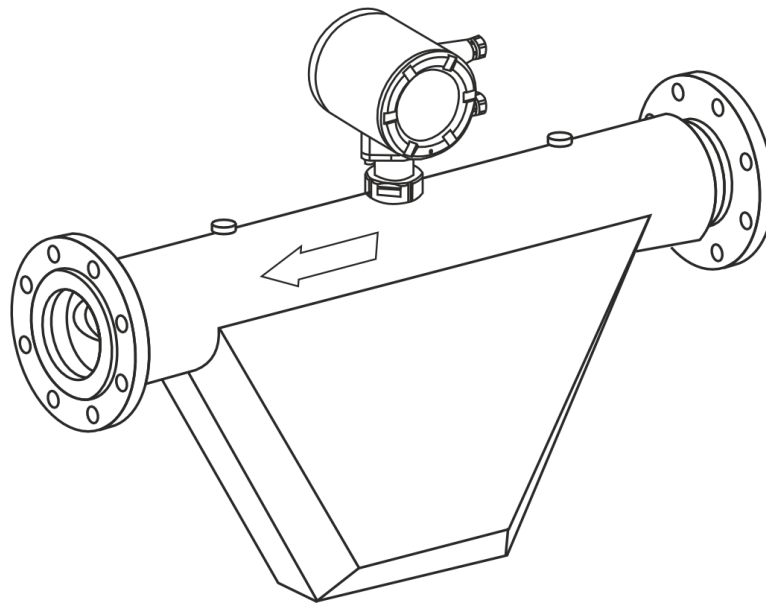




LIQUID COUNTERS



LC Corio-95/380/1200/2300/3800/6700

OPERATION MANUAL

Version 1.1



TECHNOTON
ADVANCED MACHINERY TELEMATICS

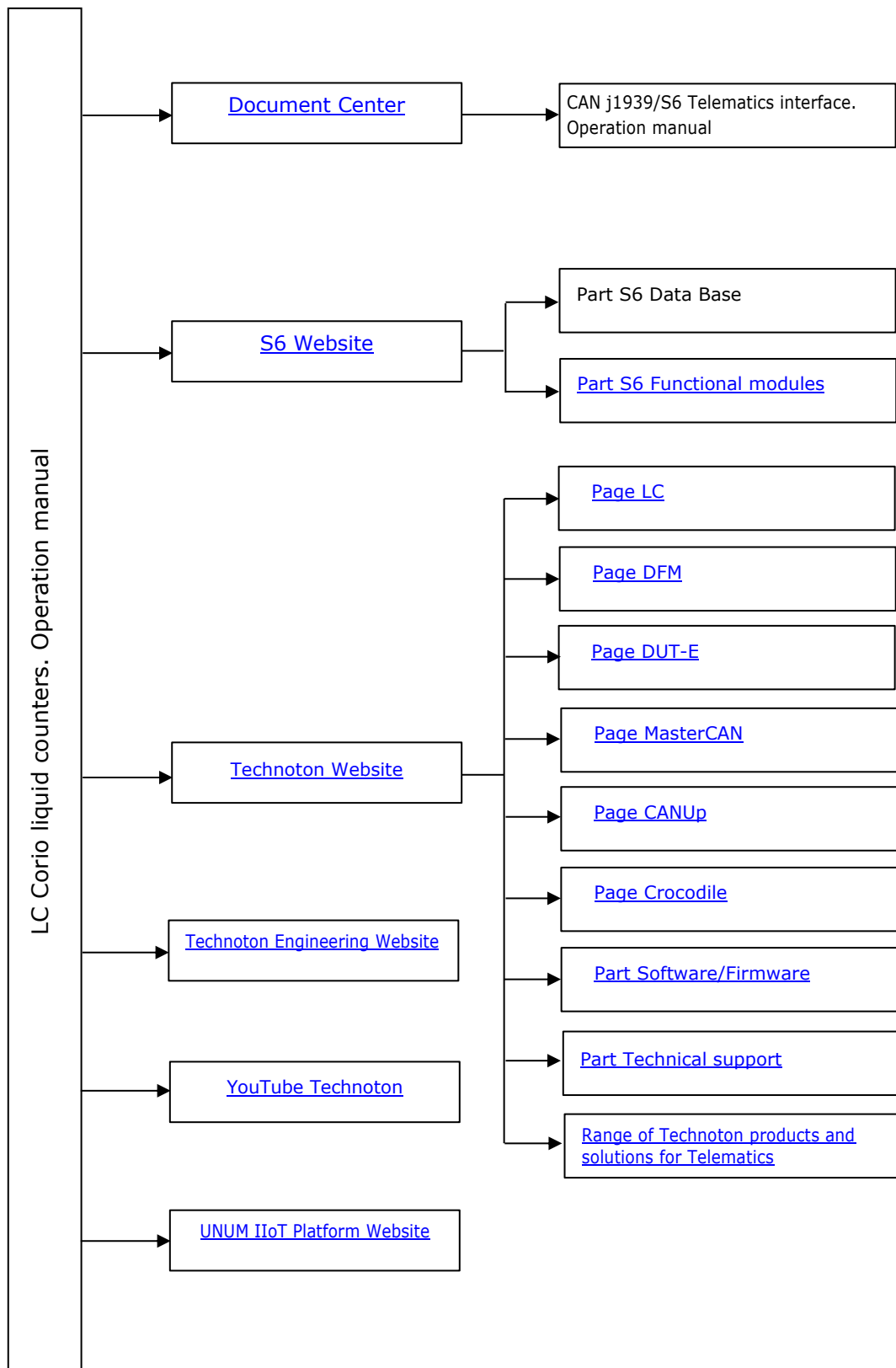
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Revision history

Version	Date	Editor	Description of changes
1.0	08.2025	OD	Basic version.
1.1	03.2026	OD	Changes based on test results of the "Monitor" service software related to settings for adapting LC Corio meters to operating conditions, etc.

