Globaltech Group Oy

Installation Instructions

for the Equipment Set “The On-Board System of Weighing and Controlling the Axle Load of Trucks
GTscales-XX”

2019

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1 Introduction

These instructions specify the installation procedure for the equipment set “The On-Board System of Weighing and Controlling the Axle Load of Trucks GTscales-XX” (hereinafter – the System). Before you start the installation of an equipment set, it is strongly recommended to read carefully these instructions. Do not allow untrained staff to install, configure, and calibrate the equipment set. To obtain the adjusted characteristics and ensure the proper functioning of the equipment set, you should strictly adhere to the provisions of these installation instructions.

2 Equipment Set Description and Operation

2.1 Intended Use

The equipment set of controlling the axle load of trucks is designed for static and dynamic weighing of trucks, trailers, semi-trailers (including tanks), road trains, containers, as well as any large-sized objects, the dimensions and design features of which enable the installation and connection of pressure sensors to pneumatic line/contour of rolling lobe and sleeve air springs.

GTscales-XX allows at any time to determine the loads on each axle, net weight of cargo and the entire road train, immediately notify if the permissible axle load is exceeded, and transfer these data to the remote monitoring system based on GPS/GLONASS satellite navigation systems.

2.2 General Information

The basic equipment set consists of the following main units: driver display (display unit), switching (main) unit, one truck pressure sensor unit (connection of 1or 2 contours), one semi-trailer pressure sensor unit (connection of 1or 2 contours). Additional: cables with connectors to connect units (9 meters and 21 meters); two sockets “tractor-trailer/semi-trailer truck”, one interconnect coiled cable “tractor-trailer/semi-trailer turck” with connectors. Depending on the delivery option, an equipment set may include: a tracker unit (GPS/GLONASS/GSM module/RS485 interface support (at least 10 LLS fuel level sensors)); up to two additional truck pressure sensor units (connecting between 1 and 4 additional contours), up to two additional semi-trailer pressure sensor units (connecting between 1 and 4 additional contours), pneumatic tubes, cables with connectors to connect units, plastic quick-release collet fittings.

The pressure sensor readings are transmitted to the switching (main) unit. The switching unit transfer the received information to the color touch screen in the driver's cab or to an Android smartphone via Bluetooth (there is a need to additionally purchase a USB Bluetooth adapter) showing the current values of loads on each axle of a heavy

vehicle, the weight of cargo transported, the weight of entire vehicle, the overload indication of each truck axle. The data from the switching unit are transmitted to the web server through the tracker unit connected to the Internet and web server. An authorized web server user can see the following information: the static and dynamic axle load of heavy vehicles, the weight of cargo transported, GPS monitoring, speed, travel time, statistical reports and other information depending on the access rights to the web server and equipment specifications.

3 Safety Precautions

Before installing an equipment set, read this instruction manual carefully. Keep it easily accessible so that you can use for future reference. Improper installation of an equipment set, wrong connection of devices and equipment may lead to electric shock, short circuit, air leaks in pneumatic lines/contours, vehicle breakdown, fire and other damage. Make sure that you use materials and equipment, which meet the manufacturer's requirements (specifications). Only qualified personnel are allowed to install the equipment. In case of any doubts concerning the installation or operation of the equipment set, please refer to your local dealer for more information and advice.

4 Equipment Set Components

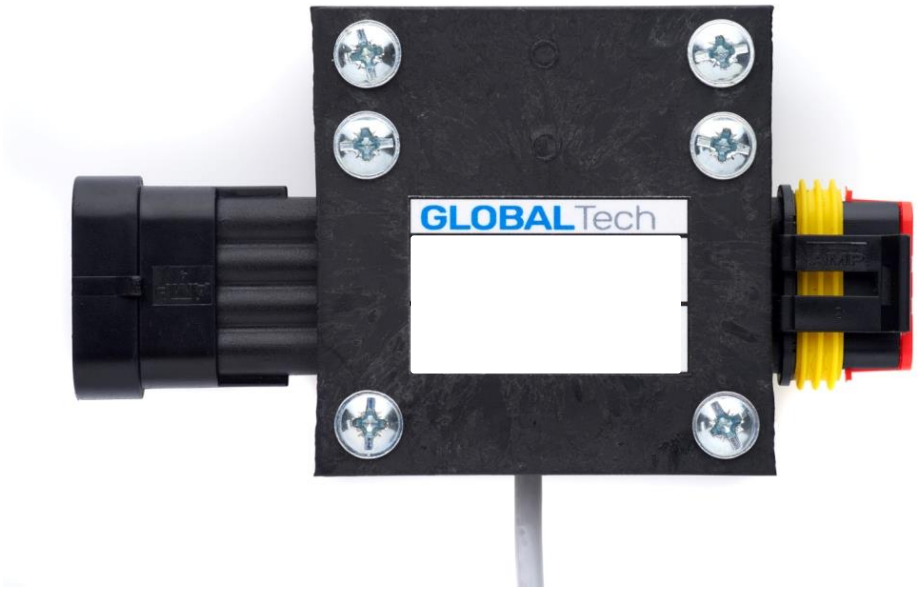
Equipment Delivery Set

Table 1

Item No.	Name	Quantity
1	2	3
	Delivery Set:	
1	Pressure sensor unit, pcs.	2
2	Switching (main) unit, pcs.	1
3	Driver display (display unit), pcs.	1
4	Passport	1
5	Installation Instructions	1
	Optional Equipment:	
6	7-pin socket, pcs.	2
7	Interconnect coiled cable "tractor-trailer/semi-trailer truck" with connectors, kit	1
8	Pressure sensor unit, pcs.	1-4
9	Interconnect cable with connectors, pcs.	1-4
10	Tracker unit, pcs.	1

Basic Equipment Set “The On-Board System of Weighing and Controlling the Axle Load of Trucks GTscales-XX”

Picture1 Pressure Sensor Unit



Picture 2 Switching (Main) Unit

Picture 3 Driver Display Example (Display Unit)

Picture 4 Tracker Unit Example

Picture 5 7-Pin Socket

Picture 6 Interconnect coiled cable “tractor-trailer/semi-trailer truck” with connectors

5 Equipment Set Specification

Table 2

Item No.	Feature	Value
1	2	3
1	Connection interface of the switching (main) unit to the tracker	RS 485
2	Display unit connection interface	USB
3	Bluetooth Adapter connection interface (certain models only)	USB
4	Non-volatile memory of each unit of the equipment set (display unit: date and time are exceptions)	Yes
5	Tractor axle number setting	Yes
6	Semi-trailer axle number setting	Yes
7	Sensor number setting on an axle	Yes
8	Pressure sensor calibration	Yes
9	Pressure sensor thermal compensation	Yes
10	Minimum pressure measured by sensors, kPa	0
11	Maximum pressure measured by sensors, kPa	1000
12	Maximum allowable pressure value in a sensor, kPa	4000
	Pressure measurement period, sec.	not more than 1
13	Pressure sensor number per unit, pcs.	2

