400x260x300
Cable length, m	on request

Encoders DPS-140(P), DPS-140(V)

Both **DPS-140(P)** and **DPS-140(V)** Encoders are intended to control rig's drawworks revolutions for the following drilling parameters calculation:

- Block Height;
- Trip Velocity;
- ROP;
- Hole Depth;
- Bit Position.

Another derived parameters such as Line Wear are calculated in conjunction with Encoder's values.



Capabilities

- Explosion-proof protection;
- The reading is preserved if power is lost and new calibration is not required.

Design features

- The advanced design enables to mount on a shaft with diameter 25-38 mm (for DPS-140(P)) or on a shaft through custom thread adapter (for DPS-140(V)).

Technical characteristics

	DPS-140(P)	DPS-140(V)
Pulses per revolution, impulses	144	144
Minimum measurement limit, m	0,01	0,01
Ex marking	1ExibIIAT3Gb	1ExibIIAT3Gb
Communication protocol	Modbus	Modbus
Rated supply voltage, V	12-18	12-18
Dimensions, mm	Ø 150x52	Ø 150x52

Power Supply DPS-140(P)

The **power supply** is designed to continuously provide power to the encoder so that in the event of a short (emergency) power outage of the main modules, the encoder retains the displacement value, and when the system's power supply is turned on, the data of the travelling block position is up-to-date.

The Power Supply automatically switches to emergency power.



Capabilities

- Retains the value of the encoder position for at least 1 hour;
- Automatic protection of the power line;
- Operation mode indication.

Design features

- Sealed metal case;
- Convenient connection (standard connectors).

Technical characteristics

Type of current	constant
Rated supply voltage, V	12-15
Rated output voltage (when running on battery), V	12
Rated output current, mA	120
Dimensions, mm	115x90x57

Encoder DPS-140(A)

DPS-140(A) Encoder is intended to control rig's drawworks revolutions for the following drilling parameters calculation:

- Block Height;
- Trip Velocity;
- ROP;
- Hole Depth;
- Bit Position.

Another derived parameters such as Line Wear are calculated in conjunction with Encoder's values.



Capabilities

- Explosion-proof protection;
- The reading is preserved if power is lost and new calibration is not required.

Design features

- The encoder is installed at the drawworks shaft and connected via chain-driven to it.

Technical characteristics

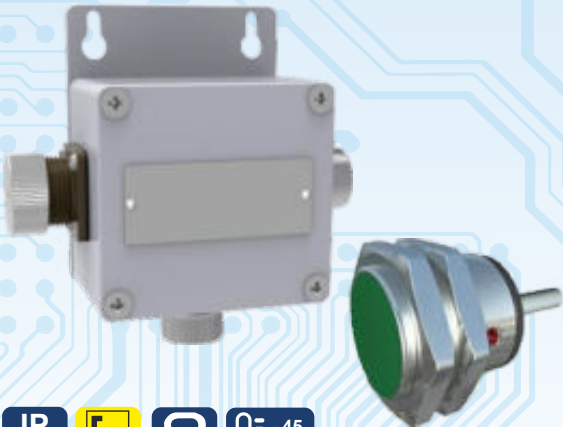
Pulses per revolution, impulses	4096
Minimum measurement limit, m	0,01
Ex marking	1ExibIIAT3Gb
Communication interface	RS-485
Communication protocol	Modbus
Rated supply voltage, V	12-18
Dimensions, mm	Ø110x60
Cable line length, m	on request

Proximity Sensor DPS-140(I)

DPS-140(I) is designed to count revolutions of drawworks drum and provides the following parameters calculation:

- Block Height;
- Trip Velocity;
- ROP;
- Hole Depth;
- Bit Position.

Two Proximity Sensors are required to be installed for the most drilling parameters deriving.



Capabilities

- Explosion-proof protection;
- The reading is preserved if power is lost and new calibration is not required (with the Power Supply connected).

Design features

- Allows installation on the rigs with inability of connection to drawworks shaft.

Technical characteristics

Rated supply voltage, V (DC)	12-18
Ex marking	1ExibIIAT3Gb
Dimensions (with bracket), mm	80x56x100

Mud Return Flow Sensor IVR-140

IVR-140 detects the mud return flow presence.



Capabilities

- Explosion-proof protection.

Design features

- The sensor's lever is made of polymer material, which allows to exclude the sticking of mud;
- The sensor measures deviation of the lever from its original vertical position. Depending on the mud flow, the sensor lever inclines to a certain angle.

Technical characteristics

Communication interface	RS-485
Communication protocol	Modbus
Rated supply voltage, V	12-18
Ex marking, IEC	1ExibIIAT3Gb
Ex marking, ATEX	II2GExib[ib]IIAT3Gb
Dimensions, mm	400x80x400

Mud Density Sensor DPR-140

DPR-140 measures mud density in pits.



Capabilities

- Explosion-proof protection.

Design features

- Float-type sensor;
- The float is plastic: no mud adhesion.

Technical characteristics

Density measurement range, g/cm ³	0,6-1,3
Communication interface	RS-485
Communication protocol	Modbus
Rated supply voltage, V	12-18
Ex marking, IEC	1ExibIIAT3Gb
Ex marking, ATEX	II2GExib[ib]IIAT3Gb
Dimensions, mm	345x160x312

Wind Velocity Sensor DSV-150



Wind velocity sensor DSV-150 measures wind velocity and dangerous wind loads.

Design features

- Easy mounting which provides fast installing operations;
- Reliable metallic enclosure.

Technical characteristics

Communication interface	RS-485
Communication protocol	Modbus
Rated supply voltage, V	12-18
Dimensions, mm	Ø150(48)x325

Wireless Communication Kit KBS Wi-Fi USR

KBS Wi-Fi USR communication equipment is designed to provide wireless connection between Control Module of the DEL-150 System and Toolpusher's PC. It comprises one pair of the active antennas

Each Kit includes:

- 2 complementary antennas;
- Converter with 12 V power supply;
- Communication cable with Converter;
- Communication cable with Control module;
- USB cable.



Capabilities

- Operation mode indication;
- Quick and easy setup of a pair of antennas.

Design features

- Lightweight and sealed body;
- Easy installation.

Technical characteristics

Wireless standards	IEEE 802.11b
Channel width selection, MHz	5
Wireless data transfer rate, Mbps (5 MHz, dynamic), no more	to 36,1
Operating range, MHz	2400-2497*
Transmitter power	< 17 dBm or < 50 mW**
Antenna type	built-in 10 dBi
Beam width horizontal/vertical	60°
Rated supply voltage, V	12-18
Dimensions (with bracket), mm	150x201x55
Guaranteed radio communication range, m, no more	300*

*Operating frequencies and other parameters may vary depending on restrictions of those countries or regions where this device is used.

**Maximum transmitter power may vary depending on the channels depending on the restrictions of those countries or regions in which this device is being used.

Wi-Fi Bridge

Wi-Fi Bridge is intended to replace communication cable between DEL-150 System's Control Module, which is located on the rig, and PC installed in the Toolpusher's trailer. It is used for replacement of the cables in DEL-150(V) CCTV System to communicate with remote cameras as well. One pair of antennas is included in the Bridge.



Capabilities

- Coverage range is more than 3000 m;
- Work mode indication.

Design features

- Light and sealed enclosure;
- Quick installation.

Technical characteristics

Frequency, GHz	2,4
Rated supply voltage, V	Passive Poe 24 V
Dimensions, mm	60x115x90

Each Kit includes:

- 2 antennas;
- Communication cable.

Signal Converters PS-150, PS-150(4K), PS-150(LLS)

PS-150 Signal Converter is designed to convert one or two analog current loop signals in the range from 4 to 20 mA and / or two discrete signals into a digital RS-485 signal.



PS-150(4K) converts digital RS-485 signal into 4 ea. analog current 4-20 mA outputs to communicate with 3rd Party instrumentation systems. The device has a non-volatile memory that stores its settings.



PS-150(LLS) is intended for connection Fuel Level Sensors to DEL-150 System.

- Quick installation;
- Sealed enclosure;
- Explosion-proof protection;
- Two sensor channels.



Technical characteristics

Number of outputs	2A/2D/2A+2D
Input current range, mA	4-20
DAC effective number of bits	16
The transformation function of the output signal	linear
Load resistance connected to the output, Ohm	0-300
Voltage range, V	12-24
Communication interface	RS-485
Communication protocol	Modbus
Ex marking, IEC	1ExibIIAT3Gb
Ex marking, ATEX	II2GExib[ib]IIAT3Gb
Dimensions, mm, no more	171x121x60
Weight, kg, no more	0,4

Technical characteristics

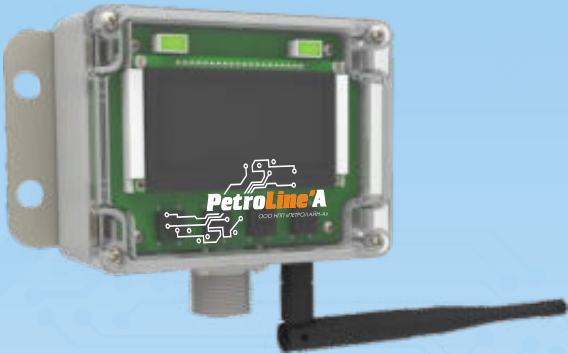
Number of outputs	4
Transducer output current range, mA	4-20
DAC effective number of bits	16
The transformation function of the output signal	linear
Output load resistance, Ohm	0-300
Max current, mA, max	120
Voltage range, V	12-24
Communication interface	RS-485
RS-485 baud rate, bit/sec	57600
Communication protocol	Modbus
Ex marking, IEC	1ExibIIAT3Gb
Ex marking, ATEX	II2GExib[ib]IIAT3Gb
Dimensions, mm, no more	192x176x57
Weight, kg, no more	0,6
Cable line length, m	on request

Technical characteristics

Number of inputs	2
Rated supply voltage, V	12-24
Ex marking, IEC	1ExibIIAT3Gb
Ex marking, ATEX	II2GExib[ib]IIAT3Gb
Weight kg, no more	0,4
Dimensions, mm, no more	100x80x20
Cable length, m	on request

Signal Transducer PS-150(RM)

PS-150(RM) Transducer is intended to communicate with the wireless Load Sensors required to control rig's mast Guy/Wind Load Pull on a mobile drilling rig.



Capabilities

- Distance to sensor 25-30 m;
- Simultaneous work with 8 sensors.