Structure of external links



Terms and Definitions

CAN (Controller Area Network) — a serial digital bus communication interface compliant with the International Standard ISO 11898-1:2003. Various higher-level protocols can be used for data transmission over the CAN bus, including J1939, CANopen, DeviceNet, CAN Kingdom, and others. The CAN bus is used to integrate multiple electronic control units and sensors into a single network, commonly applied in the automotive industry and industrial automation systems.

Complex machine is a vehicle or a stationary asset equipped with one or more engines, fuel tanks, and a large number of standard and additional sensors. The specifics of telematics for complex machines are determined by the wide range of onboard equipment with various interfaces and the need to integrate standard information buses and analog devices into a single monitoring system. Monitoring complex machines requires processing and analyzing large volumes of data to ensure accurate control, diagnostics, and optimization of operational performance.

Coriolis principle is a physical principle used in mass liquid counters. It is based on the effect of the Coriolis force, which causes the deflection of vibrating measuring tubes as the flow passes through them. The magnitude of the deviation is proportional to the mass of the liquid and serves as the basis for calculating mass consumption.

Counter — cumulative numerical characteristic of Parameter. Counter is displayed by a single number and over time its value is increasing. Examples of counters: fuel consumption, trip, engine hours counter etc.

Event — relatively rare and sudden change in SPN. For example, applying the magnetic field to the fuel flow meter in order to falsify indications of the hourly fuel consumption is the "Interference" Event. An Event can have one or several characteristics. Thus, the "Interference" Event has the following characteristics: date/time and duration of the interference. When the Event occurs, a terminal unit registers the time of occurrence, which is later mentioned in a report on the event. Thus, the Event is always attached to exact time and place of occurrence.

GNSS (Global Navigation Satellite System) — system for area positioning of an object through satellite signal processing. GNSS is composed of space, ground and user segments. Currently, there are several GNSSs: GPS, GLONASS, Galileo, BeiDou.

MODBUS RTU is an industrial communication protocol based on serial data transmission (RS-485/RS-232 interface). It is used for reliable master-slave data exchange between electronic devices in automation and monitoring systems.

Monitored object (Object) — mobile or fixed Object monitored by means of the Telematics system.

Onboard equipment refers to the components of a Telematics System installed directly on the asset. Onboard equipment can be: standard (included in the factory configuration of the asset) and additional (installed during the implementation of the telematics system). These components collect, process, and transmit data required for monitoring and managing the asset's operational parameters.

Parameter — monitored object characteristic changing with time or space. For example, speed, fuel volume in the tank, fuel consumption, coordinates. Parameter is usually displayed in the form of graph, or averaged data.

PGN (Parameter Group Number) — is a combined group of S6 parameters, which has common name and number. Functional modules (FM) of the Unit can have input/output PGNs and setup PGNs.

S6 is a technology for connecting smart sensors and other IoT devices into a wired network for monitoring complex stationary and mobile objects such as vehicles, locomotives, smart homes, industrial equipment, and more.



The technology is based on and extends the SAE j1939 automotive standards. Information on the cabling system, service adapter, and S6 software can be found in the [CAN j1939/S6 Telematic interface operation manual](#).

When used together with the MasterCAN RS2CAN data converter (see [MasterCAN RS2CAN / CAN2RS Data converters operation manual](#)), LC Corio liquid counters can transmit data via S6 Technology.

SPN (Suspect Parameter Number) — informational unit of S6. Each SPN has determined name, number, extension, data type and numerical value. The following types of SPN exist: Parameters, Counters, Events. SPN can have a qualifier which allows qualification of parameter's value (e.g. – Onboard power supply limit/Minimum).

Telematics system — comprehensive solution for tracking monitored Objects in real time and for Post-analysis of their operation. It includes On-board equipment, communication channels, telematics service.

Telematics terminal (Terminal, Tracking device) — monitoring system component performing the following functions: reading signals from standard and additional sensors mounted on the monitored Object, determining the location and transfer of data to the Telematics system server.

UNUM IIoT Platform is an industrial Internet of Things platform designed for developing and managing telematics services for complex machines across various industries, including energy, land, water, and rail transport, agriculture, mining, and more.

The Platform uses a specialized set of tools, including: [Database](#) of standardized parameters; data design and transmission technologies; IIoT hardware; cloud-based software; service equipment and software. This combination enables efficient integration, monitoring, and management of industrial telematics systems at scale.

Introduction

The recommendations and guidelines provided in this Operation Manual apply to the **LC Corio liquid counters** (hereinafter referred to as [LC Corio](#)).

This document contains information about the design, operating principle, and technical specifications, as well as recommendations for the operation and installation of LC Corio liquid counters and defines the procedure for their configuration.



LC Corio are high-precision instruments based on the [Coriolis principle](#) used for accounting of mass and volume of any non-aggressive liquids in high-power thermal energy systems, petrochemical industry, marine transport, as well as utility and industrial sectors.

LC Corio can be used as standalone devices for liquid accounting or as part of automation systems, stationary object monitoring, machinery telematics, and Industrial Internet of Things (IIoT) solutions.