14	Minimum number of connected sensor units, pcs.	1
15	Maximum number of sequentially connected sensor units, pcs.	6
16	Automatic display of trailer/semi-trailer connection information and calculation of axle load	Yes
17	Possibility to read the fuel level sensor values over RS485 interface (LLS)	Yes
18	Display of information about the level of fuel sensors	Yes
19	Accounting the FLS data in cargo net weight calculations	Yes
18	Switching unit dimensions, WxHxD, mm	not more than 120x43x67
19	Switching unit weight, gr	not more than 100
20	Pressure sensor unit dimensions, WxHxD, mm	not more than 120x43x67
21	Pressure sensor unit weight, gr	not more than 150
	Display:	
20	Resolution, dpi	320 x 240
21	Diagonal, inch	2,4
22	Color display	Yes
23	Number of colors	65536
24	Sensor type	resistive
25	Display type	TFT LCD
26	Display unit dimensions, WxLxD, mm	not more than 120x43x67
27	Average life cycle, years.	at least 7
28	Operating temperature	from – 40ºC to +70ºC
29	Equipment set constant voltage, Volt	from +10 to +40
30	Equipment set maximum current consumption, mA	not more than 1100

6 List of Used Materials and Tools

The following materials are required to carry out the installation:

– 300 mm long nylon cable ties for outdoor use;

– mounting kit (hexagon set screw (DIN933, M8x30, full thread, zinc plated) or cheese-head screw (DIN7985, M8x30, full thread, zinc plated), lock washer

(DIN127, M8, spring, zinc plated) and nut (DIN934, M8, hexagonal, zinc plated)) – 4 kits;

- Interconnect coiled cable “tractor-trailer/semi-trailer truck” with connectors – 1 kit;
- pneumatic tube, 6 mm outer diameter, UV resistant and designed to be used in the temperature range from – 50ºC to + 100ºC;
- plastic fittings;
- multicore cable metal ferrules – 8 pieces;
- protective spiral tube (made of high density polyethylene; a good solution to protect the tubes from damage in places of hazardous contacts. Quick installation on both one tube and tube bundle at the same time. Material is highly friction resistant and UV resistant);
- electrical tape or heat shrink tube.

The following tools are required to carry out the installation:

- 3 m conductor;
- nipper;
- electric drill;
- 45 mm metal crown;
- PH-2 cross screwdriver;
- SL-2 flat screwdriver;
- cable stripping tool;
- electrical tester;
- crimper (cable core ferrules crimping);
- stripper (cable stripping tool).

7 Equipment Set Installation Diagram

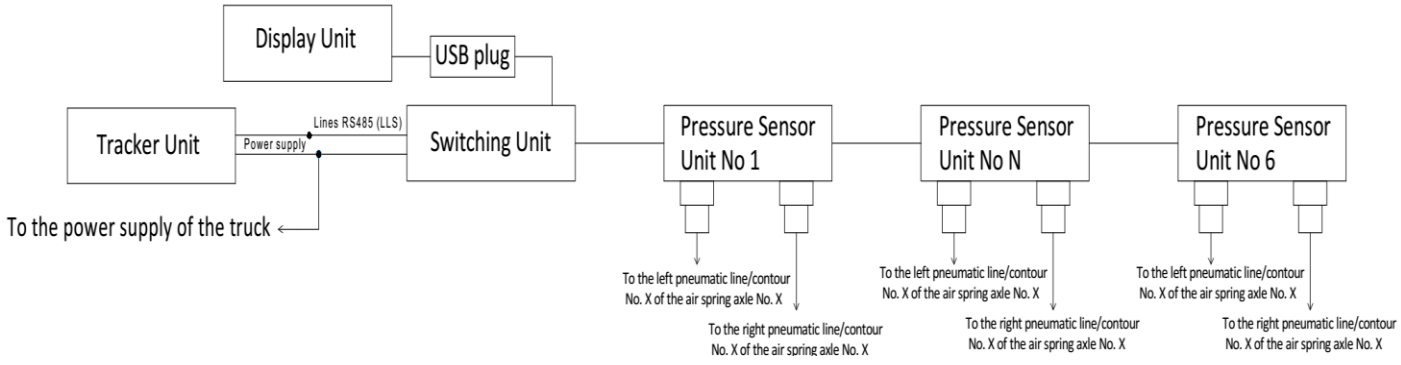
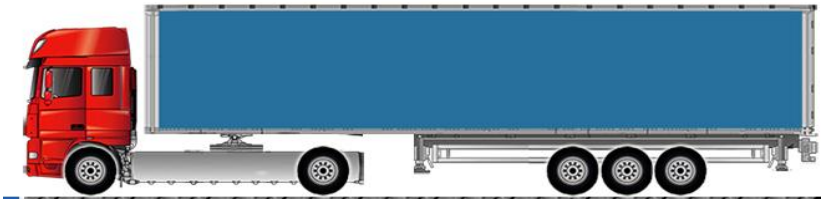


Diagram of Connecting Units to Each Other

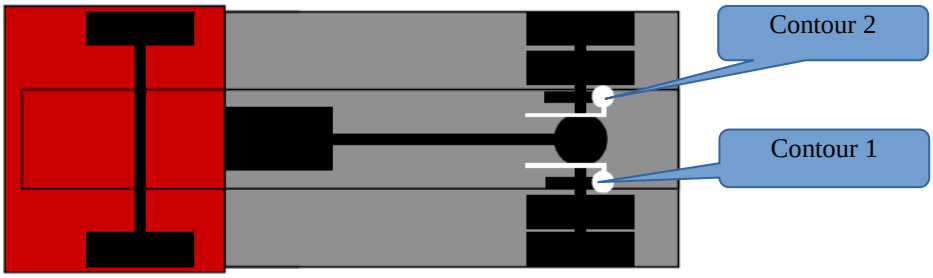
Below there is an example of the equipment set installation on a semi-trailer (3 axles) truck (2 axles).



