Fuel level sensors
eurosens Dominator
Application

The devices are used in vehicle tanks and stationary capacities for fuel level measurement.

The sensors are used in vehicle tracking systems to control fuelling and fuel drain as well as for fuel consumption control.

Target market

Solutions that require high-precision fuel measurement and fuel management.

- Application:
  - Transport companies
  - Building and construction machinery
  - Public transport
  - Agricultural vehicles
  - Mining companies
Versions

Output signals:
- Analog, V
- Frequency, Hz
- RS-232
- RS-485
- CAN

Design

IP67 ingress protection rating against environmental exposure under GOST 14254-96. (for versions with display – IP54).

The electronic board of the sensor is filled in with a compound that provides protection and safe operation of sensors even in extreme service conditions.

The hermetic automobile connector is fixed on the body.
**Dominator Mini version**

For installation in compartments of limited height.

Degree of protection from exposure environment IP67.

The sealed automotive connector is mounted on the cable outlet.

Mini version of Eurosens Dominator have absolutely same features, connector, wiring and firmware. Sensors are cross-compatible by mounting place and cable.

**Design features**

Modular build!

The connector location on the sensor body conforms to automobile requirements.

Bayonet fastening significantly simplifies sensor installation.

The convenient placement of openings on the sensor body simplifies sealing.

Great internal space of electrodes reduces risk of pollution.
## Technical data

### AF

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power voltage, V</td>
<td>9 - 32 V</td>
</tr>
<tr>
<td>Reverse polarity protection</td>
<td>Yes</td>
</tr>
<tr>
<td>Measuring accuracy</td>
<td>±1%</td>
</tr>
<tr>
<td>Temperature range, °C</td>
<td>-40 - +85°C</td>
</tr>
<tr>
<td>Output voltage, V</td>
<td>0,5 – 9,5 V</td>
</tr>
<tr>
<td>Output frequency, Hz</td>
<td>500 – 1500 Hz</td>
</tr>
<tr>
<td>Configuration interface</td>
<td>K-Line</td>
</tr>
<tr>
<td>Protection rating</td>
<td>IP 67</td>
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</table>

### RS

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
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<td>Power voltage, V</td>
<td>10 -60 V</td>
</tr>
<tr>
<td>Reverse polarity protection</td>
<td>Yes</td>
</tr>
<tr>
<td>Measuring accuracy</td>
<td>±1%</td>
</tr>
<tr>
<td>Temperature range, °C</td>
<td>-40 - +85°C</td>
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<tr>
<td>Output interfaces</td>
<td>RS-232 и RS-485</td>
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<tr>
<td>Configuration interface</td>
<td>K-Line</td>
</tr>
<tr>
<td>Protection rating</td>
<td>IP67 (IP54)</td>
</tr>
</tbody>
</table>

eurosens Dominator RS-I has 9-digit display
Spring element
It prevents sensor vibration when in service in severe conditions.
It increases attachment rigidity.

Configuration change
Measuring electrodes are supplied separately that simplifies management of stock reserve of fuel sensors by length.

The electrodes differ by the number of sleeves (1 or 2).

Standard length of electrodes – 700 mm.
It is possible to produce electrodes for water (on order).

Simplify technical support
It is often necessary to meet the fact that a company servicing installed fuel level sensors has to leave to study the causes of incorrect fuel volume readings in the control system.

Modular design will reduce the number of trips to a minimum due to rapid diagnosis and localization of the problem.

1. Remove the sensor from the tank (quick release)
2. Unscrew the electrodes from the electronic module.
These actions can be performed by a specialist of the customer, and will help you to localize the problem: the electronic module - the electrodes - the fuel.

Then everything is collected in the reverse order for 10 minutes.

The replacement of the Eurosens Dominator is as simple as possible. Thus, it becomes possible to shift part of the system maintenance work to its owner (from the service provider company).

This is significantly cheaper, since it allows you to reduce the number of trips.

To do this, you need the following:
1. After installing each new sensor, its settings and calibration must be saved to a file with the vehicle identification number.
2. The owner of the monitoring system should appoint a person responsible for the replacement and sealing of the sensors.
3. To replace the electronic sensor module, it is necessary to save the saved settings and calibrations (for this vehicle) to the new module.
4. Attach the old electrodes to the new electronic module, install the sensor in the bayonet mount and seal it.