Design features

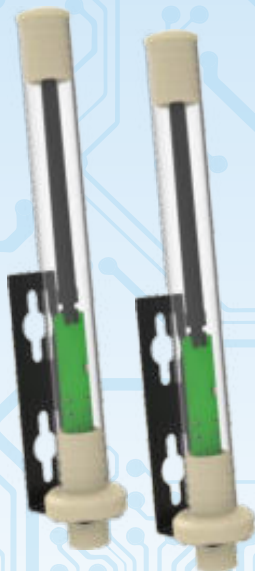
- Light and sealed enclosure;
- Quick installation.

Technical characteristics

Frequency, GHz	2,4
Communication interface	RS-485
Communication protocol	Modbus
Ex marking, IEC	1ExibIIAT3Gb
Ex marking, ATEX	II2GExib[ib]IIAT3Gb
Rated battery voltage, V	12-18
Dimensions, mm	115x60x90
Max. distance for stable wireless communication, m	25

Wireless Kit KBS (RF 868 MHz)

KBS (RF 868 MHz) replaces a cable between DEL-150 System's Control Module and Commutation Modules. The Kit includes a pair of active remote antennas.



Capabilities

- Range: over 300 m;
- Mode indication;
- The Control Module's antenna can communicate with several Commutation Modules' antennas.

Design features

- Light, sealed enclosure;
- Quick and easy installation.

Technical characteristics

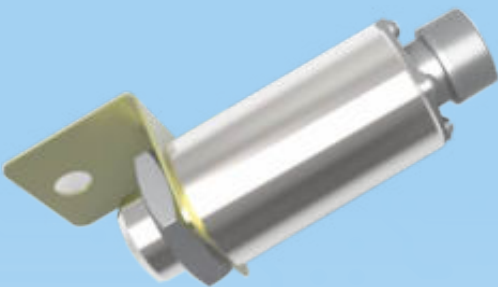
Frequency range, MHz	868, 7-869,2
Output power, mW	25
Rated supply voltage, V	12-18
Ex marking, IEC	1ExibIIBT3
Ex marking, ATEX	II2GExib[ib]IIAT3Gb
Weight, kg, no more	0,3
Dimensions, mm	Ø 30x220
Max. distance for stable wireless communication, m	1-300

Each Kit includes:

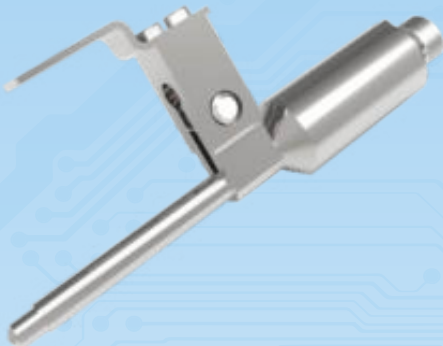
- Antennas (the number is configurable);
- Communication cables.

Temperature Sensors DTE-140, DTE-140(G)

DTE-140 measures Ambient Temperature.



DTE-140(G) measures Mud Temperature and has length of the probe element 200...600 mm.



Capabilities

- Explosion-proof protection.

Design features

- Easy to mount, quick installation.

Technical characteristics

Parameters	DTE-140	DTE-140(G)
Minimum measurement limit, °C	0,1	0,1
Measurement accuracy, %	1	1
Communication interface	RS-485	RS-485
Communication protocol	Modbus	Modbus
Rated supply voltage, V	12-18	12-18
Ex marking, IEC	1ExibIIAT3Gb	1ExibIIAT3Gb
Ex marking, ATEX	II2GExib[ib]IIAT3Gb	II2GExib[ib]IIAT3Gb
Max weight, kg	0,3	0,3
Dimensions, mm	Ø 35x100	Ø 35x250*
Cable length, m	on request	on request

*Probe configurations are available on Customer's request: 200 mm, 400 mm, 600 mm.

Converter RS-485

The converter is connected to the DEL-150 System's devices and provides an interface between a RS-485 data link and a PC USB 2.0 port.



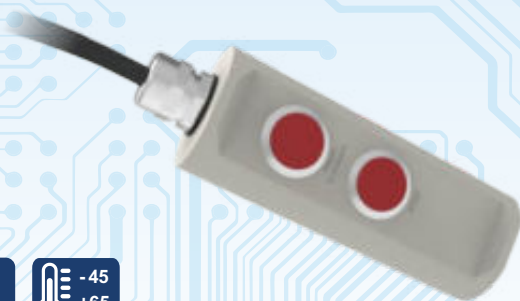
Capabilities

- Connection PC to peripheral devices;
- MU-140, MU-150 Control Modules connection to PC;
- Service functions for MU-140, MU-150 Control Modules;
- Service functions for peripherals;
- Mode indication.

Design features

- Optional auxiliary power supply;
- USB 2.0 port;
- RS-485 port;
- The ports are electrically isolated.

Pushbutton Panel



Capabilities

- A unified device for a range of Display Modules;
- Display Module mode selection.

Design features

- Sealed, impact-resistant, plastic enclosure.

Technical characteristics

Max weight (with a 10 m cable), kg	1,8
Dimensions, mm	60x160

Stabilized Power Supplies

BP-137 is designed to supply power for one device (Control Module/Commutation Module) with rectified stabilized voltage 24V, current no more than 4A, from the 220V AC.



BP-137-A is designed to supply power for one device (Control Module/Commutation Module) with rectified stabilized voltage 24V, current no more than 4A, from the 220V AC with the function of automatic switching to backup power from the on-board network (24V).



BP-237 is designed to supply power for one device (Video Recorder / Control Module / Commutation Module) with rectified stabilized voltage 24V, current no more than 10A, from the 220V AC.

BP-237-2 is designed to supply power for two devices (Video Recorder / commutation cabinet / Control Module / Commutation Module) with rectified stabilized voltage 24V, current no more than 10A, from the 220V AC.



BP-237-Ex is designed to supply power to devices in an explosive area from the 220V AC.



Capabilities

- 220V AC input, 24V DC supply line electronic protection;
- Mode indication.

Design features

- Sealed metal enclosure;
- Electrically isolated power supply.

Technical characteristics

	BP-137	BP-237	BP-237-2
Current	1-Phase AC		
Rated input voltage, V	110-240	110-240	110-240
Rated output voltage, V	24	24	24x2
Rated output current, A	4	10	10
Weight with 10 m cable, kg	2,1	2,1	2,2
Dimensions, m	170x170x100	240x160x92	240x160x92

	BP-137-A	
Current	1-Phase AC	DC
Rated input voltage, V	90-264	10-32
Rated output voltage, V	24	24
Rated output current, A	4	1,7
Weight with 10 m cable, kg	2,6	
Dimensions, mm	240x160x92	

Technical characteristics

Ex marking	1ExdIIB+H2T5Gb
Current	1-Phase AC
Rated input voltage, V	110-240
Rated output voltage, V	24
Rated output current, A	10
Weight with 10 m cable, kg	15
Dimensions, mm	370x310x220

Annunciator OK-150

OK-150 Annunciator is designed to work with the MU-150 Control Module, MK-140 and MK-140(GAZ) Commutation Modules, GSV-1 Series Sensors and is controlled by associated blocking module.

MK-140(GAZ) Module allows to actuate audible and visual alarms separately.

Two thresholds are controlled working together with GSV-1 Sensors.



Capabilities

- It is intended for operation in an explosive zone.

Design features

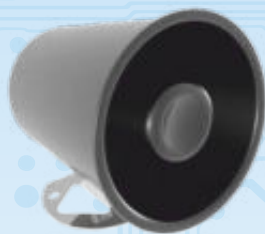
- Annunciator is connected to the plug "Horn" of the Control Module/ Commutation Module;
- Supplied with a cable of required length;
- It is connected to the GSV-1 Sensor by a threaded bushing.

Technical characteristics

Rated supply voltage, V	12-30
Current (12V), A	0,15
Sound level, dB	105
Volume control	-
Ex marking	1ExibIIAT5GbX
Weight (with 4 m cable), kg, no more	0,5
Dimensions, mm	116x66x64

Audible and Visual Alarm Devices

Audible Horn is part of the DEL-150 System and is controlled by blocking module.



Audible and Visual Alarm Device Orbita is intended to work with the MK-140(GAZ) Commutation Module.

MK-140(GAZ) Module allows to actuate audible and visual alarms separately.



Technical characteristics

	Audible and Visual Alarm Device Orbita	Audible Horn
Rated supply voltage, V	12-30	12-24
Current, A	0,66	0,2
Sound level, dB	105	110
Max weight with 4 m cable, kg, no more	0,5	0,5
Dimensions, mm	Ø 100x50	Ø100x112
Cable length, m	on request	on request

Alarm Device is triggered when 95 % of a process variable threshold is reached.

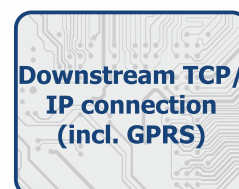
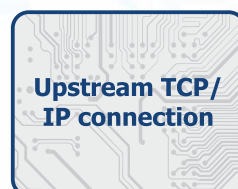
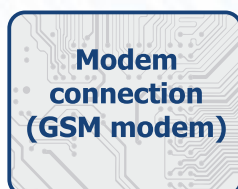
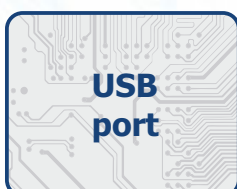
Drilling and Well Workover Monitoring Software

Drilling and Well Workover Monitoring software support DEL-140, DEL-150, DEL-150(V) Systems and offers the following functionality:

- System status and readings monitoring;
- Processing measured data;
- Measured data export to enterprise IT systems;
- Measured data reporting.

The software can be run both locally and on a dedicated enterprise server that acquires measurement results from sensors. There are administration and user authentication tools to manage the dedicated server access rights.