Axle number 1 2 3 4 5

Conventional Truck Top View

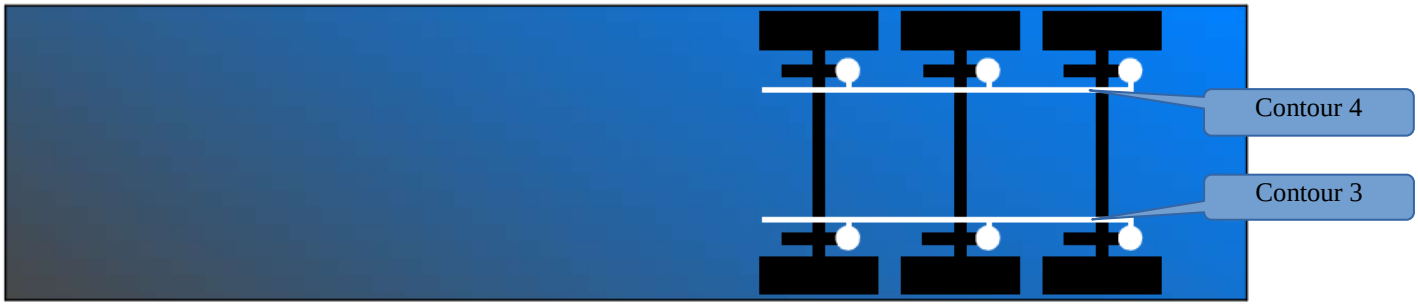
Right side



Axle number: 1 Left side 2

Conventional Semi-Trailer Top View

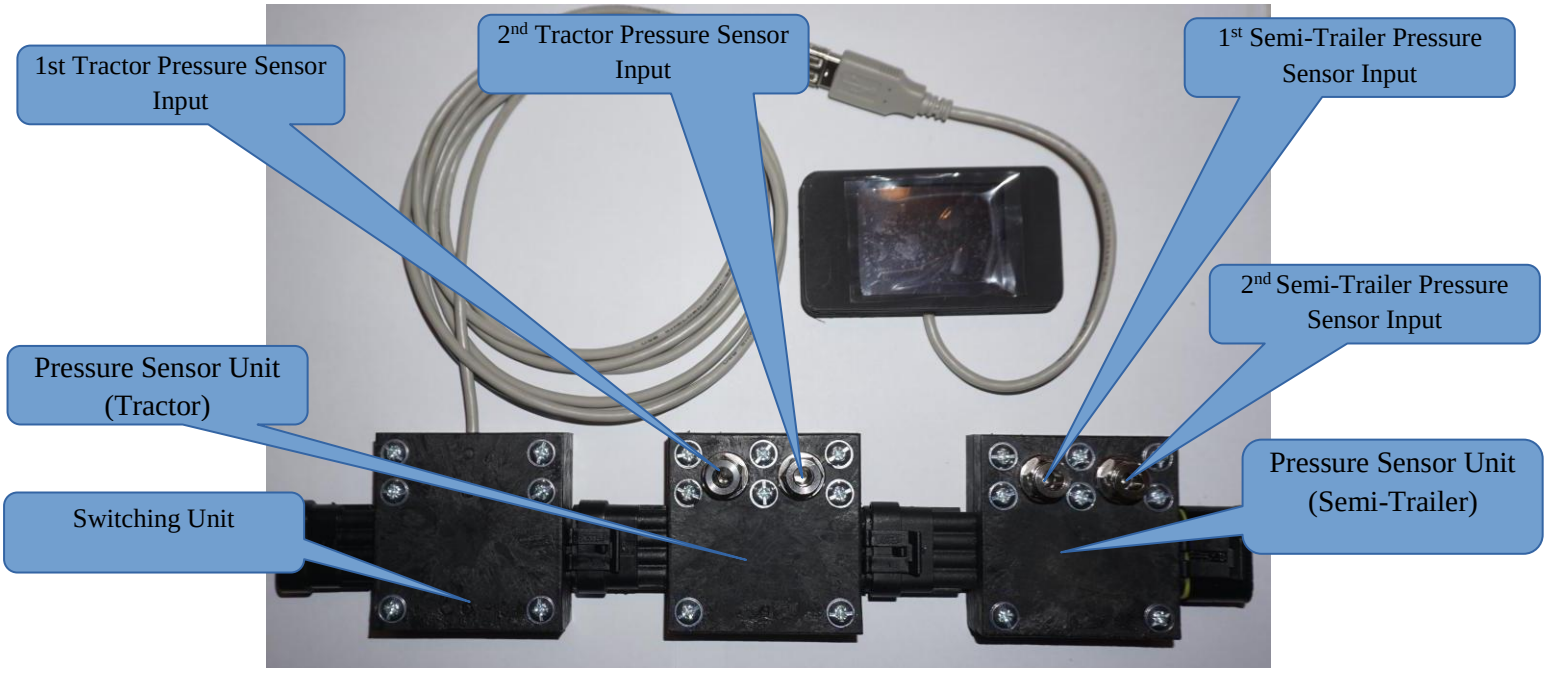
Right side



Axle number: Left side 4 5 6

A semi-trailer has 2 pneumatic contours: the first is on the left side and the second on the right side. Considering the installation diagram of pneumatic contours to pneumatic cylinders along the semi-trailer axles, we select the axle to connect pressure sensors. We have to select one of semi-trailer axles: the 3rd, 4th or 5th. For example, let's choose the 4th axle.

Pressure sensors shall be connected to the pneumatic contours of the 2nd and 4th axles. The loads on the other axles (the 1st, 3rd, and 5th) shall be calculated using mathematical formulas. Axles, contours and pressure sensors shall be numbered from bottom to top and from left to right, as shown in the picture above.



Scheme: The numbers of pressure sensors and connecting the pressure sensor unit switching cable

The pressure sensor unit shall be connected to the tractor and semi-trailer pneumatic contours in accordance with the table below.

Item No.	Pressure Sensor Unit Installation Location	Unit No.	Pressure Sensor No.	Tractor/Semi-Trailer Axle No.	Pneumatic Contour Number/Side
1	Tractor	1	1	2	1/left
2	Tractor	1	2	2	2/right
3	Semi-trailer	2	1	4	3/left
4	Semi-trailer	2	2	4	4/right

If the number of pressure sensor units needs to be increased, connect the units with each other using standard connectors and continue the numbering of pressure

sensors. Below there is an example of numbering pressure sensors for a 4-axle tractor. The sensor numbering for semi-trailers shall be performed in the same way.

Item No.	Pressure Sensor Unit Installation Location	Unit No.	Pressure Sensor No.	Tractor/Semi-Trailer Axle No.	Pneumatic Contour Number/Side
1	Tractor	1	1	2	1/left
2	Tractor	1	2	2	2/left
3	Tractor	2	3	3	3/left
4	Tractor	2	4	3	4/right
5	Tractor	3	5	4	5/left
6	Tractor	3	6	4	6/right

Install the equipment set in accordance with the installation diagram.