**Working principle**

Measuring the capacitance of the capacitor that forms the rod and tube.

The capacitance varies linearly with the depth of immersion of the measuring electrodes in the liquid (fuel).

The capacitance is converted into a frequency by a measuring oscillator.

The calculated value is compared to relative number from the range of the output data (from 0 to 4095) or to volume in the tenth of liter (only for RS).

Built-in filtration algorithms remove "spikes" of indications in case of fuel fluctuations.

Thermal correction compensates changes of a construction and properties of liquid depending on temperature.
**Thermal correction**

The external temperature affects the design of the sensors and the measured liquid.

In our sensor built-in algorithms for thermal correction of both.

Since the characteristics of the liquid being measured are not known in advance, the correction of the expansion coefficients of the liquid (fuel) is available to the user in the service software.

Correction of changes in sensor design is provided technologically in the entire range of operational temperatures (from -40 to +85 degrees).

**Filtration**

Under actual operating conditions there are always fuel fluctuations.

To get correct level value it is necessary to calculate (to filter) it for some period. Necessary level of a filtration (measurement period) of output data can be set in service software.

The greater is measurement period the greater is delay to give out the measurement result. Necessary level of filtration should be selected depending on sensor service conditions.

If the filtration of the output data is made by the external device the level of filtration can be set to the minimum.

**Analog output**

Voltage level changes depending on level (volume) of fuel in a capacity.

After sensor calibration, voltage level linearly changes depending on fuel level.

After tank calibration, voltage level linearly changes depending on fuel volume.

Range of output voltage is selected in service software during sensor setting up.
Frequency output

Frequency changes depending on fuel level or volume in a capacity. After sensor calibration frequency linearly changes depending on fuel level. After tank calibration frequency linearly changes depending on fuel volume. Range of frequencies is selected during device setting up.
Possible range – from 200 to 2000 Hz.

Digital interfaces

Electrical specifications conform to requirements of RS-232 and RS-485, CAN bus J1939 protocol.
Electrical specifications of the configuration interface conform to requirements of ISO 9141 (K-Line).
Interfaces are brought to different contacts of the connector.
The interface required for work is selected in service software.
The communications protocol is compatible with LLS, MODBUS RTU.

Installation and connection

Tools:
1. Hacksaw
2. Tape measure
3. Bench work tool
4. Drill
5. Boring head Ø 38 mm
6. Service kit Eurosens Destination
Extra:
1. Measuring tank
2. Calibration pipe
3. Additional rubber gasket (for convex tank)
4. Cloth
   • When drilling openings a mill should be hold at an angle 5-10 degrees to prevent “disk” falling in a tank. After bolts twisting their
penetration in the mounting plate should be checked. If tank walls are very thin or there are doubts that the surface is flat it is better to put sealant between rubber gasket and a tank.

**Mounting set**

All the things needed for installation are supplied in Dominator mounting set.

Check before travel to the installation site.

If

Drill hole ∅ 38 mm in the center of tank
the initial length of the measuring electrodes of the sensor is more than necessary for installation in the fuel tank, they must be cut to the required length. Trimming part is Dominator Electrode.

When installing the bottom stop, the distance from the bottom end of the electrodes to the bottom of the tank should be approximately 30 mm. In the absence of a bottom stop: 10-15mm.

Installation of the bottom stop
Cutting of the electrodes

When the bottom stop is installed, the sensor should protrude 15 mm from the top of the tank after immersion in the tank.

In the absence of the bottom stop, the sensor must be completely lowered onto the bayonet plate without touching the bottom of the tank.

Default settings of the sensor

Electronic modules are pre-calibrated for the initial length of 700 mm, based on the fact that the measured fuel will be diesel fuel.

Dominator AF: configured for analog output 2.5-9V, with averaging of 9 seconds.

Dominator RS (RS-I): configured for RS485 interface, data is available on request from any address to any address. Averaging 9 seconds.

Dominator CAN: configured on CAN J1939 interface, averaging 9 seconds.

In the case of measuring the level of other petroleum products (not diesel fuel), the range of output data may be different, therefore, in this case, it is recommended to recalibrate exactly in the liquid whose level the level sensor is intended to use.

Why is the sensor calibrated and in what cases?