The following device communication channels are available:



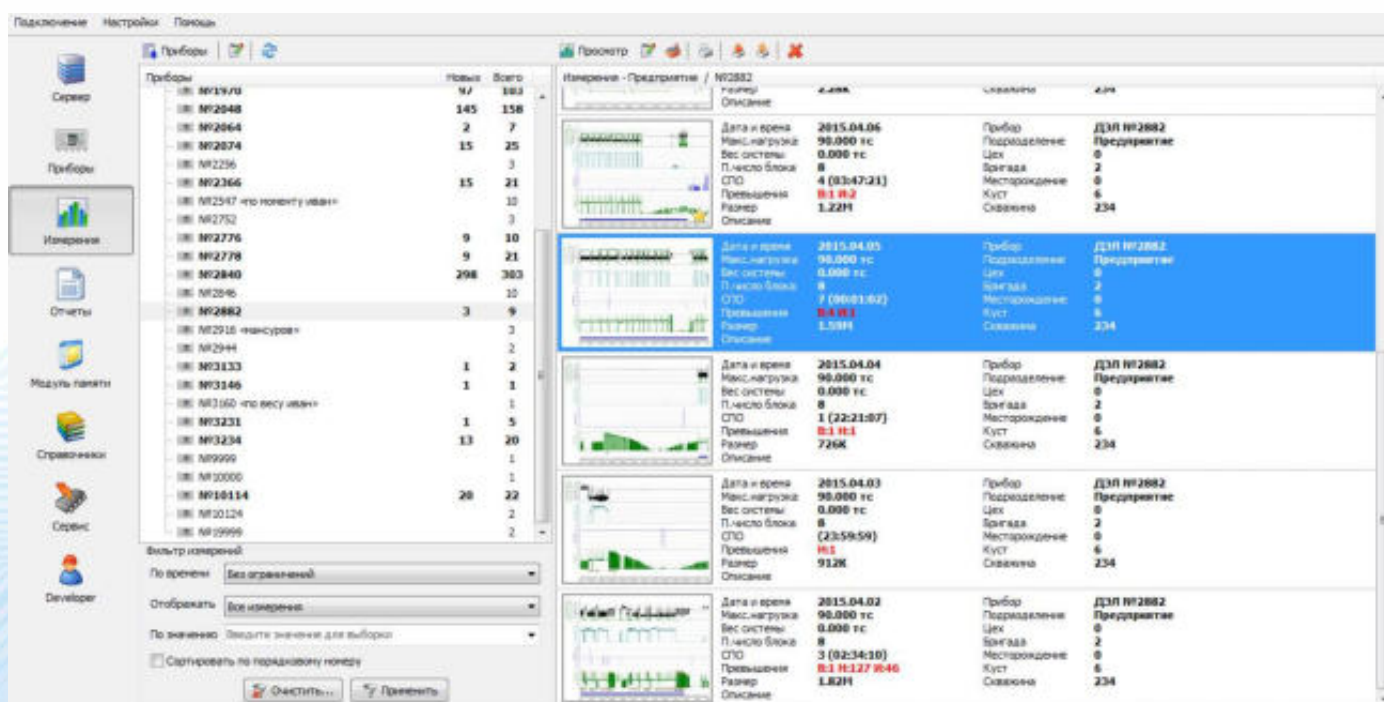
The instrument readings are stored in the software database for subsequent analysis and reporting.

The Drilling and Well Workover Monitoring software server can automatically send data to external databases (SQL Server, Oracle) and enterprise IT systems.

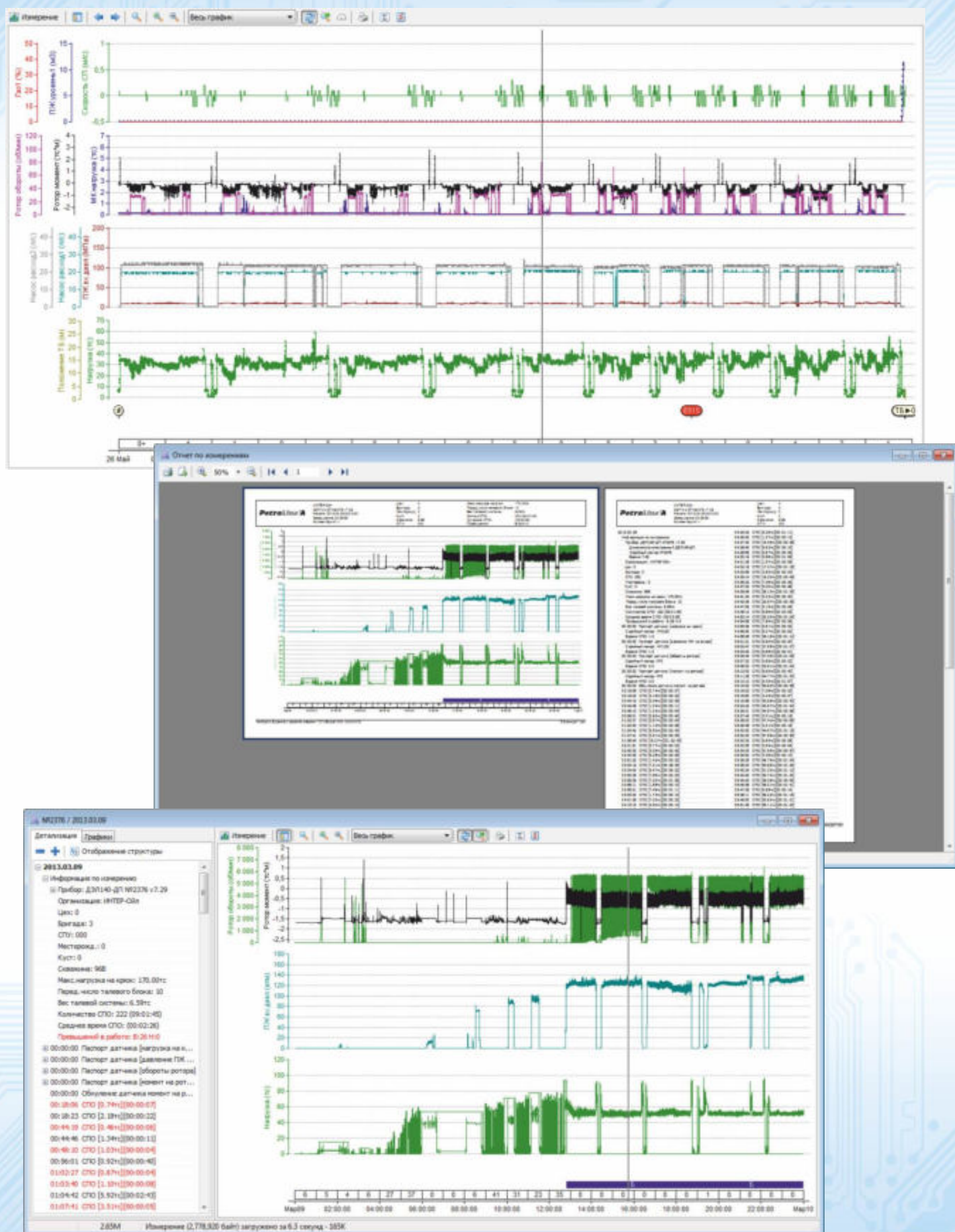
An e-manual (PDF file) is included with the software. Use Acrobat Reader to read the e-manual.

The current Drilling and Well Workover Monitoring software version is available on the Petroline-A official website at: <https://www.pla.ru/service/produkciya12/programmnoe-obespechenie/>

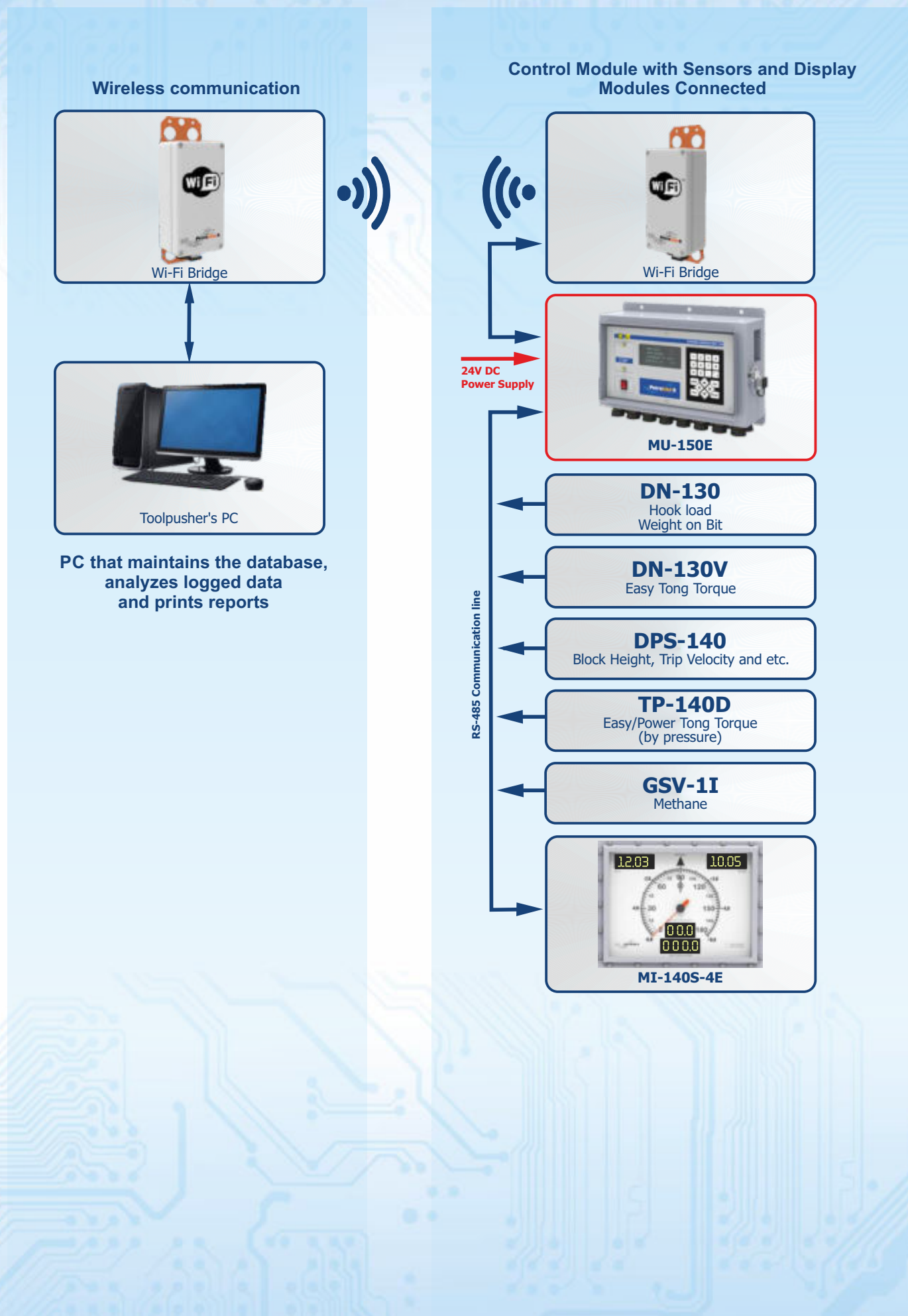
Installation package includes Server and Client parts of the software. Server part allows to deploy dedicated enterprise server to collect data from sensors and to provide access for users to these data.