Key advantages of LC Corio liquid counters:

- **Direct mass measurement of the working liquid** without the need for temperature and/or density compensation.
- **High measurement accuracy** (no more than ± 0.21 % by volume and ± 0.16 % by mass) is maintained under all declared operating conditions, meeting the requirements of commercial metering and automatic control.
- **Reliable performance under harsh operating conditions** — the counters are resistant to vibration, sudden changes in liquid temperature, and pressure fluctuations.
- **Multi-parameter real-time measurement** — simultaneously records several flow parameters (total volume, mass and volumetric flow, density, and temperature), enabling convenient integration with monitoring, automation, and process control systems.
- **Applicable to most non-aggressive liquids** with different physical and chemical properties, including viscous media, emulsions, mixtures, and liquids with varying density and temperature. Operation with products containing gas inclusions is allowed within the specified limits.
- **Simple installation requirements** — can be mounted into pipelines of any configuration (straight, curved, or complex) without additional flow-stabilizing devices.
- **No straight pipe sections required** at the inlet and outlet, simplifying system design and allowing use in confined spaces.
- **Long service life and low operating costs** — the absence of moving parts eliminates mechanical wear and ensures extended service life with minimal maintenance.
- **Wide range of applications** — measurement of batch and total liquid volumes in loading and metering systems; flow parameter monitoring in blending process lines; metering in continuous-flow systems; monitoring parameters in oil well control systems, and more.
- **Flexible integration into control systems** — support for the RS-485 digital interface ([Modbus RTU](#) protocol) enables counters to operate within automated control and SCADA systems. When used with the [MasterCAN RS2CAN](#) data converter (purchased separately), measurement results can be transmitted to the [CAN j1939/S6 telematics interface](#) as [SPN](#) messages.

- **100% calibration** — each counter undergoes metrological verification, ensuring full compliance with declared specifications.
- **Compliance with national and international standards.**
- **Comprehensive [technical support](#) and [documentation](#).**

The LC Corio liquid counter ordering code is formed in accordance with figure 1:

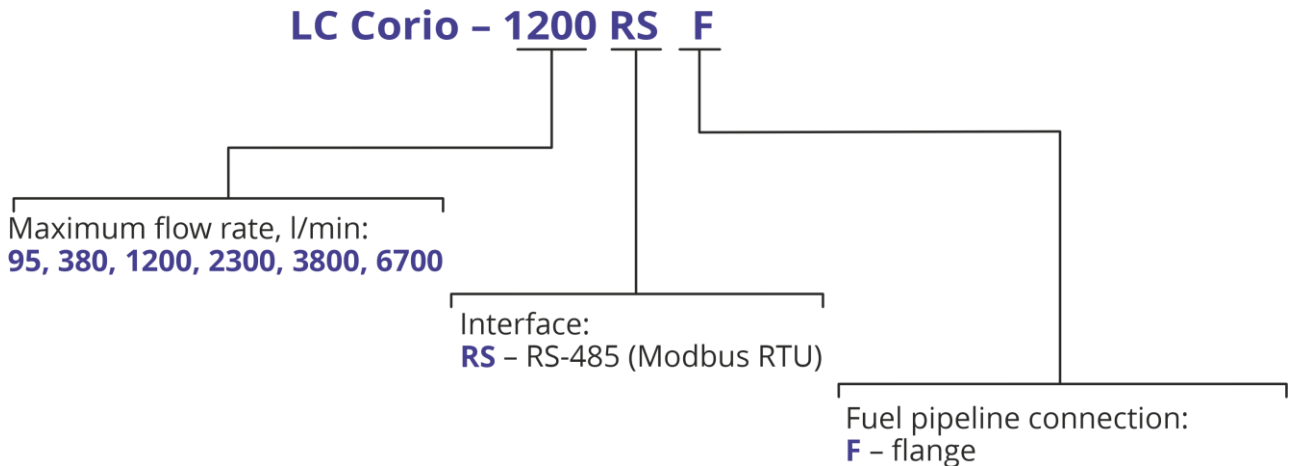


Figure 1 — LC Corio liquid counter ordering code

Example of LC Corio order entry:

"LC Corio-1200 RS F liquid counter"
(maximum flow rate — 1200 L/min, RS-485 interface, flange connection).

When using LC Corio liquid counter together with [MasterCAN RS2CAN](#) data converter, S6 SK service adapter (purchased separately) and ServiceS6 MasterCAN software are used to configure data output to the [CAN j1939/S6 telematics interface](#). The latest version of the software can be downloaded from the official website at <https://jv-technoton.com/> in the [Software](#) section.



ATTENTION: LC Corio devices are designed in compliance with modern safety requirements and are manufactured in a condition safe for operation. However, if used improperly or for purposes other than intended, they may pose a potential hazard. Therefore, when operating LC Corio, it is essential to strictly follow the manufacturer's recommendations specified in this Operation Manual.

The manufacturer guarantees that LC Corio complies with the requirements of technical regulatory legal acts, provided that the storage, transportation, and operating conditions are observed, as well as the application guidelines specified in this Operation manual.



ATTENTION: The manufacturer reserves the right to modify the technical specifications of LC Corio without prior notice to the customer, provided that such changes do not degrade the product's performance or consumer properties.

1 General information and technical specifications

1.1 Purpose, application areas, tasks

Purpose:

[LC Corio liquid counters](#) are designed for high-precision measurement of mass, volume, density, and temperature of the working fluid.