8 Equipment Set Installation

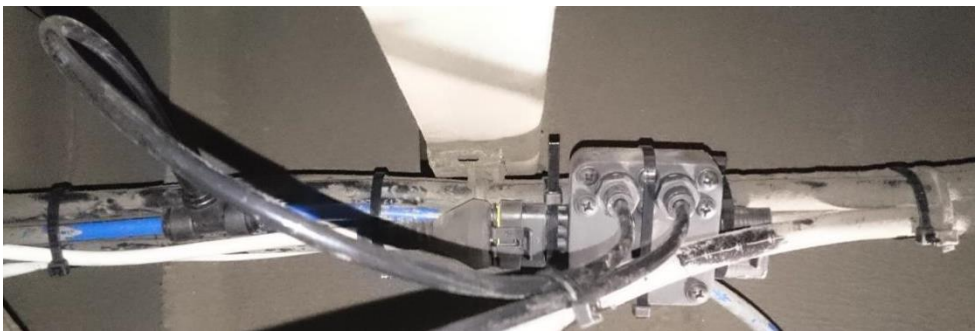
8.1 Installing a Pressure Sensor Unit on Trucks (Trailers and Semi-Trailer Trucks)

Choose the location of pressure sensor unit installation close to the electrical power line of a truck (trailer, semi-trailer truck).

The location of unit installation shall be selected in accordance with the following requirements:

- easy access to the installation location;
- exclude the possibility of direct impingement of dirt, water, foreign objects (stones, boards, sand, metal objects, etc.) on the unit during driving;
- install no closer than 300 mm from the cooling/air conditioning lines; no closer than 300 mm from the heating elements of a vehicle;
- don’t install a pressure sensor unit above the heating elements of a vehicle (exhaust system);
- don’t install a pressure sensor unit under the cooling/air conditioning lines, etc.;
- don’t install a pressure sensor unit in the vicinity of moving parts that can damage it.

Using three nylon cable ties, fasten the pressure sensor unit to the installation location according to the picture. If necessary, prepare and mount a platform for fastening the unit.



1.1 Connecting a Pressure Sensor Unit to the Pneumatic Line/Axle Contour

Before starting installation work, release the pressure from the vehicle pneumatic line/axle contour to atmospheric pressure.

Using fittings (tee fittings, corner fittings, transition fittings, etc.) the unit shall be connected to air springs through the pneumatic feed tubes with an outer diameter of 6 mm. The pneumatic tube connected to the pressure sensor unit shall have an outer diameter of 6 mm. Depending on the type of vehicle pneumatic systems, pneumatic tubes of different outer diameters and various ways can be used for connecting to the pneumatic lines/axle contours.

The first connection option is a tie-in into the pneumatic tubes of pneumatic line/axle contour.

The second option is to install a fitting in the air spring.

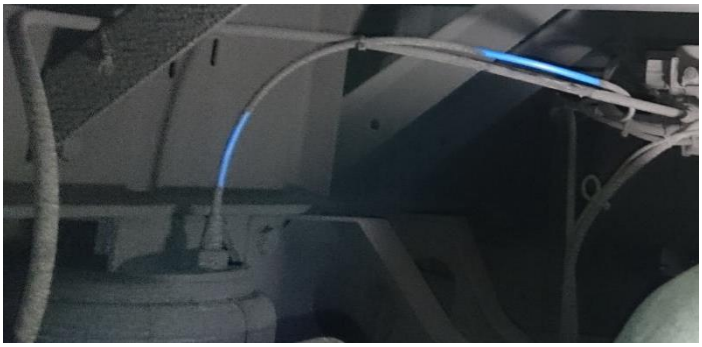
Choose the desired connection option. Before starting installation work, make sure that you've selected a proper fitting for connecting to the pneumatic line/contour. If necessary, buy a special fitting required to connect a pressure sensor unit. High-strength plastic fittings are recommended to be used.

Lay the pneumatic tube with a diameter of 6 mm from the pressure sensor unit to the mounted fitting. Fix the pneumatic tube using nylon ties in increments of not more than 300 mm. Choose the laying route pursuant to the following requirements:

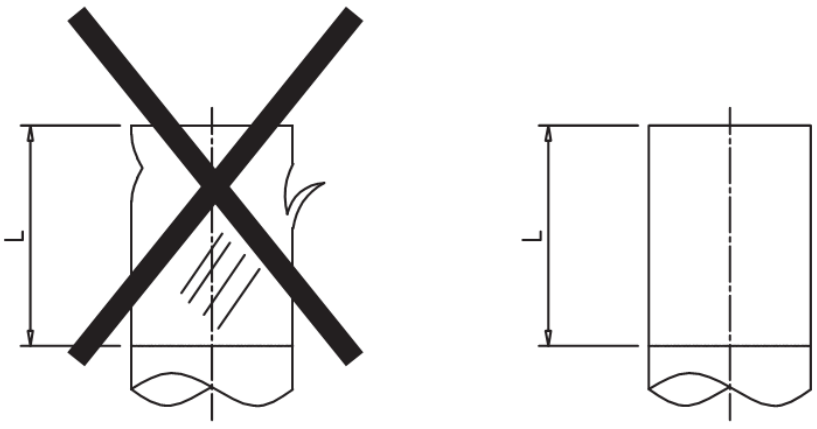
- ensure a bend radius of at least 50 mm for the pneumatic tube;
- exclude the possibility of direct impingement of dirt, water, foreign objects (stones, boards, sand, metal objects, etc.) on the unit during driving;
- lay no closer than 300 mm from the cooling/air conditioning lines; no closer than 300 mm from the heating elements of a vehicle;
- don’t lay above the heating elements of a vehicle (exhaust system);
- don’t lay under the cooling/air conditioning lines, etc.;
- don’t lay in the vicinity of moving parts that can damage pneumatic tube.

Consider, for example, the tie-in option into the vehicle pneumatic line/axle contour.

Select a straight section of the pneumatic line/contour leading to the air spring having a length not less than 50 mm. Remove dirt from the tube section. Degrease the cleaned section.

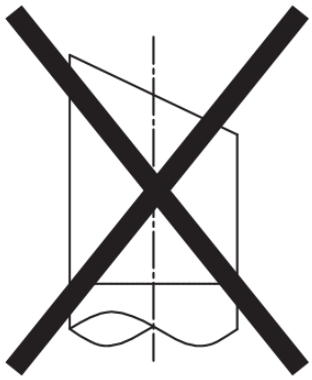


The cleaned section of the tube mounted in the fitting at the sealing length shall not exhibit any damage, such as cuts, dents or burrs.