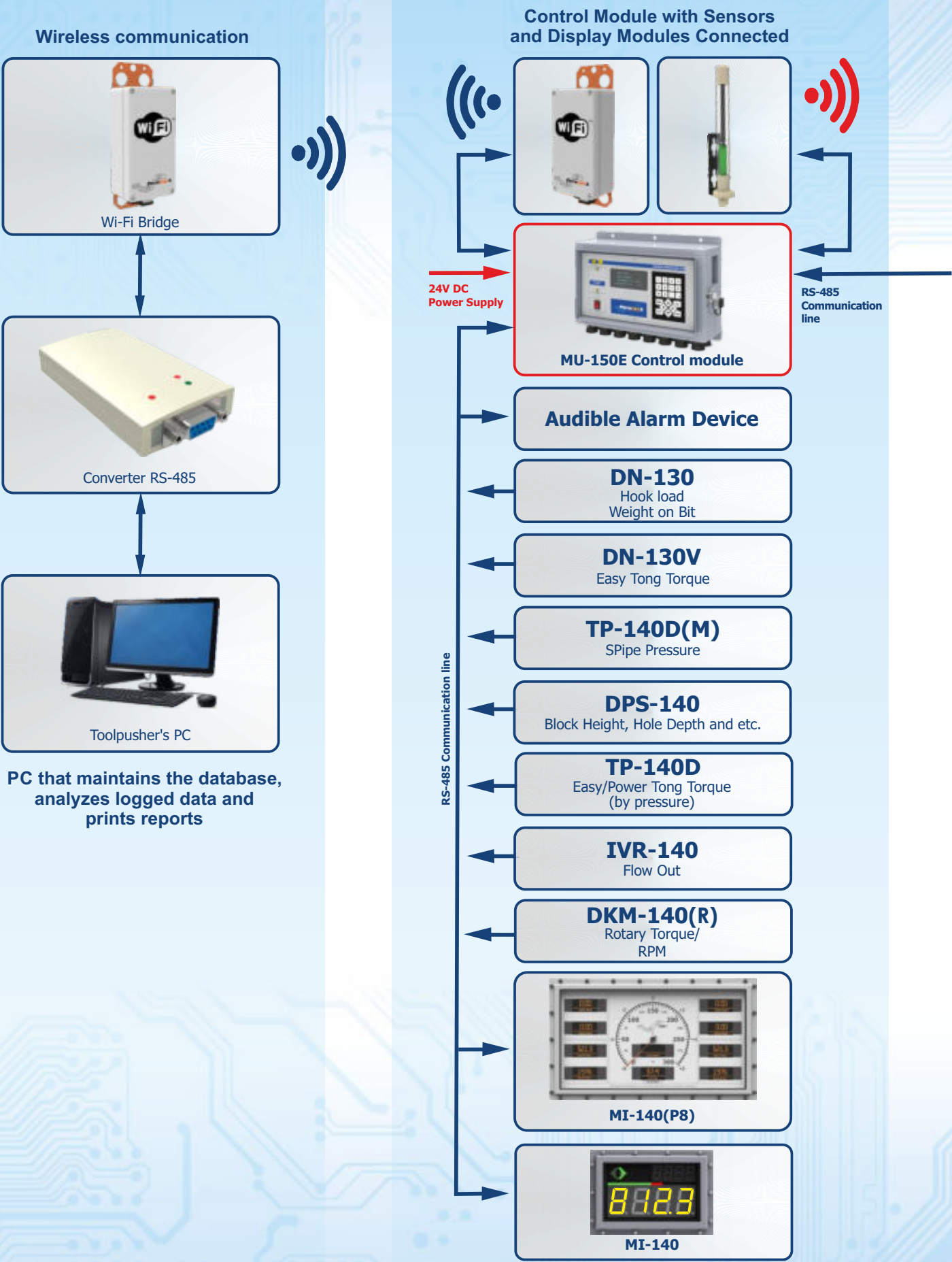
Drilling and Well Workover Monitoring Software



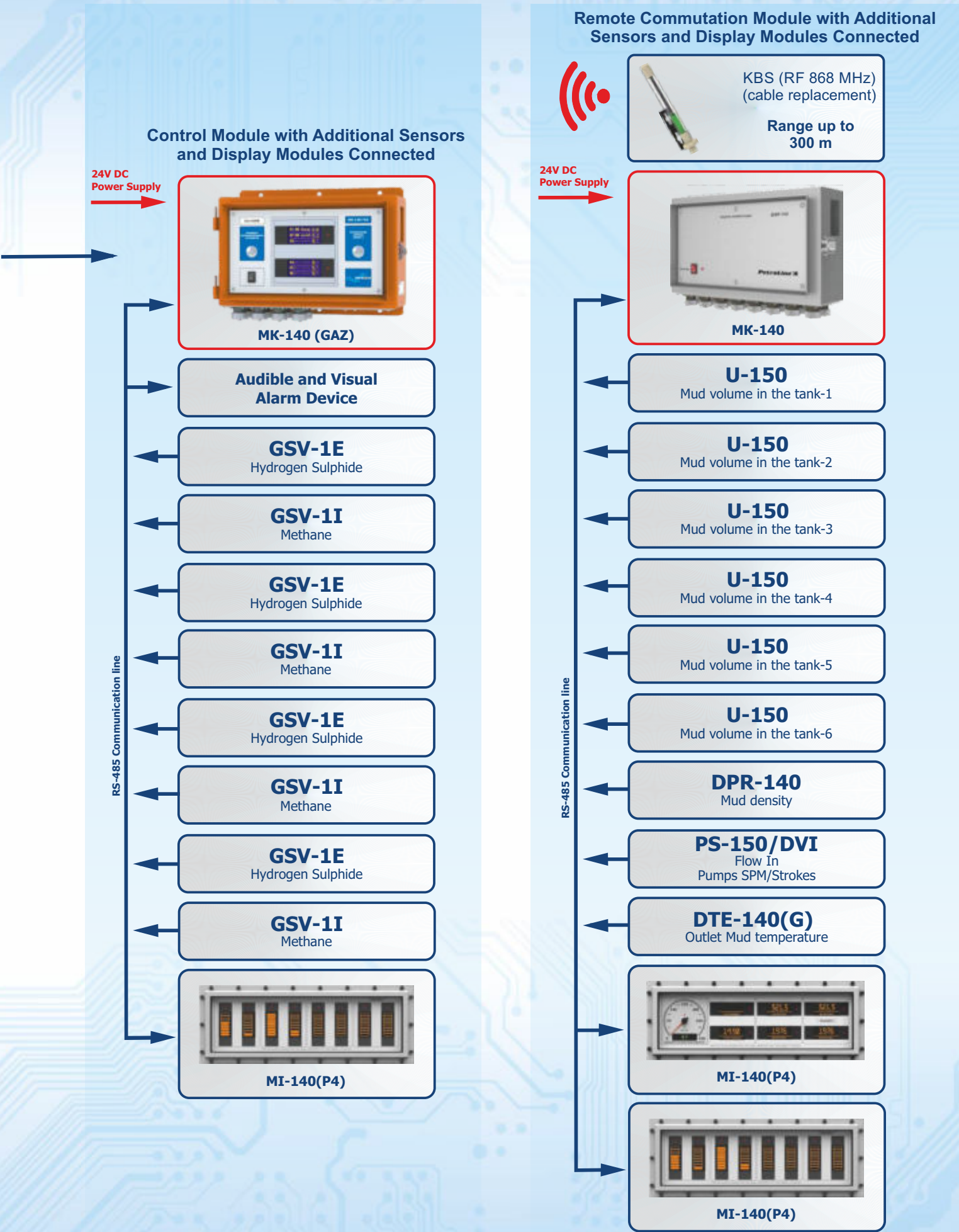
Well Workover Package Configuration



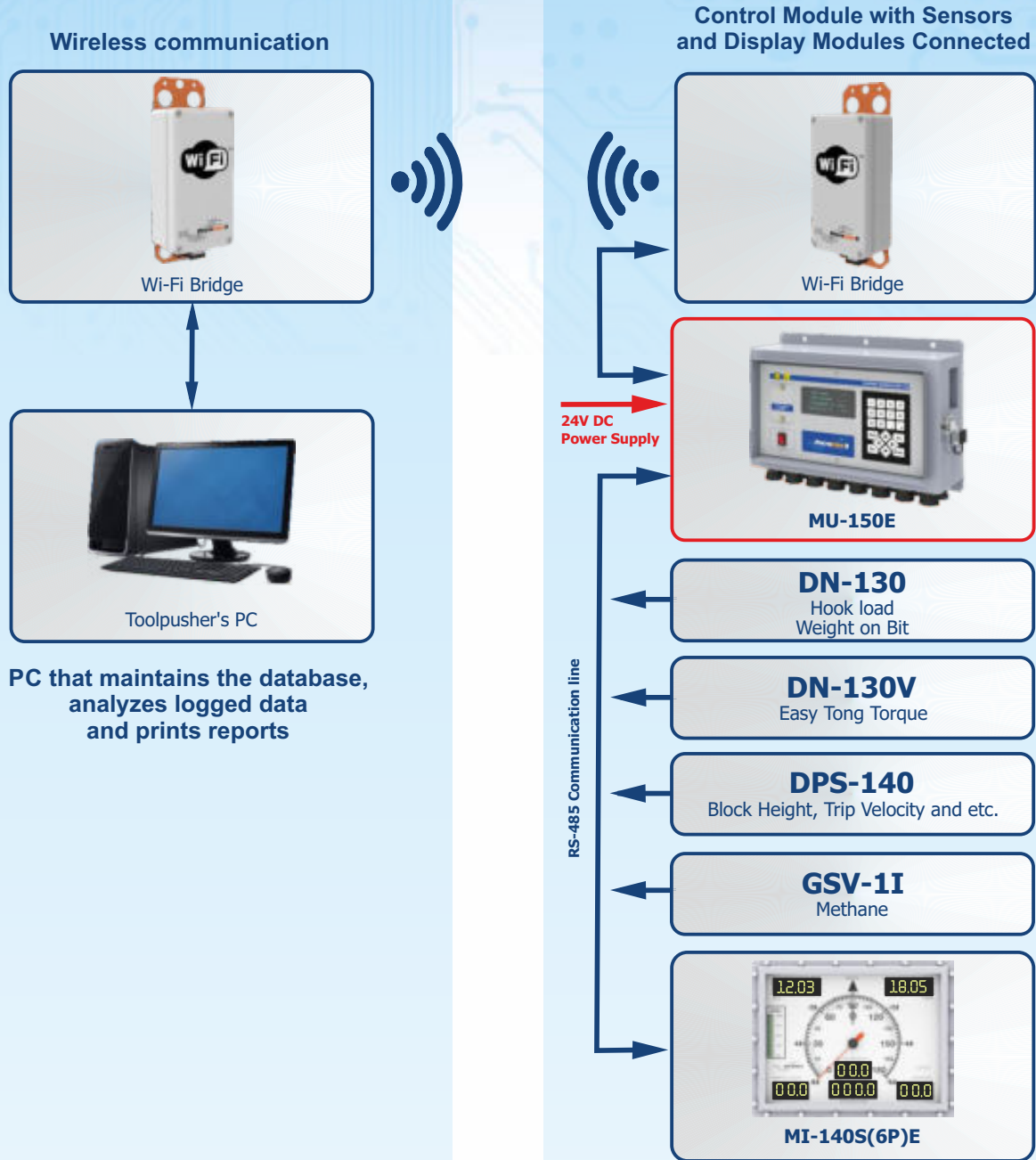
Rig Package Configuration



Rig Package Configuration



Well Service Package Configuration



CCTV System DEL-150(V)

Video recorder DEL-150V2-MDx4

It is the basis of the video recording (CCTV) system and performs the following functions:

- recording video archive on removable memory drive;
- connection to 4 video cameras;
- video data transmission.