LC Corio liquid counters

High-precision devices
for liquid monitoring
by mass and volume

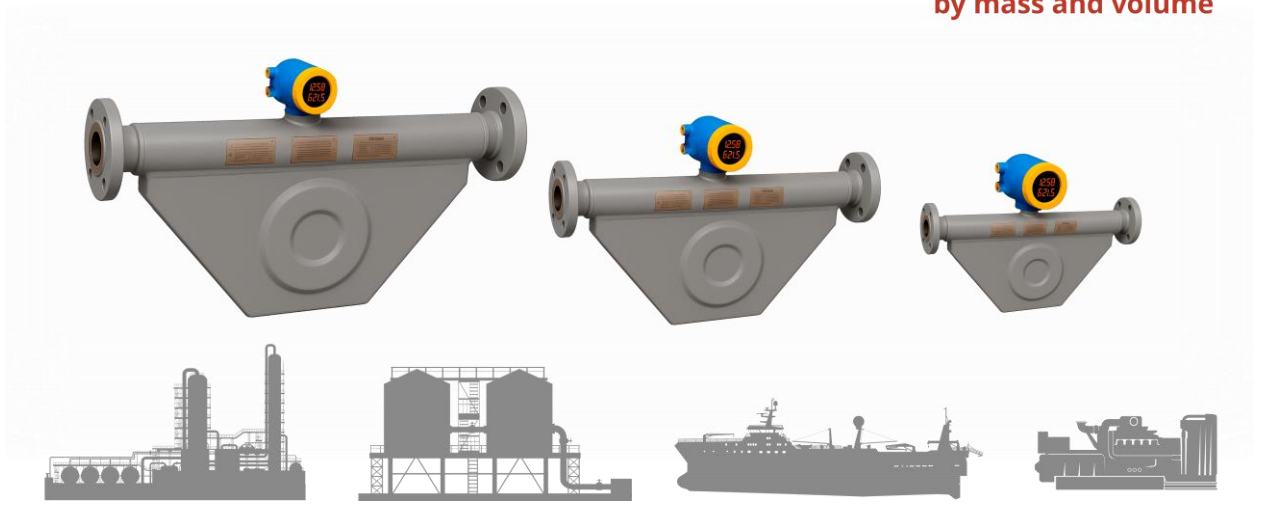


Figure 2 — Purpose of LC Corio liquid counters

Application areas:

1) Oil and chemical industry: commercial metering and automatic control of petroleum products, paints and coatings, solvents, and other liquids used in production.

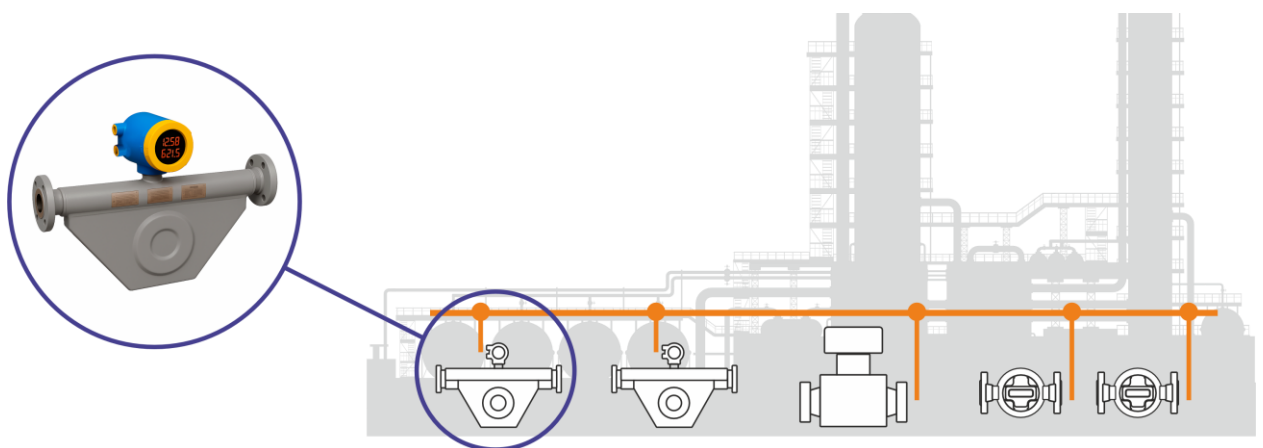


Figure 3 — Application of LC Corio in chemical manufacturing enterprises

2) Water transport: monitoring heavy fuel oil and diesel fuel consumption by marine engines and generators.

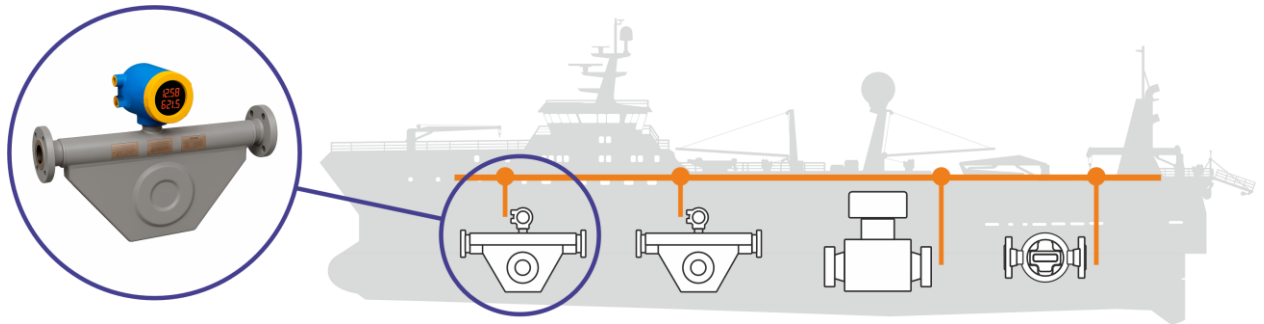


Figure 4 — Application of LC Corio on a marine vessel

3) Power plants and generators: monitoring fuel consumption in diesel power plants and fleets of high-capacity diesel generators.

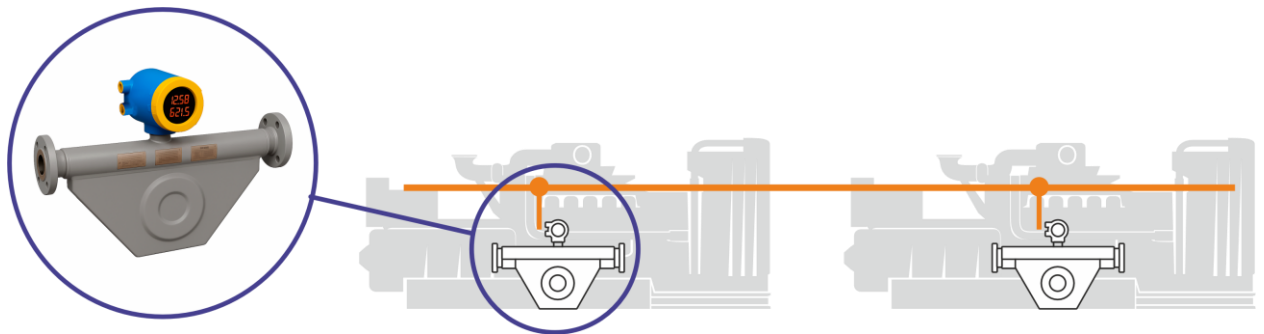


Figure 5 — Application of LC Corio at a diesel power plant

4) Control of water in industry and water supply systems.