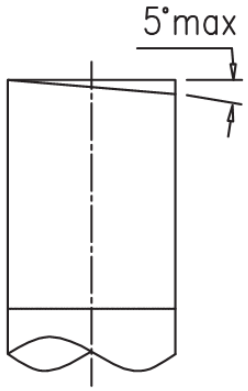


NO YES

The tube must be cut strictly perpendicularly to its axis so that the subsequent connection lays flat to the fitting and is tighter. The misalignment of the tube end should not exceed 5°. We recommend using special scissors to cut the tube.



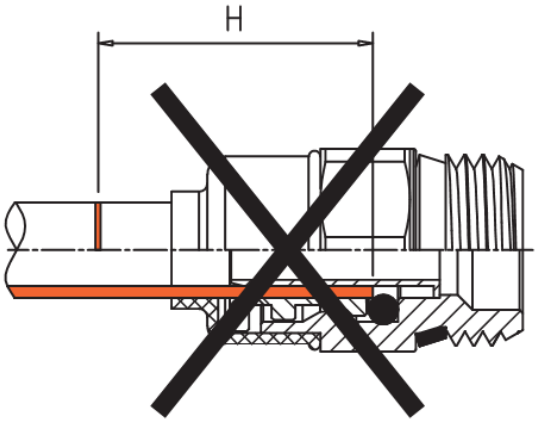
NO



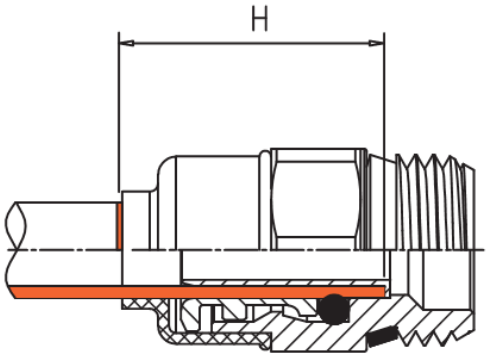
YES

Tube installation (dismantling) into the fitting should be carried out by qualified professionals who are familiar with the fitting assembly.

The tube should be installed with a low insertion force into the fitting until it stops in the sleeve over the entire installation length H, directed towards the fitting until it is firmly fixed in it.

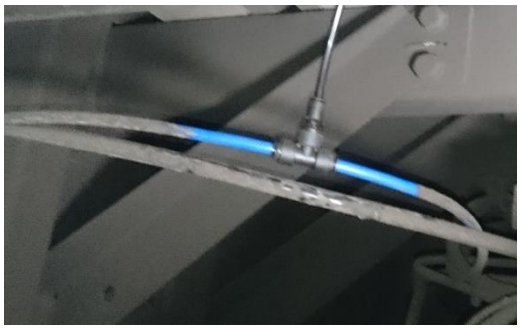


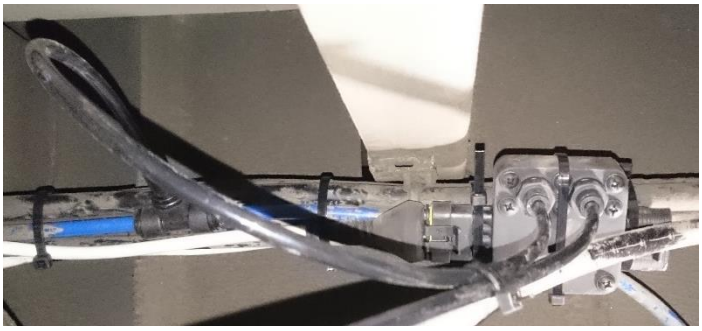
NO



YES

For control, it is recommended to make a check mark on the tube (as indicated by a blue arrow). Install the fitting into the pneumatic line/axle contour. Carry out the assembly of the pneumatic tube into the installed fitting and pressure sensor unit in compliance with the above-mentioned requirements.

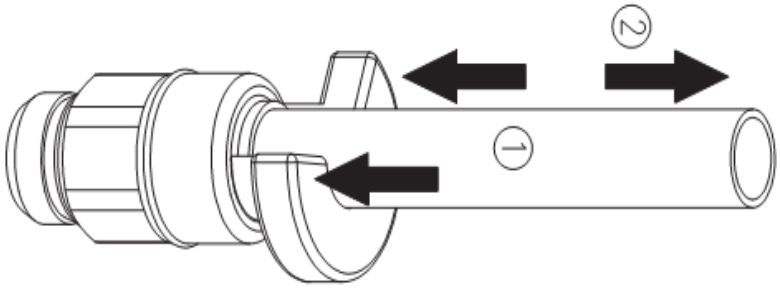




Upon completion of the equipment set installation, check the pneumatic line/contour for air leaks.

In case of air leaks, it is necessary to find the cause of an air leak and eliminate it.

To dismantle the tube, it is necessary to press the fitting cap (1), while the force is transmitted to the collet end. While moving, the collet disengages from the tube. By keeping the collet end pressed down, remove the tube from the fitting (2). It should be noted that the connection under pressure is non-separable.



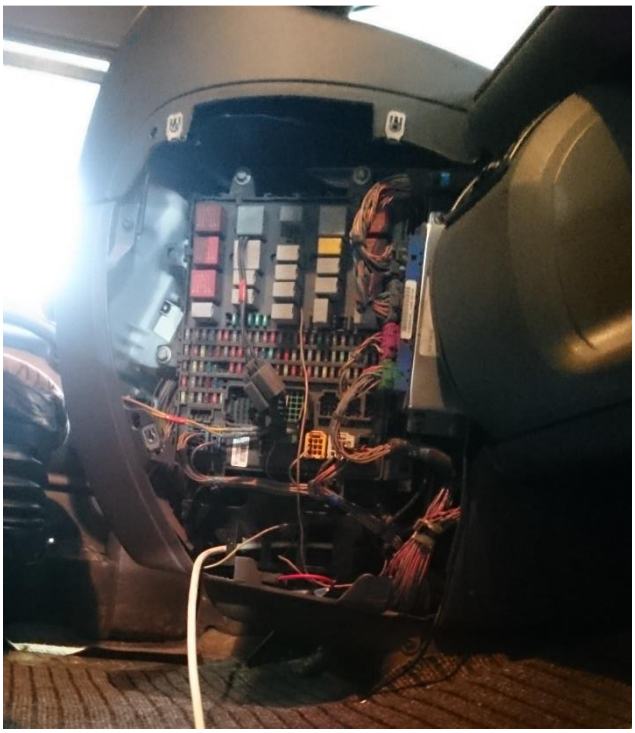
8.2 Interconnect Cable Laying:

Lay the interconnect cable with connectors along the vehicle cable trunk to the installation locations of the units and cantilever connectors (in a vehicle cab, rear axle, connector console (docking system for connecting the power line) of a vehicle for trailer/semi-trailer, trailer/semi-trailer connector console (docking system for connecting the power line), trailer/semi-trailer axle. Fix the interconnect cable with nylon ties with distance not exceeding 200 mm between them. When fixing the interconnect cable, ensure that the following requirements are met: absence of cable knots, entangling cables, cable slack; lack of moving parts near the cable that could damage it.