Video Recorder **DEL-150V2-MDx4** has robust metal enclosure and inner door with control panel.



Video Recorder DEL-150V2-M0

The DEL-150V2-M0 is designed for indoor use and performs the following functions:

- recording video archive on removable memory drive;
- connection of video cameras;
- video data transmission.

The video recorder is made in plastic case on the back side of which are the necessary connectors for connecting external devices and power supply.



Capabilities

- Data storage in the internal memory module;
- Data storage on the removable memory drive ;
- Remote accessbilty to current video data;
- Synchronization of the video archive with the drilling parameters of the Drilling and Well Workover Monitoring System DEL-150;
- The same software for the DEL-150 and the DEL-150(V) Systems.

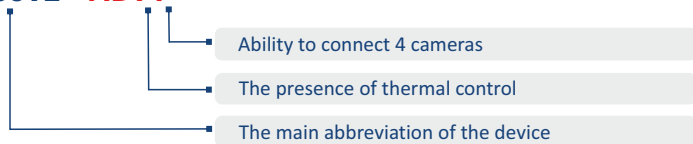


Design features

- Additional protection of the electronic part (two doors);
- Protection of ventilation holes;
- Unique solution for the removable memory drive module.

Video Recorder has different configurations depending on the below marking:

DEL-150V2 - MDT4



Technical characteristics

Supply voltage, V	24
Power consumption, W, no more	240
Number of connected video camera, ea.	1-4
Total number of video cameras in the system, ea., no more	9
Removable memory drive	HDD/SSD 2.5"
Dimensions, mm	300x400x150

Capabilities

- Data storage on the removable memory drive ;
- Remote accessbilty to current video data;
- Synchronization of the video archive with the drilling parameters of the Drilling and Well Workover Monitoring System DEL-150;
- The same software for the DEL-150 and the DEL-150(V) Systems\$
- Possibility to operate with the different size removable drives .

Design features

- Lightweight compact body;
- Unique solution for the removable memory drive module.

Technical characteristics

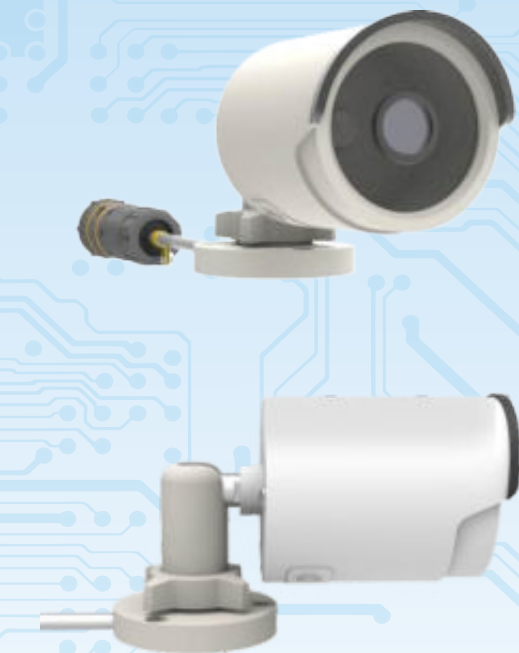
Supply voltage, V	12
Power consumption, W, no more	20
Number of connected video cameras through the Commutation Boxes, ea., no more	9
Total number of video cameras per system, ea., no more	9
Removable memory drive	HDD/SSD 2.5"
Dimensions, mm	200x75x165

CCTV System DEL-150(V)

Explosion proof CCTV camera VOV-150-VK



Outdoor CCTV camera NK-1



Technical characteristics

Matrix	1/2.8" Progressive Scan CMOS
Sensitivity	Color: 0.01lux@(F1.2,AGC on), B/W: 0.028lux@(F2.0,AGC on), 0lux with IR
IR illumination	up to 30 m
Resolution, max	1920 x 1080
Compression	
Main stream	H.264
Additional stream	H.264/MJPEG
Image	
Maximum resolution	1920 x 1080
Main stream	25 fps (1920 x 1080, 1280 x 960, 1280 x 720)
Additional stream	25 fps (640 x 480, 640 x 360, 320 x 240)
Lens, mm	2.8 mm, 4 mm, 6 mm, 8 mm@F2.0
Lens Object of View	default: 2.8 mm: horizontal: 103°, vertical: 59°, diagonal: 118°
	on request: 4 mm: horizontal: 86°, vertical: 46°, diagonal: 102°
	on request: 6 mm: horizontal: 54°, vertical: 30°, diagonal: 62°
	on request: 8 mm: horizontal: 43°, vertical: 23°, diagonal: 50°
Power	PoE (802.3 af)
Lens mount	M12
Dimensions, mm	Ø 104x108

Technical characteristics

Matrix	1/2.8" Progressive Scan CMOS
Sensitivity	Color: 0.01lux@(F1.2,AGC on), B/W: 0.028lux@(F2.0,AGC on), 0lux with IR
IR illumination	up to 30 m
Maximum resolution	1920 x 1080
Compression	
Main stream	H.264
Additional stream	H.264/MJPEG
Image	
Resolution, max	1920 x 1080
Main stream	25 fps (1920 x 1080, 1280 x 960, 1280 x 720)
Additional stream	25 fps (640 x 480, 640 x 360, 320 x 240)
Lens, mm	2.8 mm, 4 mm, 6 mm, 8 mm@F2.0
Lens Object of View	default: 2.8 mm: horizontal: 103°, vertical: 59°, diagonal: 118°
	on request: 4 mm: horizontal: 86°, vertical: 46°, diagonal: 102°
	on request: 6 mm: horizontal: 54°, vertical: 30°, diagonal: 62°
	on request: 8 mm: horizontal: 43°, vertical: 23°, diagonal: 50°
Power	PoE (802.3 af)
Lens mount	M12
Dimensions, mm	Ø 70x155,03

CCTV System DEL-150(V)

Explosion proof Monitor MV-150
is designed to display the current video information from IP CCTV Cameras.



Capabilities

- Explosion-proof protection;
- Display up to 9 windows at the same time;
- "Circular" function of windows display. Sealed enclosure is made from a light metal.

Design features

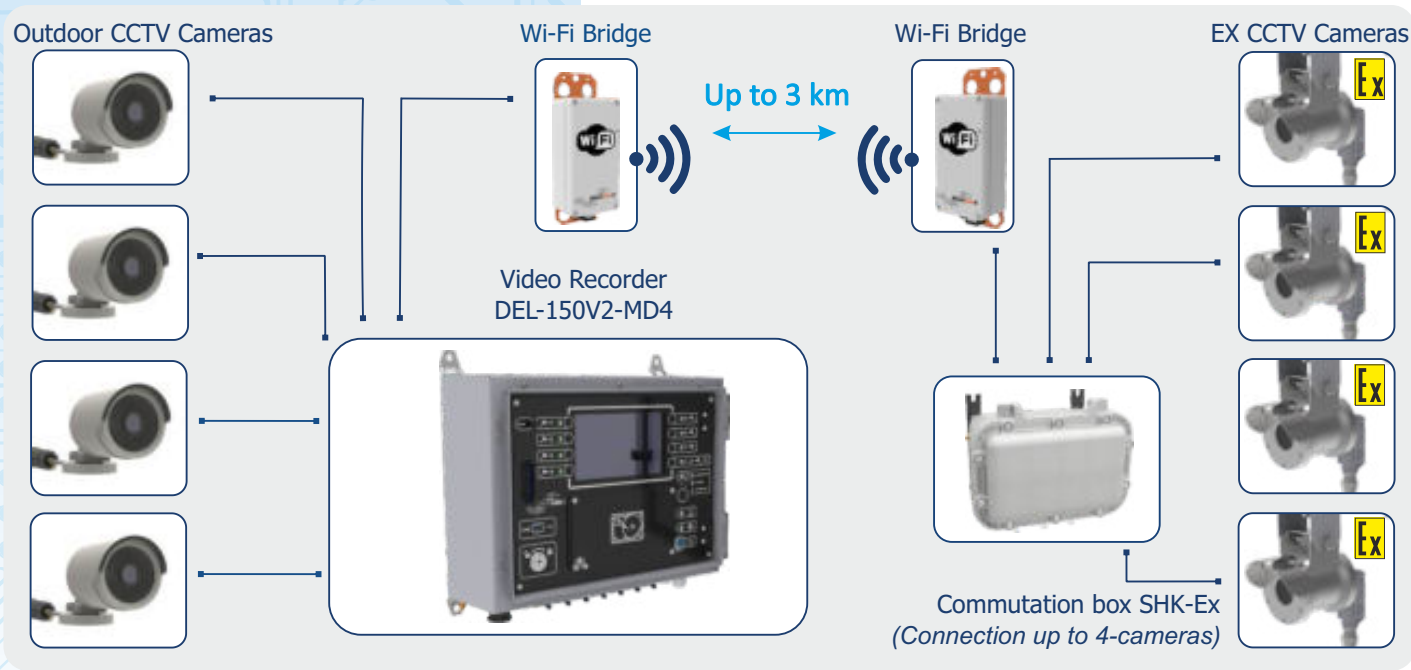
- Availability of universal bracket to mount the rig's mast or to a flat vertical surface;
- Possibility of mounting on the Driller's panel;
- Sealed enclosure is made from a light metal.

Technical characteristics

Max number of displayed windows	9
Nominal supply voltage, V, no more	24
Input power, W, no more	10
Ex marking, IEC	2ExnRIIAT5Gc
Ex marking, ATEX	II3GExnRIIAT5Gc
MV-150 Dimensions, mm	440x404x106
MV-150(S) Dimensions, mm	440x368x106



Typical Connection Diagram



CCTV System DEL-150(V)

Commutation Boxes SHK Series are intended for connection of remote CCTV Cameras to the DEL-150(V2) System.