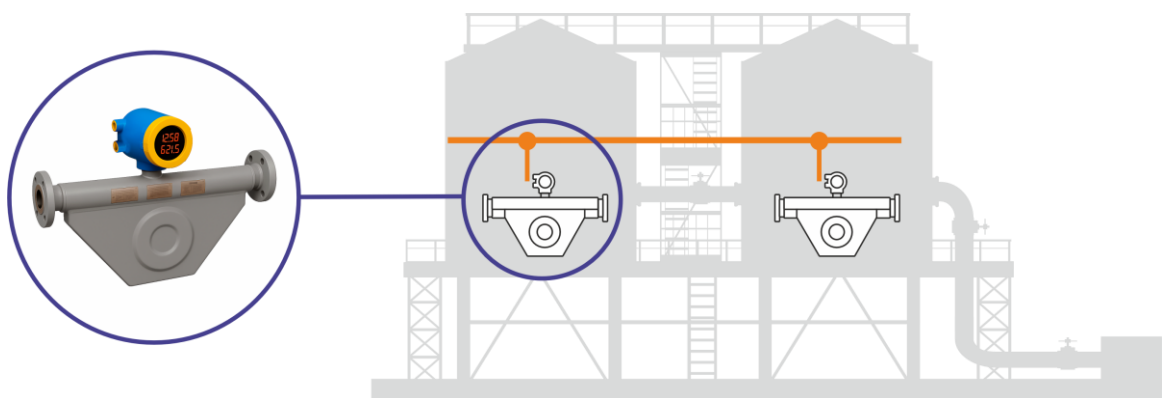


Figure 6 — Application of LC Corio at an industrial enterprise

5) Operation within telematics systems for complex machines based on the UNUM IIoT Platform:

LC Corio transmits measurement results (mass flow, volumetric flow, liquid temperature, and density) via the RS-485 interface to the [MasterCAN_RS2CAN](#) data converter (purchased separately). The converter, according to its configuration, reads the data from registers using the Modbus RTU protocol, converts them into [SPNs](#), and transmits them via [S6 Technology](#) to the [CAN_j1939/S6 Telematics interface](#).

Using S6 Technology, up to 16 LC Corio counters can be simultaneously connected to a [Terminal](#) (for example, the [CANUp 27 telematics gateway](#)). The data is easily integrated into a telematics service based on the [UNUM IIoT Platform](#) for monitoring the operation of [Complex machines](#). The converted LC Corio readings can also be displayed on a [CAN](#) display.

For detailed instructions on configuring the converter, refer to the document [MasterCAN_RS2CAN / CAN2RS Data Converters. Operation manual](#).