The interconnect cable along the cable trunk of a trailer

The interconnect cable along the cable trunk of a trailer

The interconnect cable along the cable trunk of a truck (laying to the driver cab)

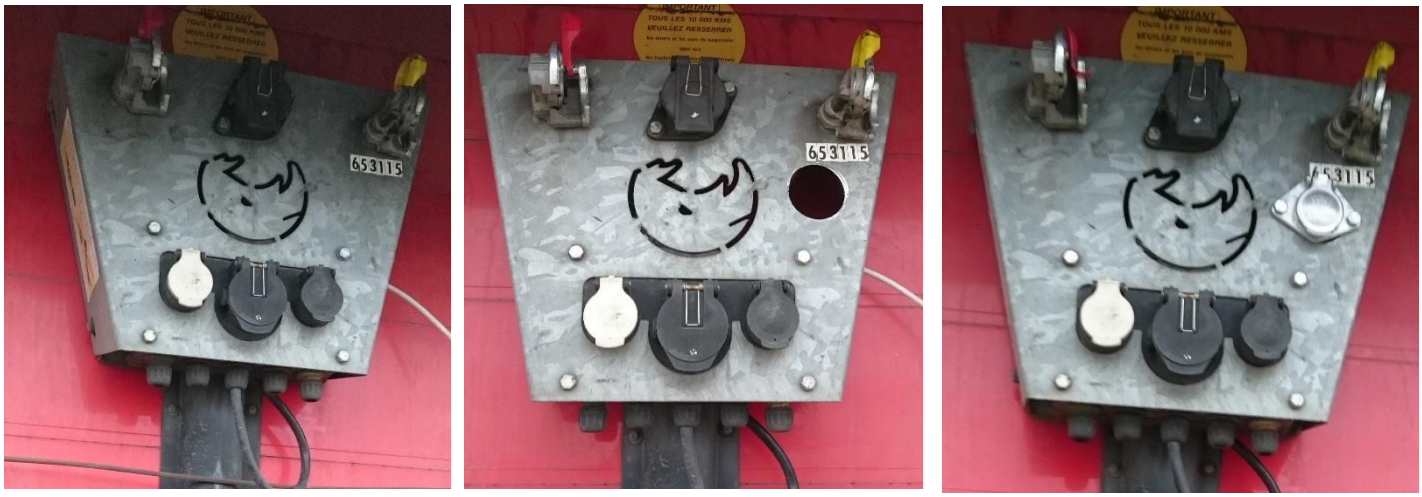


The interconnect cable in the driver cab

8.3 Socket Installing and Wiring:

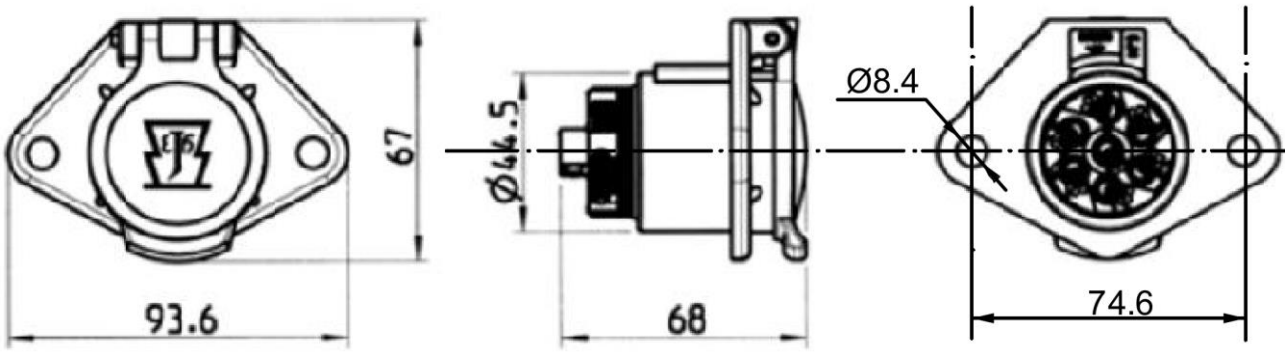
If there is a vacant place in the console panel for mounting a socket, skip the step of preparing a place for the socket mounting.

If there is no place in the console panel for mounting a socket, you should select the desired installation location yourself. Mark the socket location in accordance with the socket dimensions or buy the mounting bracket for this socket and install it at the desired location. Let’s consider the option of lack of a place for mounting a socket in the console panel.



Example of installation on the console panel of a semi-trailer

Example of installation on the console panel of a truck



Using a crown with a diameter of 45 mm and a drill bit with a diameter of 8.2 mm drill the holes for the socket housing in places where the socket is bolted in the

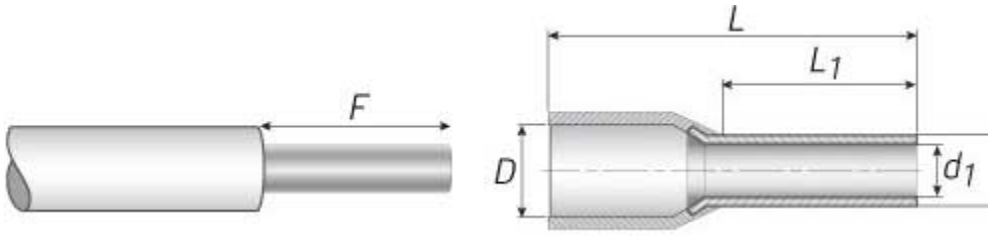
console panel. The socket shall be fixed in the console panel with a hexagon set screw (DIN933, M8x30, full thread, zinc plated) or a cheese-head screw (DIN7985, M8x30, full thread, zinc plated), a lock washer (DIN127, M8, spring, zinc plated) and a nut (DIN934, M8, hexagonal, zinc plated).

Wiring the Interconnect Cable to the Socket

The use of cable ferrules when wiring is an opportunity to improve the contact quality, thereby reducing the transition resistance and the section heating of the area when currents flow. In addition, the cable safety is ensured when it is connected using a screw clamp.

During wiring, it is worth remembering that the cross-section of a wire and a sleeve must clearly correspond to each other and be selected taking into account the manufacturer. This is the only way to avoid installation difficulties, exclude the possibility of cable damage and be sure that the connection will serve for the entire lifetime.

Strip the interconnect cable cores of the console panel by a length (L) equal to the length of the metal part of the cable ferrule.