SHK Box is designed for 4 ea. CCTV Cameras connection.

SHK-1 Box is the best solution for 1 ea. remote CCTV Camera.

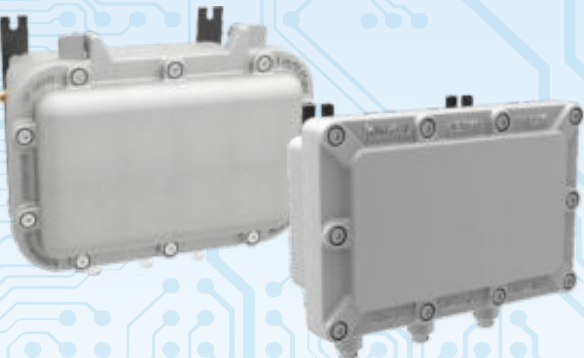


HDMI Converter is a device required to send data to monitor / TV via HDMI interface.

Communication with Video Recorder of the DEL-150(V) CCTV System is via Ethernet cable or Wi-Fi Bridge.



Commutation box SHK-Ex in Ex enclosure.



Capabilities

- Availability of SHK-485 modification for connection to the MU-150 Control Module of the DEL-150 System;
- Power supply for up to 4 IP CCTV cameras;
- Communication with the video recorder (wired/wireless communication);
- Connection to the MU-150E Control Module of the DEL-150 System.

Technical characteristics

	SHK	SHK-485	SHK-1
Nominal supply voltage, V	18-36		
Number of connected IP CCTV cameras, ea.	4	3	1
Connection to MU-150 Control Module	-	+	-
Connection to MU-150E Control Module	+	-	-
Connector availability to connect Wi-Fi Bridge	+	+	+
Dimensions, mm, no more	362x250x130		192x176x57
Protection degree according to GOST 14254-2015 (IEC 60529-2013)	IP54	IP54	IP65



Capabilities

- Display from 1 to 6 windows simultaneously;
- "Circular" function of windows display.

Technical characteristics

Number of displayed windows	1-6
Nominal supply voltage, V	15-36
Dimensions, mm	240x160x93



Capabilities

- Power supply for up to 4 IP CCTV cameras;
- Communication with the Video Recorder (wired/wireless communication);
- Connection to the MU-150E Control Module of the DEL-150 System.

Technical characteristics

	SHK-1-Ex	SHK-Ex
Ex marking	1ExdIIB+H2T5Gb	
Nominal supply voltage, V	18-36	
Number of connected IP CCTV Cameras, ea.	1	4
Connection to MU-150E Control Module	+	
Connector availability to connect Wi-Fi Bridge	+	
Dimensions, mm, no more	282x182x118	370x310x220
Weight, kg, no more	7,5	15

Mud Monitoring System DEL-150 (SKR)

DEL-150 (SKR) is aimed to control, mud parameters while well workover and wireline operations. The Systems allows to store and wireless data transfer.



Logged variables

- Mud Consumption
- Mud density;
- Pressure;
- Mud temperature;
- Total Mud Volume;
- Date and time of works.

Capabilities

- Data transfer to remote server via GSM;
- Data storage in non-volatile memory
- Data storage in removable memory module.

Technical characteristics

Power Supply, V	20-36
Power consumption, W, no more	30
Pressure, MPa	40
Number of electroluminescent screen lines	4

Mud Monitoring System DEL-150 (SKR-M)

DEL-150 (SKR-M) is aimed to control consumption, pressure and mud density on cemented aggregates while well workover and wireline operations. The system is integrated in cemented aggregates as TCA-320, TCA-320M, ATC-32 and other.



Capabilities

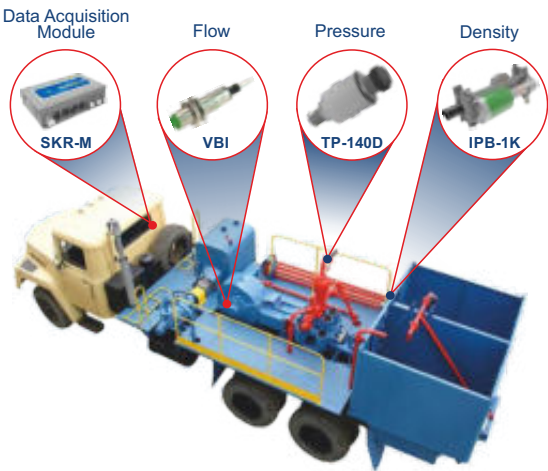
- Record and storage in non-volatile memory;
- Data transfer to remote server via GSM;
- Power supply from the track's power system.

Logged variables

- Mud Consumption
- Mud density;
- Pressure;
- Total mud volume;
- Date and time of works.

Technical characteristics

Power Supply, V	20-36
Power consumption, W, no more	30
Pressure, MPa	40
Number of electroluminescent screen lines	4



Mud Monitoring System DEL-150 (SKR-2)

DEL-150 (SKR-2) System is intended to control mud parameters while well workover and wireline operations. The Systems allows to store and wireless data transfer.



Logged variables

DR-150 Configuration:

- Mud Consumption
- Total Mud Volume.

DDR-150 Configuration:

- Mud Consumption;
- Total Mud Volume;
- Pressure;
- Mud temperature.

DDRP-150 Configuration:

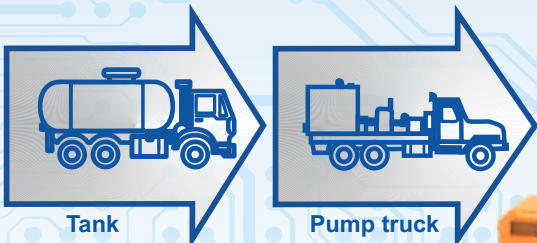
- Mud Consumption
- Mud density;
- Pressure;
- Mud temperature;
- Total Mud Volume;
- Date and time of works.

Capabilities

- Separate Display/Control Module;
- Capability to connect to DEL-150 System;
- Data transfer to to remote server via GSM;
- Data storage in non-volatile memory;
- Power supply from the track's 24V DC power system;
- Sensors configuration based on the Customer's requirements.

Technical characteristics

Power supply range, V	20-36
Power consumption, W, no more	30
Pressure, MPa	40
Number of electroluminescent screen	4



Mud Monitoring System DEL-150 (SKR-2)

DR-150 Configuration includes:

- Flow Sensor



DDR-150 Configuration includes:

- Pressure sensor;
- Flow Sensor.



DDRP-150 Configuration includes:

- Pressure sensor;
- Flow Sensor;
- Density sensor.



Logged variables while connecting to Control Module MU-150

- Mud Consumption
- Mud density;
- Pressure;
- Mud temperature;
- Total Mud Volume;
- Date and time of works.

Technical characteristics

Communication interface	RS-485
Communication protocol	Modbus
Ex marking	1ExdIICT6X
Pressure, MPa, max	40
Fluid viscosity, m ² /s	5x10 ⁻⁶

Flow Sensor

Parameter	Minimum	Maximum
Flow Measurement Range	2,1 m ³ /h (0,6 l/s)	65 m ³ /h (17 l/s)

Pressure Sensor

Max pressure measurement, kgf/cm ³	400
Min pressure measurement, kgf/cm ³	0,1
Accuracy, %FS	1,5