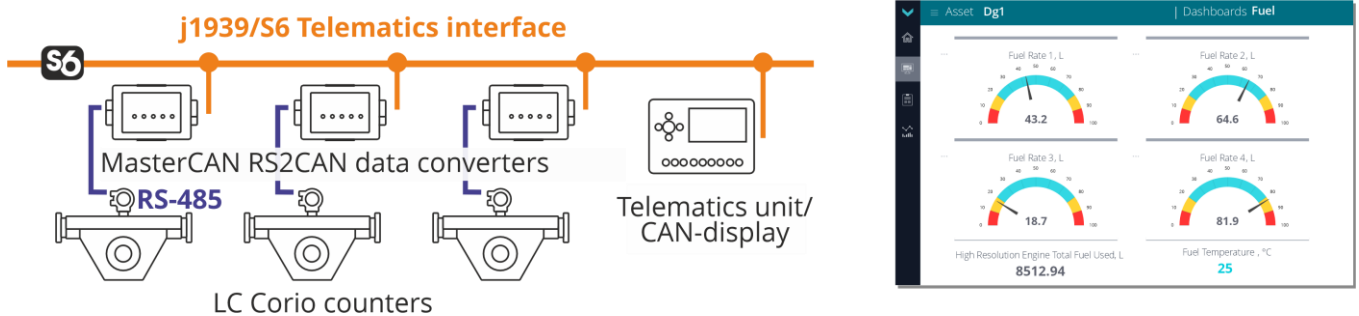




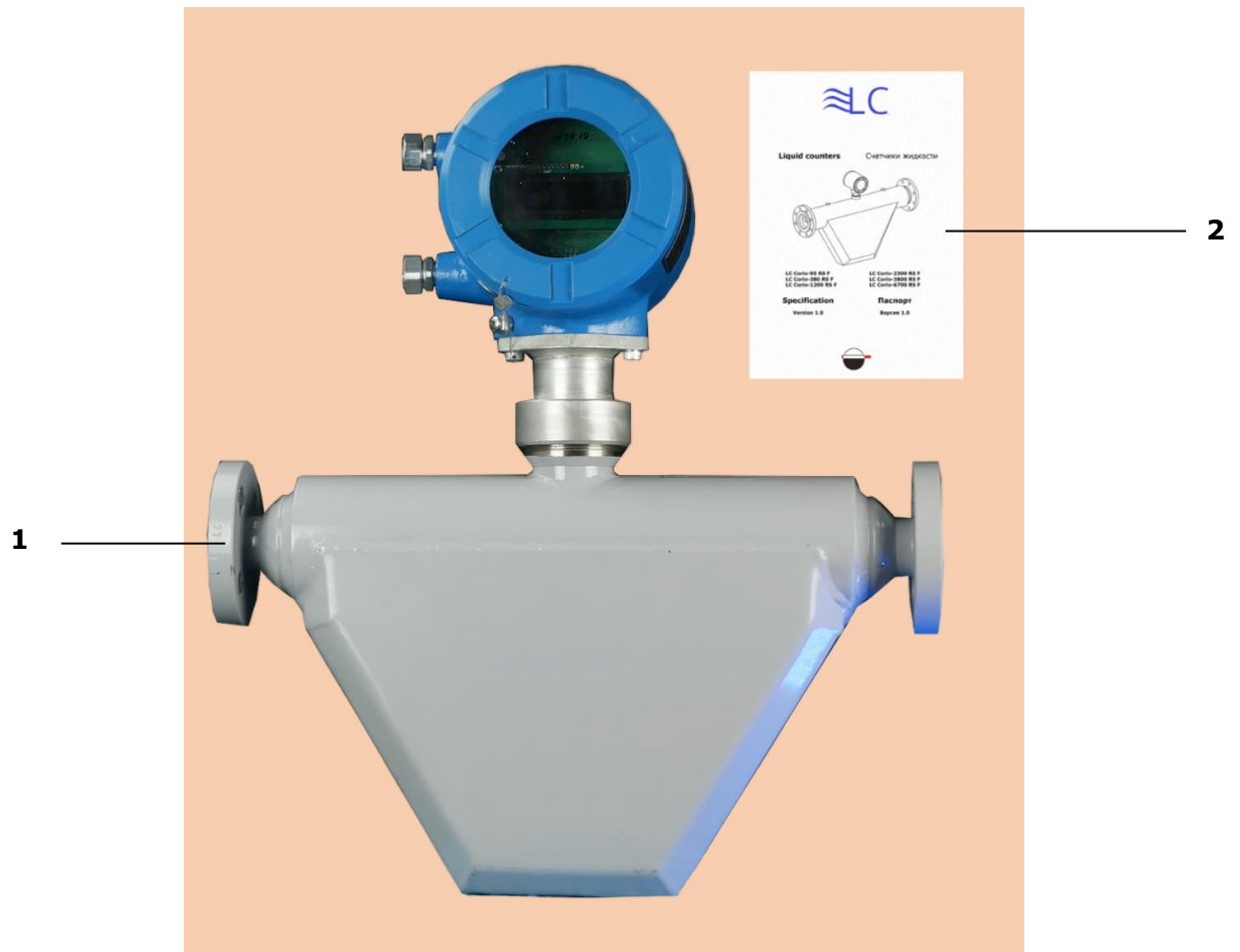


Figure 7 — Integration of LC Corio data via S6 Technology into the [Telematics system](#) based on the UNUM IIoT Platform

Tasks:

-  High-accuracy measurement of mass and volumetric flow.
-  Standardization of the transferred liquid.
-  Prevention of liquid theft from the pipeline.
-  Monitoring liquid temperature and density.

1.2 Exterior view and delivery set



1 [LC Corio liquid counter](#)

– 1 pc.;

2 Specification

– 1 pc.

Figure 8 – LC Corio delivery set

1.3 Design and operating principle

The [LC Corio liquid counter](#) consists of the following components: a primary mass flow transducer (hereinafter referred to as PT) (**1**) with two welded flanges for connection to the pipeline (**2**); an electronic module with a built-in display (hereinafter referred to as EM) (**3**); and cable glands for connecting the power supply (**4**) and the communication line via the RS-485 interface (**5**) (see figure 9).

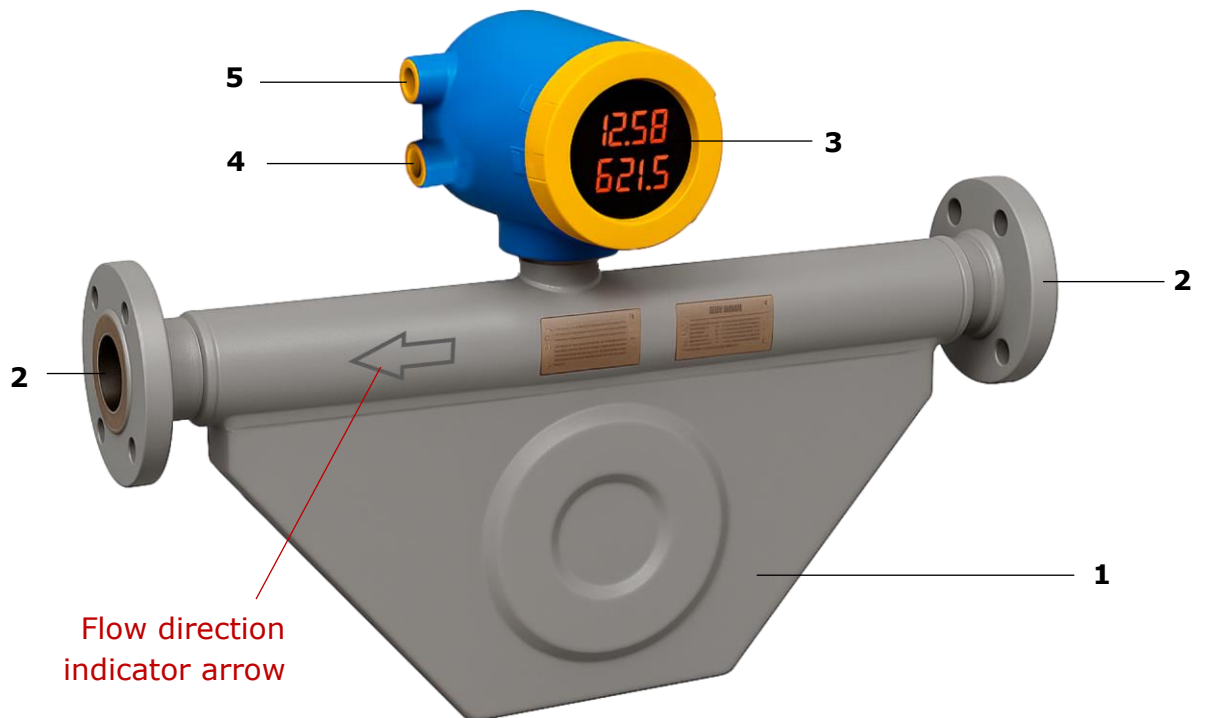


Figure 9 — LC Corio components

The primary transducer (PT) of the liquid counter, installed in the pipeline, converts flow parameters — mass flow, density, and temperature — into electrical signals transmitted to the electronic module (EM). The EM processes the PT's primary signals, outputs measurement data to external devices via the RS-485 digital interface (Modbus RTU protocol), displays the data on the built-in screen, and allows counter configuration.