Calibration of the sensor consists in comparing the minimum and maximum values of the internal detector (fuel level value) with the minimum and maximum values of the output signal, as well as in the sensor settings.

When trimming or when increasing a long range, the detector is shifted, so the output signal is beyond the maximum and minimum values and can not be displayed. Thus, a dead zone appears.

For Dominator AF: allowable large trim without calibration - 30% (with default settings). If the amount of trimming is larger, a dead band will appear at low level values.

For Dominator RS: The output signal range is set from 1 to 4095. Therefore, after trimming calibration is mandatory.

Calibration does not need to be carried out in any case when saving the calibration table of capacity in the sensor memory (Calibration mode in Eurosens Dominator Configurator). First and end points of tank calibration are at the same time calibration points of sensor. We recommend to use this feature because it reduces installation time.
Calibration

Calibrate the sensor in sequence:
- connect the sensor to the PC and run the Eurosens Dominator configurator
- completely immerse the sensor in the fuel and on the Calibration tab, click the "Full" button.
- then remove it from the fuel, wait for the fuel to flow out of the electrodes and click on the "Empty" button on the Calibration tab.

How to calibrate the sensor to a new length without dipping into fuel?

Request our technical support or download the Excel file at the gpsguru.org forum. - Approximate calculation of the detector.
The obtained data can be written into the calibration table of the sensor manually, without dipping into the fuel.

**Mounting**

Mark 5 holes for self-drillings screws. Usual screws (also included) can be recommended for installation on containers with a thickness of metal from 3 mm (with threading in the thread holes), or when installed in standard holes.

Between the tank and the bayonet plate, install a flat rubber gasket. If self-tapping screws are used - it is recommended that the gasket be turned so that the screws do NOT fall into the gasket holes.

1. Secure the bayonet plate with screws or screws.
2. Lubricate with silicone and install a gasket ring.
3. Place the fuel level sensor with the bottom stop installed in the bayonet hole as far as it will go.
4. Turn the sensor till the stop.
Installed sensor

Dominator AF section

5. Select the type of output - Analog or Frequency.
6. Select output range (for analog output at 12V on-board power supply it is not recommended to set a maximum voltage of more than 7V.)
7. Switch pulling the output to the power for frequency output, if required for compatibility with the data acquisition device (GPS terminal).
8. This is enough for successful work.

The rest of the settings are described in the user manual for the configuration software.
Dominator RS section

1. Select the type of interface - RS232 or RS485 switch.
2. For RS485 - set the sensor address (the FLS address) in the network (uncheck the "Ignore" option). If there is one data collector (GPS-terminal) in the network, the option "Ignore" for the SMT address is left.
3. Set the output mode (some data collection devices require automatic data output from the sensor).
   This is enough for successful work.
4. The rest of the settings are described in the user manual for the configuration software.

**Tank calibration**

The output of the calibrated sensor is directly proportional to the level of the measured fuel. In order for the data in the fuel level monitoring system to be directly proportional to (or consistent with) the fuel volume, it is necessary to carry out the tank calibration procedure. The calibration table is a characteristic of the tank and not of the sensor.

The calibration table can be stored in the sensor or on the side of the data acquisition software. Use the option of storing the calibration table in the sensor if you want to connect a local display to display the fuel volume and connect additional sensors to calculate the total volume in several tanks.
Tank calibration methods

1. Calibration by filling the tank (or drain) with measured portions with the fuel level sensor installed. At the same time, the output signal from the sensor and the corresponding value of the fuel volume in the tank are fixed.

2. Analytical calculation of the calibration table based on the geometric shape of the container. Usually used for large tanks - where filling from empty to full is very difficult and costly.

The process of creating a calibration table is described in the Eurosens Dominator User Configurator.
To connect Eurosens sensors to the network, you can use special cables and splitters (T-cable).
Sealing

Restriction

Use of sensors is allowed only in the range of working temperatures specified in the Technical characteristics.

Operation of sensors at damaged body or cable isn't allowed.

Operation of sensors isn't allowed at voltage and current parameters exceeding the ranges specified in the Technical characteristics.

Use of sensors for measurement of level or volume of liquids changing physical state in the range of working temperatures isn't allowed.

Use of the device for measurement of level or volume of liquids with changeable dielectric capacity leads to increases in measurement error.

At product installation in capacity it is necessary to leave some space between a measuring tube and the bottom of capacity.