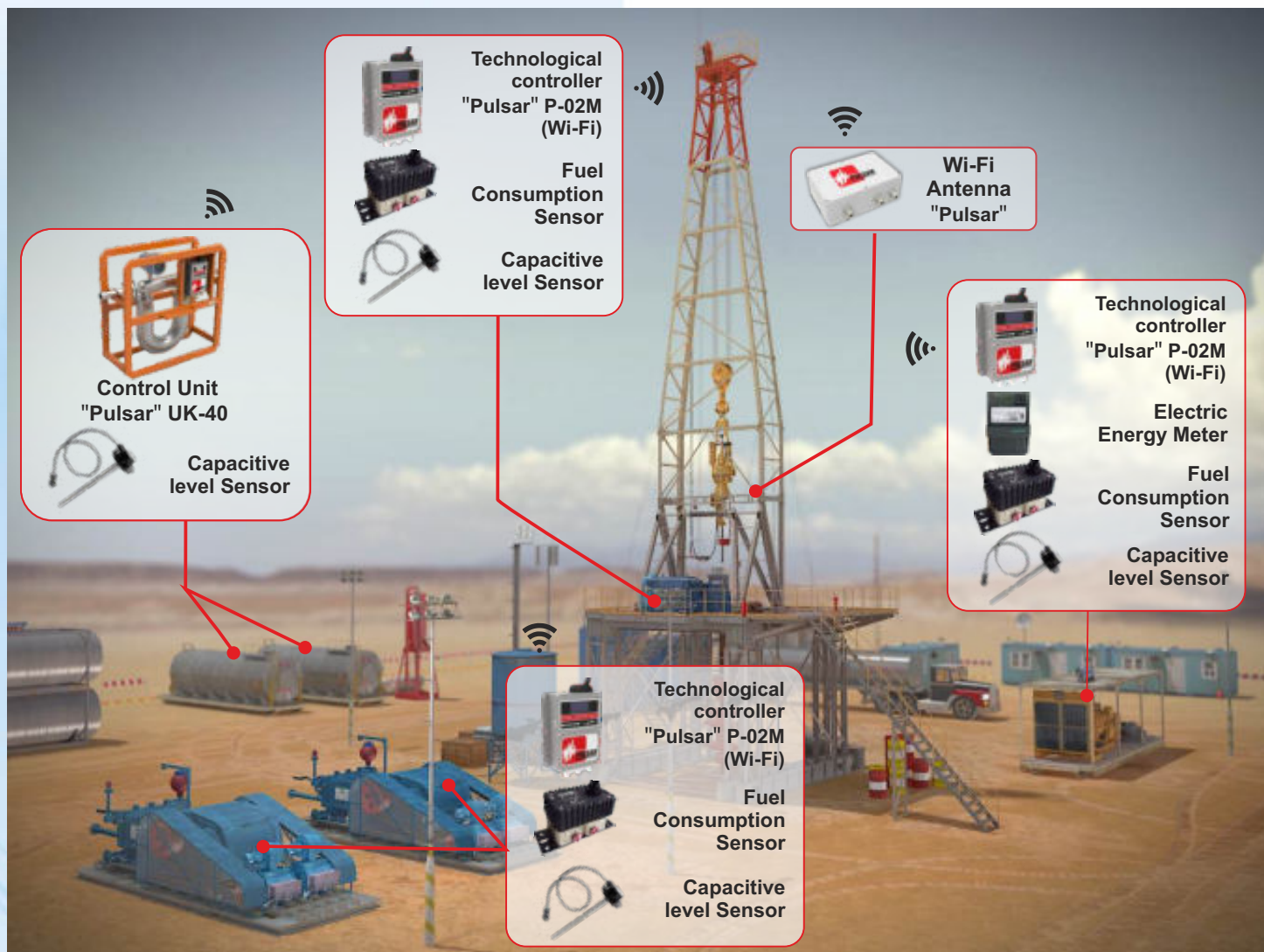
Density Sensor

Density Measurement Range, kg/m ³	600-2200
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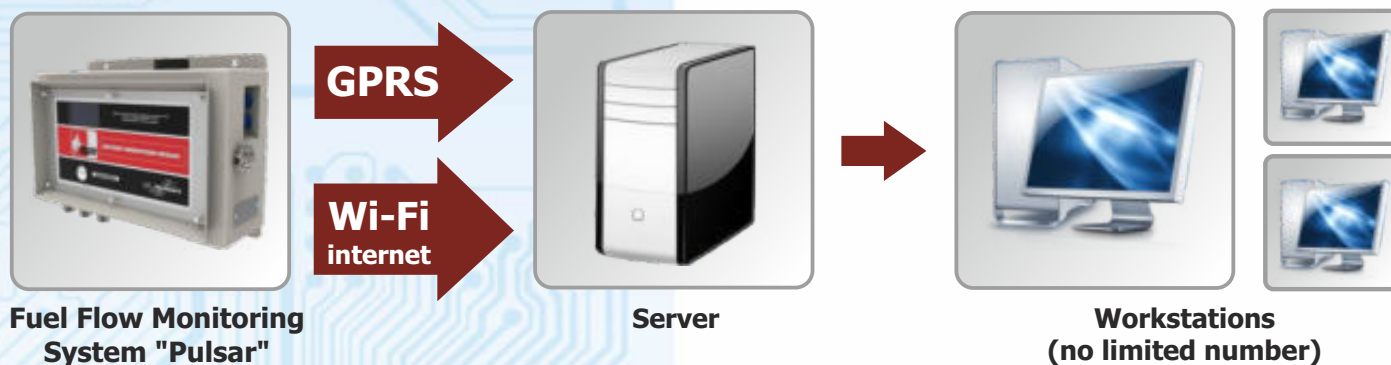
Fuel Flow Monitoring System "Pulsar"

The "Pulsar" System is a software and hardware complex designed to optimize operational control processes of fuel consumption by consumers and in above-ground storage tanks.

Connection layout (Wi-Fi)



Connection Server



Fuel Flow Monitoring System "Pulsar"

Technological controller "Pulsar" collects information about the current parameters, writes to dynamic memory and sends data to the remote Server "Pulsar".

The controller has an indication board that reflects current fuel level in tanks.

Data is transferred to the Server via GSM communication or via Wi-Fi channel. Additionally satellite transmission module IRIDIUM can be installed.

The controller is connected to sensors with a cable line up to 120 m. The controller supports up to 16 capacitive Level Sensors with RS-485 output signals, and up to 8 analog discrete sensors.

Wireless connection is established with 848 MHz and up to 1000 m line-of-sight range.

Controller R01



Controller R01M (Compact)



Technical characteristics

	R01	R01M
Avg. power, W	1,6	1,6
Digital-to-analog converter effective number of bits	10	10
Number of analog discrete and pulse-frequency inputs	8	8
Number of discrete outputs	4	4
Digital interfaces	1-Wire, CAN, USB, RS-232, RS-485	
Integrated battery, mA	Li-Ion. 600	Li-Ion. 600
GLONASS module	MGGS2217	MGGS2217
GSM modem	GSM 900/1800	GSM 900/1800
Data link	GPRS/SMS	GPRS/SMS
Antenna type (GLONASS, GSM)	external	external
PC interface	USB 2.0	USB 2.0
Internal memory	flash memory: up to 58.000 data points, microSD card: up to 5.000.000 data points	
MicroSD card included, Gb	4	4
Supply Voltage, V	9-39	9-39

Functionality

- Fuel level (liquid volume) monitoring;
- Fuel consumption monitoring over a specified period;
- Fuel consumption rate monitoring;
- Fuel consumption hours of operation monitoring;
- Oil pressure monitoring;
- Coolant temperature monitoring;
- Active and reactive AC power;
- Power consumption monitoring.

Fuel Flow Monitoring System "Pulsar"

MBS 3000 Pressure Sensor



Mercury 230ART Electric Energy Meter measures active and reactive electric power in 3 phase, 4-wire 50Hz AC grids with measuring transformers. It also registers energy losses and transmits the current and history readings over digital channels and other interfaces.



The sensor measures fluid pressure. The enclosure is made of acid resistant stainless steel. Laser calibration, built-in temperature adjustment, interference immunity compliant with EC EMC.

Technical characteristics

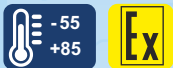
Measured environment	air, gas, liquids
Pressure type	absolut / manom
Measurement range, bar	from 0-1 to 0-600
Measured environment temperature range, °C	from -40 to +80
Accuracy, %FS	≤ +0,5
Additional error depending on ambient temperature, %FS / 10 °C	≤ +0,5
Output signal, V	0-10
Power Supply, V	15-30

Technical characteristics

Power metering accuracy class	Active: 0,5S or 1,0 Reactive: 1,0 or 2,0
Rated power supply, V	3*57,7/100 or 3*230/400
Rated (max.) current, A	5(7,5); 5(60); 10(100)
Max current for 0,5 sec - for Irated = 5 A - for Irated = 10 A	150 A 200 A
Starting current (sensitivity), A - for Irated(max)=5(7,5)A, Urated =57,7 or 230V - for Irated(max)=5(60)A, Urated =230V - for Irated(max)=10(100)A, Urated =230V	0,005 0,020 0,040
Active / apparent power of each meter's circuit, W/VA, no more	0,5 / 7,5
Max apparent power in the current circuit, VA, no more	0,1
Number of peak/offpeak rates	4
Number of season rates (months)	12
Primary / calibration output ratio, pulses/kW, pulses / kVAR: - ART-00 (Urated 57,7 V, Irated 5 A) - ART-01 (Urated 220 V, Irated 5 A) - ART-02 (Urated 220 V, Irated 10 A) - ART-03 (Urated 220 V, Irated 5 A)	5000 / 160000 1000 / 32000 500 / 16000 1000 / 160000
Calibration interval, years	10
Weight, kg, no more	1,5
Dimensions, mm	258x170x74

Fuel Flow Monitoring System "Pulsar"

Capacitive Level Sensor detects filling level of light oil products in tanks (storage tanks). Applies in automotive technology as fuel level meter, in industry as a level meter for any light oil products. The Sensor converts calculated fuel level into digital code.



Level Sensor U-150
U-150 is ultrasonic level sensor required for measurement of different types of fluids including explosive areas.



Capabilities

- The sensor can be configured via a digital interface (RS-232, RS-485), analog or frequency.

Design features

- Can be shortened in the field up to 150 mm.

Technical characteristics

Power supply, V	8-45
Short-term overvoltage protection, V	up to 80
Power consumption, W, no more	0,3
Measurement period, sec	1
Measurement results filtering time range, sec	2-225
Accuracy, %FS	0,1
Additional error depending on ambient temperature in a working range, %FS, no more	1

Capabilities

- Explosion-proof protection;
- Capabilities for wireless communication.

Design features

- Contactless measuring of liquid level;
- Light plastic enclosure.

Technical characteristics

Measuring range, m	0,3-3
Accuracy, %FS	1
Maximum input voltage, V	28
Maximum input current, AC	0,5
Communication interface	RS-485
Communication protocol	Modbus
Ex marking, IEC	1ExibIIBT5Gb
Ex marking, ATEX	II2GExibIAT3Gb
Calibration interval, months	24
Dimensions, mm - with support - without support	Ø 85x195 Ø 160x425

Fuel Flow Monitoring System "Pulsar"

Control Unit "Pulsar" UK-40

is based on a multivariable Coriolis. This is innovative equipment designed for direct measurement mass flow, density and temperature of high-viscosity and aggressive liquids, gases, pulps and oils, calculations volume flow, mass and volume, scaled density/volume flow (water cut oil) in systems of commercial and technological accounting.

UK-40 consists of a Coriolis flowmeter, a controller for collecting and transmitting data to the server. Working with data is carried out using the Pulsar software.



Fuel Consumption Sensor Eurosens Delta

Differential fuel consumption sensors Eurosens Delta is designed to measure fuel consumption of diesel engines or other consumers in the range from 1 to 1500 liters per hour without changing the fuel supply scheme.

Delta flowmeters have a wide range of modifications, depending on maximum fuel consumption through the sensor (100, 250, 500 liters per hour), display or type output interface. They are an officially approved measuring instruments for commercial metering of diesel fuel consumption.



Technical characteristics

Measured environment	liquid gas liquefied gas
Accuracy, %	When measuring the flow of liquid: ±0,1; ±0,15; ±0,2; ±0,25; ±0,5 When measuring gas flow: ±0,35; ±0,4; ±0,45; ±0,5; ±0,75 When measuring temperature: ±1 When measuring density, kg/m³: ±0,3; ±0,5; ±1,0
Dimensions	from 10 to 200 mm
Measured environment pressure	up to 6,3 MPa, up to 25 MPa (special order)
Measured environment temperature	from -60 °C to +200 °C
Output signals	analog current 4-20 mA impulse RS-485 Modbus HART
Ex marking	1Exdb [ib] IIA/IIB/IIC T6 Gb X (electronic unit) 1Ex ib IIA/IIB/IIC T6...T1 Gb X (sensor)
Interval between verifications	5 years

Advantages:

- Minimum pressure loss;
- Reducing the possibility of cavitation;
- Resistance to vibrations of industrial frequencies.