The PT housing is made of stainless steel. The connection flanges are manufactured from high-strength, corrosion-resistant steel. The EM housing is made of an aluminum alloy coated with polyurethane paint.

The LC Corio can be manufactured in the following configurations:

- EM mounted directly on the PT;
- EM installed separately from the PT and connected to it by a cable in a protective metal sleeve (length specified when ordering).

Operating principle of LC Corio

LC Corio counters implement a **direct method of dynamic measurement** of liquid mass and density.

Under the protective cover of the primary transducer (PT), two parallel, curved precision **measuring tubes** are cantilever-mounted. These tubes are equipped with an electromagnetic excitation coil, two electromagnetic signal pickup sensors, and temperature sensors.

- Mass flow measurement: The measuring tubes are driven into synchronous oscillation at their natural resonant frequency by the excitation coil (see figure 10). In the absence of flow, the tubes oscillate in phase. When liquid flows through the tubes, additional inertial forces — **Coriolis forces** — arise. These forces cause phase shifts between the oscillation frequencies of opposite sides of the tubes. These phase shifts represent a time delay, which is detected by the electromagnetic sensors. **The phase shift values of the measuring tube oscillations are proportional to the mass of liquid passing through the meter per unit time.**
- Density measurement: The measuring tubes vibrate at their natural resonant frequency, which depends on the geometry, construction materials, and the mass of the oscillatory system (i.e., the total mass of the tubes and the liquid inside them). Since the mass of the tubes and the volume of liquid inside them (equal to the product of liquid density and the inner volume of the tubes) are constant, the oscillation frequency directly depends only on the density of the flowing liquid. Thus, **the liquid density is proportional to the resonant frequency of the measuring tube oscillations.**
- Volume is calculated by the meter based on the measured mass and liquid density values.
- Temperature measurement is performed directly by the built-in temperature sensors of the corresponding measuring tubes.

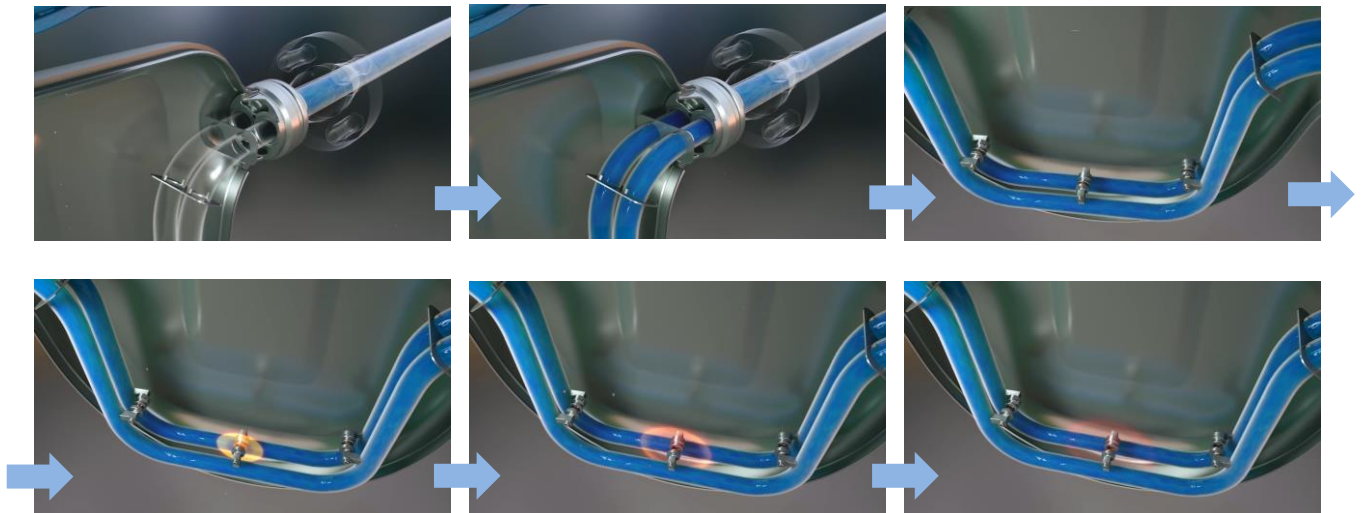
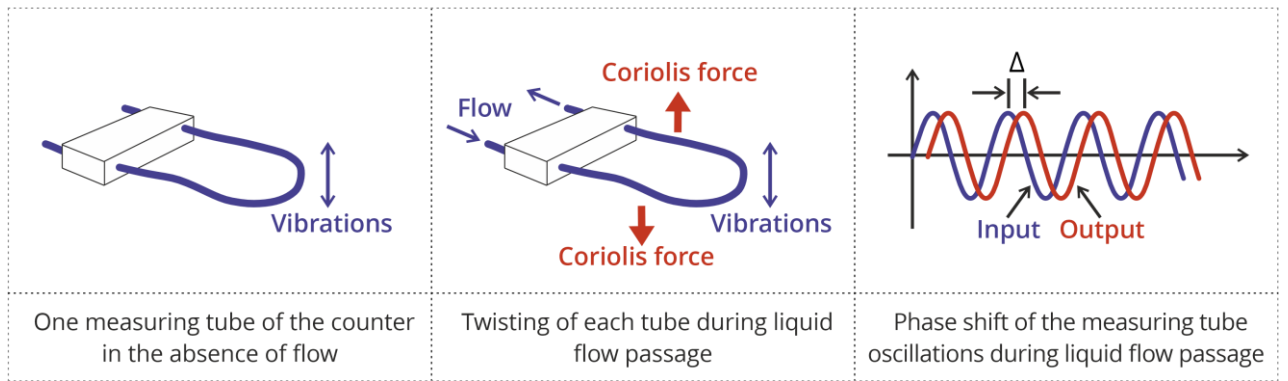
To transfer data from the LC Corio liquid counter to an external device (for example, a [Terminal](#), [CANUp 27 Genset telematics gateway](#), display, or controller), the RS-485 interface (Modbus RTU) of the counter's EM module must be connected to the corresponding interface input of the external device.