Put the cable ferrule on the stripped cable core in accordance with the requirements indicated in Figure 3 and crimp the cable ferrule with a crimper. An illustrative example of the cable ferrule mounting on a stripped core of a multicore cable is shown in Picture 13.

Figure 3 Cable Ferrule Mounting Procedure

- mounting is not allowed

- mounting is allowed

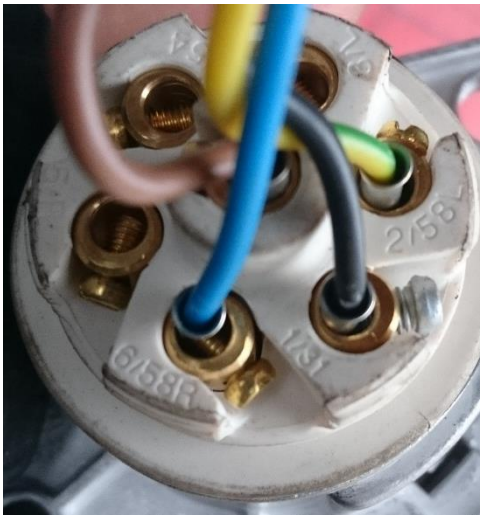
Picture 13 Example of Mounting a Cable Ferrule on the Stripped Core of Multicore Cable

Put the socket protective rubber boot to the switching cable. Apply grease to the electrical pins to protect them from corrosion. Connect the switching cable to the socket as shown in the scheme below for each of the console panels of the truck and semi-trailer.

No.	Number of a socket pin	Switching cable core color code	Number of pin on the unit connector (switching unit, pressure sensor)	Cable core color code
1	1	Black	4	Black
2	2	Yellow-green	1	Yellow-green
3	6	Dark blue	2	Dark blue
4	7	Brown	3	Brown

Tighten pins in sockets.

Upon completion of wiring, verify the accuracy of the switching cable cores termination in the socket pins and the reliability of the cable cores fastening.



Put the protective rubber boot tightly on the socket, install it in the console panel and fix the socket with fasteners (bolt, washer, nut).

8.4 Installation and Connection of Switching, Display and Tracker Units:

The switching, display and tracker units shall be installed in the driver cab. The display unit shall be mounted on the truck dash in a position convenient for the driver. The switching and the tracker unit shall be installed inside the cab, in a place that does not affect the quality of their operation. Depending on the type of tractor or truck, it is preferable to install them, for example, under the dash, behind the instrument panel, the center stack, the glove box, the decorative paddings (inserts) of vehicle torpedo, etc.

Examples of the Driver Display Installation (Display Unit)

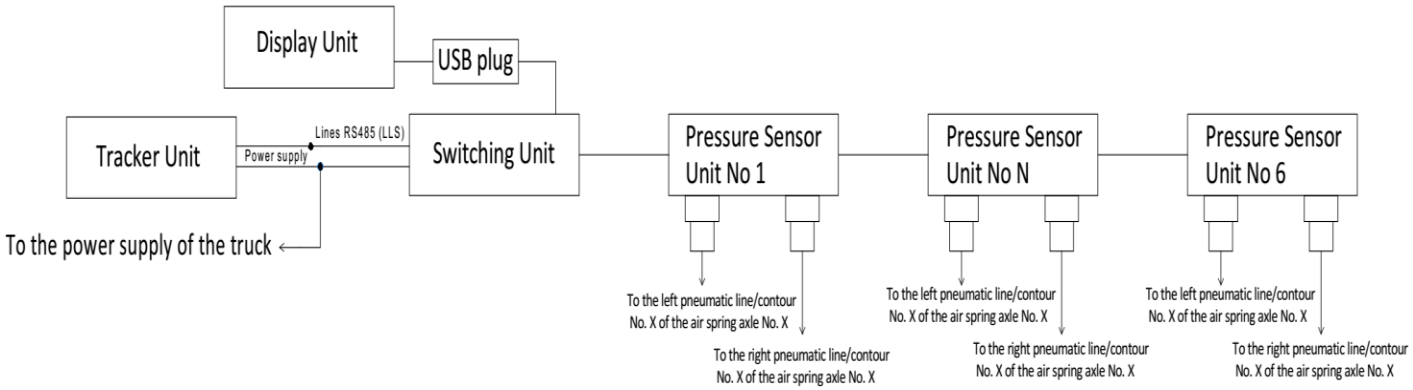
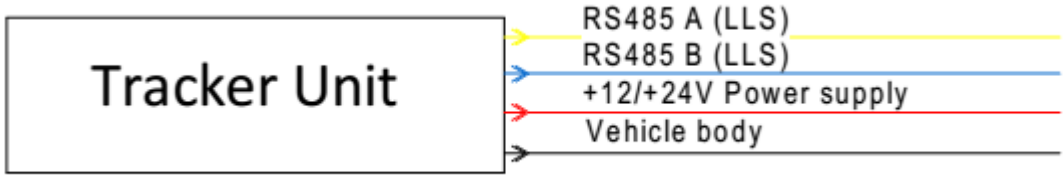
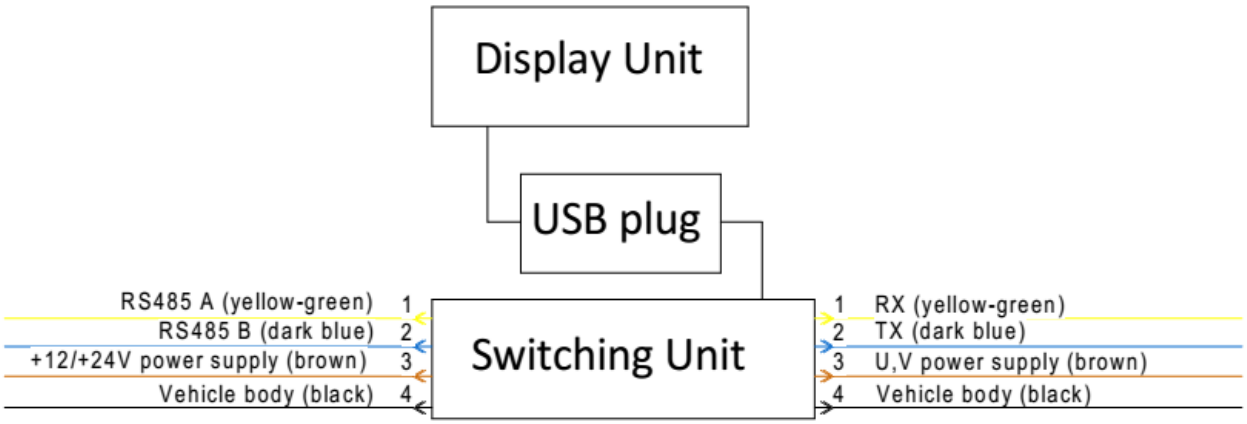