Technical characteristics

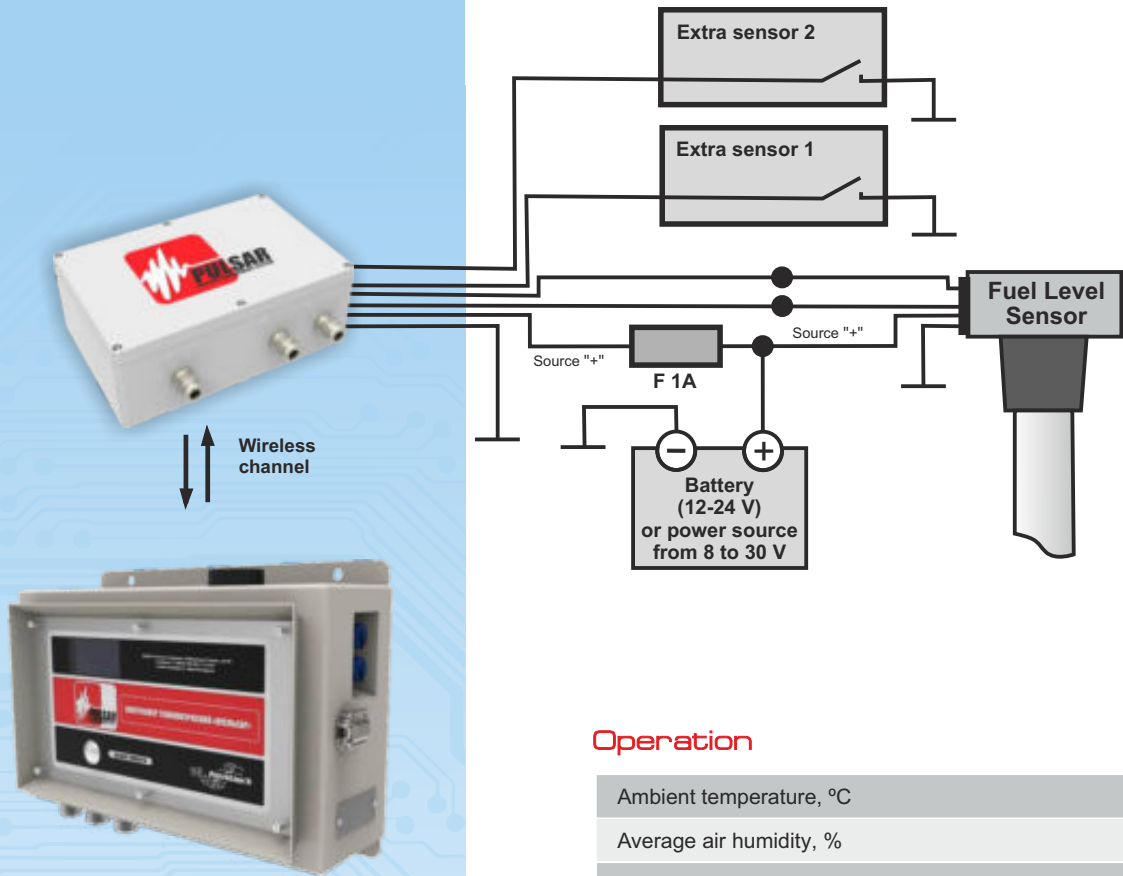
Connecting thread	M14x1,5 (M16x1,5 for Delta 500)
Supply voltage, V	10-50
Reverse polarity protection	Yes
Max pressure, MPa	2,5
Maximum flow, l/h*	1-1500
Output interface*	impulses, RS-232/485, CAN

**Depending on version Important: Engine fuel consumption — only part of the fuel that is pumped in the supply and return fuel pipes.*

Fuel Flow Monitoring System "Pulsar"

Radio Extender

Radio extender is aimed to control data and measure of output signal frequency from fuel level sensor, result transfer via wireless channel.



Technical characteristics

Supply voltage, V	8-39
Power consumption of radio receiver, W, no more	0,01
Power consumption of radio transmitter, W, no more	0,02
Frequency measurement Input "F" parameters (for radio signal transmitter). Input type – closing to "Ground"	
Frequency, Hz, min	1
Frequency, Hz, max	3000
Current (voltage 12 V), mA, no more	16
Current (voltage 24 V), mA, no more	32
Time of frequency measuring, sec	1-10
Discrete Input "E" parameters (for signal transmitter). Input type - closing to "Ground"	
Current (voltage 12 V), mA, no more	16
Current (voltage 24 V), mA, no more	32
Frequency measurement Output "F" parameters (receiver). Output type – closing to "Ground"	
Frequency, Hz, min	1
Frequency, Hz, max	3000
Signal type	Squarewave
Voltage, V, max	100
Current, mA, max	100

Operation

Ambient temperature, °C	from -40 to +50
Average air humidity, %	30-80
Atmospheric pressure, kPa	84-106,7

Discrete Output "E" parameters (for radio signal receiver). Output type - closing to "Ground"	
Voltage, V, max	1
Current, mA, max	3000
Interface parameters RS-232 (RS-485)	
Baud rate, bit/sec	300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200
Wireless channel parameters	
Radio signal frequency, MHz	868
Transmission range in open space, m, no less	300
Address range for device identification by wireless channel	0-65534
Other parameters	
ATBF in operation, h, no less	30000
Average life time, years, no less	6
Ingress protection of signal receiver and transmitter by GOST 14254-96	IP67
Dimensions, mm	83x57x25
Weight, kg, no more	1,15

Fuel Flow Monitoring System "Pulsar"

Fuel Flow Monitoring System "Pulsar" Software


Capabilities

- User distribution over the sites based on the company structure;
- Monitored site distribution across departments and teams;
- Various forms of reports;
- Logging:
 - daily;
 - by shift.
- Various sensor types supported:
 - fuel level sensors;
 - equipment sensors;
 - temperature, strain, load, pressure, rpm sensors;
 - GPS/GLONASS receiver.
- Maintenance of regulations and control of the maintenance of equipment;
- Viewing the current state of the object;
- Web version of software.

Fuel level and consumption rate diagram



Fuel report

A	B	C	D	E	F	G	H	I	J	
1	 Отчет по топливу									
2	за период с 28.07.2014 00:00 по 30.07.2014 00:00									
3										
4		Владелец:	Буровая бригада Галлямова Л.Л.							
5		Наименование:	Буровая бригада Галлямова А.Г.							
6		Подразделение:								
7		Группа:								
8										
9	№ п/п	Емкость	Остаток на начало периода [л]	Остаток на конец периода [л]	Заправка [л]	Слив [л]	Расход [л]	Оборудование	Время работы [час]	Средний расход [л/час]
10	1	Емкость ГСМ	8 988	5 955	0	0	3 033			-
11	2	МБУ (CAT C15)	741	462	917	0	1 213	МБУ (CAT C15)	37.4	32.4
12	3	Насос буровой (CAT 3412)	267	539	1 873	0	1 653	Насос буровой №1 (CAT 3412) Насос буровой №2 (CAT 3412)	24.0 23.9	-
13		ИТОГО:	9 995	6 955	2 790	0	5 900			
14										
15										
16										
17										
18										

Automated Diesel Fuel Metering System ASUDT "Pulsar"

The Automated diesel fuel metering system "Pulsar" has been designed to track the movement of diesel fuel, as well as maintaining reports and analytics of costs at industrial facilities, which allows the Customer to keep accurate records of diesel fuel.



Capabilities

- Assessment of quality, volume, mass of fuel online and offline;
- Recording volume, weight, density, temperature of the fuel when refueling tanks/fuel storage;
- Pumping fuel to consumers (DGU, drilling pump/unit, boiler house, steam generator plant) after the fuel tanker drains the contents;
- Send data from ASUDT "Pulsar" to the Customer's server with the help by a specially developed RPE "Petroline-A" controller "Pulsar";
- Detailed tracking of the movement of fuel in a mobile park.

Design features

- Automated control system "Pulsar" is mounted in a sea container.

System composition

- High performance fuel pumps;
- Filtration systems;
- Mass flow sensors;
- Gas concentration sensor;
- Fuel station;
- Flame arresters;
- Fire extinguishing systems;
- Heating system;
- Forced ventilation system;
- Other auxiliary elements.

Technical characteristics

Efficiency, m ³ /h	≤ 30
Pressure, m	20
Filtration fineness, microns	100
Accuracy class, %	0,5
Dimensions, m	6,0x2,4x2,5
Net weight, kg, no more	5000
Connector type	Flanged GOST 12815-100
- input, mm	Ø 100
- output, mm	Ø 50

Also, execution according to the Customer's specification is possible.



Certification

ISO 9001:2015

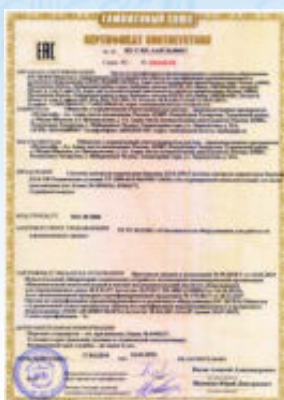
Accreditation certificate for the right to verify measuring instruments



ATEX EX-Certificates



DEL-150 Systems



Display Modules



Control Modules



MV-150 EX-Monitors



Gas Sensors GSV-1



**VOV-150 EX-CCTV
Cameras**



Level Sensors U-150



**Load Sensors DN-130(R),
DN-130V(R)**



Annunciators OK-150



**Pressure Sensors
TP-140D(R), DN-140D(RM)**



**Signal Transducers PS-150,
PS-150R, PS-150RA**





The Russian Federation



Gas Sensors GSV-1



Load Sensors DN-130



Load Sensors
DN-130V



Level Sensors U-150



Pressure Sensors
TP140D, TP-140D(M)



The Republic of Azerbaijan



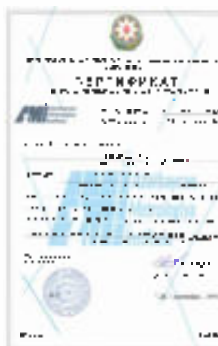
Gas Sensors GSV-1



Load Sensors DN-130



Load Sensors DN-130V



Level Sensors U150



Pressure Sensors
TP140D, TP-140D(M)



The Republic of Belarus



Gas Sensors GSV-1



Load Sensors DN-130,
DN-130(A), DN-130(R)



Load Sensors
DN-130V



Level Sensors U-150



Pressure Sensors
TP140D, TP-140D(M)



The Republic of Kazakhstan



DEL-150 Systems



Gas Sensors GSV-1



Load Sensors DN-130,
DN-130(A), DN-130(R)



Load Sensors
DN-130V



Pressure Sensors
TP140D, TP-140D(M)



The Kyrgyz Republic



**Load Sensors DN-130,
DN-130(A), DN-130(R)**



**Pressure Sensors
TP-140D, TP-140D(M)**



Turkmenistan



Gas Sensors GSV-1



**Load Sensors DN-130,
DN-130(A), DN-130(R)**



Load Sensors DN-130V



**Pressure Sensors
TP-140D, TP-140D(M)**



The Republic of Uzbekistan



Gas Sensors GSV-1



**Load Sensors DN-130,
DN-130(A), DN-130(R)**



Load Sensors DN-130V



**Pressure Sensors
TP-140D, TP-140D(M)**



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The image shows a full-page template for notes. It has a blue background with a subtle circuit board pattern. A dark blue header at the top contains the text "For Notes" in white. The main body of the page is filled with horizontal lines for writing. At the bottom, a dark blue footer contains the text "e-mail: main@pla.ru, www.pla.ru" in white.

For Notes

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