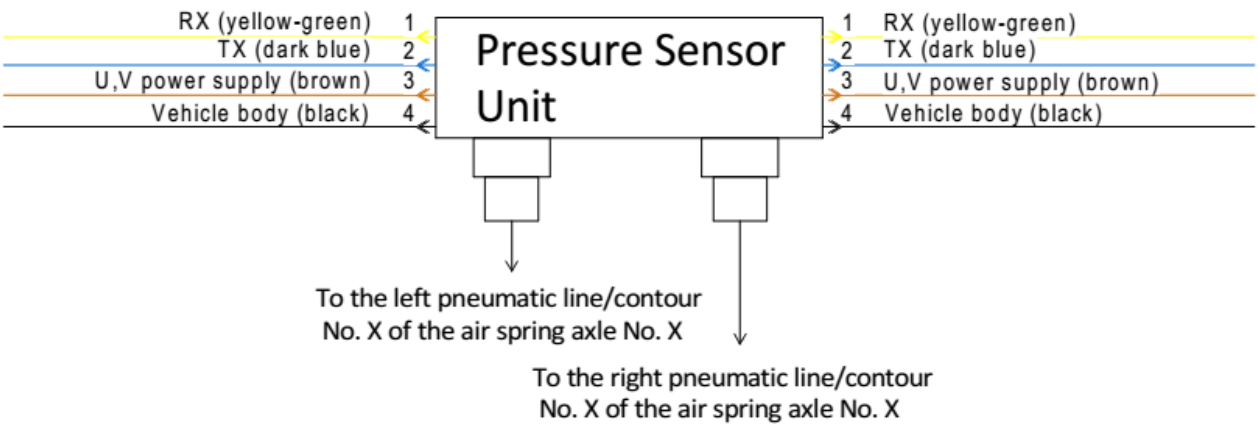
Diagram of Connecting Units to Each Other



Tracker Unit Installation Diagram



Switching and Display Units Installation Diagram



Pressure Sensor Unit Installation Diagram

Strip at least 50 mm of cores on the switching cable having one connector for the switching unit and cable cores of the tracker unit.

Connect the switching cable cores with the tracker unit and the power connectors (DC power supply +24 (+12) volts) in the truck cab. The positive power pole is supplied to the units through a 3A fuse.

Attention!!! The positive power pole shall be connected last of all to the DC power supply of +24 (+12) volts of a truck and only after the connection (switching) of all the connectors to the units.

The negative power pole shall be connected to the truck body.

Verify the accuracy of the cable cores wiring according to the equipment set installation diagram. If the connection of the indicated cable cores does not comply with the specified diagram, it is necessary to disconnect the improperly connected cable cores and connect them properly.

Insulate the place of wire twisting with electrical tape or heat-shrink tube.

In accordance with the tracker's manufacturer handbook, install and configure the tracker unit to operate with the selected web service (Wialon, Mapon, SKAU, etc.). Configure the RS485 interface port values in accordance with the port addresses of the axle load controlling equipment.

Item No.	Number LLS FLS	Port No.	Port Name	Port Redundancy
1	1	1	Fuel Sensor No. 1	Redundant
2	2	2	Fuel Sensor No. 2	Redundant
3	3	102	Gross weight of a semi-trailer truck	
4	4	112	Cargo weight in a semi-trailer	
5	5	161	Tractor: load on axle No. 1	
6	6	162	Tractor: load on axle No. 2	
7	7	163	Tractor: load on axle No. 3	Redundant
8	8	167	Semi-trailer: load on axle No. 1	
9	9	168	Semi-trailer: load on axle No. 2	
10	10	169	Semi-trailer: load on axle No. 3	
11	11	170	Semi-trailer: load on axle No. 4	Redundant

12	12	220	Semi-trailer pressure sensor unit serial number	
13	13	13	Empty	Redundant
14	14	14	Empty	Redundant
15	15	15	Empty	Redundant
16	16	16	Empty	Redundant

RS485 Interface Port Setting

RS485 interface additional settings: rate of exchange 19,200 bps; disable error propagation; transmission of complete value exceeding the maximum value.

Place the switching and the tracker units easily accessible for maintenance and fix them with nylon ties. The tracker unit shall be installed with the information part (information label) up, as shown in the figure above. It is not recommended to install the unit upside down.

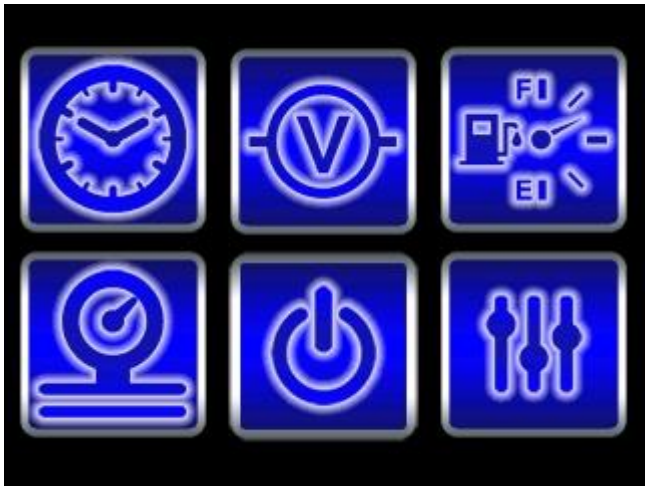
Install the display unit on the truck torpedo in accordance with the driver's wishes. The display unit shall be attached to its location with double-sided tape or using the mounting pads (supplied). Route and fix the USB cable (shown in the figure below) from the switching unit to the display unit. Connect the cable from the display unit to the switching unit (USB plug and socket).

Switching Unit

Display Unit

Check the connection of all units to each other in accordance with the installation diagram of the equipment set Truck Weighing System. If the connection does not match the specified diagram, correct this discrepancy.

Apply power to the positive pole of the System cable core.
The user interface is loading on the display unit.
The user interface start screen is shown in the figure below.



ATTENTION!!!

Upon completion of the equipment set installation, it is necessary to preset this equipment:

- to set the current on-board voltage reading;

- to carry out actions in accordance with the setup instructions for the axle weighing equipment set for a semi-trailer truck (subsections 5.4.4.1 Defining the Tractor Pressure Sensor Unit; 5.4.5.1 Defining the Semi-Trailer Pressure Sensor Unit; 5.4.X.X.X Pressure Sensor Number Setting for Axle No. X (register the pressure sensor numbers).