Detailed information about telematics gateways can be found in the [CANUp 27 telematics gateways. Operation manual](#). Information on the CANUp 27 Genset settings, displayed and/or edited using the service software, is provided in the [CANUp 27 telematics gateways. Functional modules catalog](#).

When using LC Corio together with the [MasterCAN RS2CAN](#) data converter (purchased separately), the counter's readings can be transmitted to the [CAN j1939/S6 telematics interface as SPN messages](#). The converter, according to its configuration, reads data from registers via the Modbus RTU protocol, converts them into SPNs, and transmits them via [S6 Technology](#).

For detailed instructions on configuring the MasterCAN RS2CAN converter, refer to the [MasterCAN RS2CAN / CAN2RS data converters. Operation manual](#).

Using S6 Technology, up to 16 LC Corio counters can be simultaneously connected to a single [CAN](#) input of the Terminal (for example, the [CANUp 27 telematics gateway](#)). The data can be easily integrated into a telematics service based on the [UNUM IIoT Platform](#) for monitoring the operation of [Complex machines](#). The converted LC Corio readings can also be displayed on a CAN display (for example, the [MasterCAN Display 35](#)).



twisting of the measuring tubes of the counter's primary transducer (PT) under the effect of the Coriolis force generated by the liquid flow

Figure 10 — Operating principle of LC Corio

1.4 Technical specifications

1.4.1 Working liquids and ordering information

[LC Corio liquid counters](#) can be used with the following types of **working liquids**:

- 1) Fuel and petroleum products
 - diesel fuel;
 - marine fuels (MGO, LSMGO, IFO-180/IFO-380, HFO);
 - fuel oils (M-40, M-100, M-200);
 - kerosene;
 - biodiesel and blends (B20, B50, B100);
 - crude oil.
- 2) Oils and lubricants
 - hydraulic oils (all common ISO VG classes);
 - turbine and compressor oils;
 - industrial and gear oils;
 - transformer oils;
 - synthetic lubricants.
- 3) Water-based media
 - clean and softened water
 - technical water;
 - seawater;
 - steam condensate;
 - aqueous glycol solutions.
- 4) Other liquids
 - emulsions and suspensions without abrasive particles;
 - non-aggressive reagent solutions;
 - low-concentration alcohol mixtures;
 - other types of non-aggressive liquids within the kinematic viscosity range of **0.5...3000 mm²/s (cSt)**.

IMPORTANT:

When **ordering** LC Corio, the following **information** must be provided to the supplier:

- 1) Name of the working liquid.
- 2) Nominal diameter (DN) of the pipeline.
- 3) Operating flow range.
- 4) Working liquid temperature range.
- 5) Maximum working liquid pressure.
- 6) Required measurement accuracy limits.
- 7) Ambient temperature range.
- 8) Distance from the counter installation site to the [Terminal](#) / data recording and display device.



1.4.2 Measurement ranges and accuracy

Table 1 — Measurement ranges and accuracy for [LC Corio liquid counters](#)

LC Corio model	Nominal diameter (DN)		Measurement ranges				Relative measurement error*, %, not more than	
			Mass flow rate, t/h		Volume flow rate, L/min		Mass	Volume
	mm	inches	Min	Max	Min	Max		
95 RS F	15	1/2	0.35	5.2	7	100	±0.16	±0.21
380 RS F	25	1	1.3	20	25	380		
1200 RS F	50	2	4	65	77	1240		
2300 RS F	80	3	10	120	192	2300		
3800 RS F	100	4	27	200	514	3800		
6700 RS F	150	6	30	350	575	6700		

* The values are provided for diesel fuel.

For all LC Corio models:

- Working liquid **density** measurement range: 0.6...1.2 t/m³.
Absolute density measurement error: ±0.0005 t/m³.
- Working liquid **temperature** measurement range: -60...+100 °C.
Absolute temperature measurement error: $\Delta T = \pm(0.5 + 0.005 \cdot |T|)$ °C,
where T is the current measured value of the working liquid temperature, in °C.

RECOMMENDATIONS:



- 1)** The required [LC Corio](#) model should be selected according to the actual flow range and the permissible pressure loss.
- 2)** The minimum recommended upper limit of the measurement range should be approximately **1/20** of the maximum upper limit of the measurement range.
- 3)** In most cases, when selecting a model, an allowance of **20...50 %** above the maximum value of the upper measurement range limit is considered optimal.
- 4)** For abrasive materials, such as liquids containing solid particles, it is recommended to select a lower value for the upper measurement range limit.

1.4.3 Main specifications

It is recommended to install [LC Corio](#) in locations that prevent direct sunlight and atmospheric precipitation from reaching the counter.

Table 2 – Main specifications of LC Corio liquid counters

Parameter, measurement units	Value
Working liquids	see 1.4.1
Working liquid temperature range, °C	-60...+100
Working liquid pressure range, MPa	0...4
Pressure loss on PT, MPa, not more than	0.1
Working liquid kinematic viscosity range, mm ² /s	0.5...3000
Measurement ranges and accuracy	see 1.4.2
Straight inlet/outlet sections for installation	not required
Digital interface	RS-485 (Modbus RTU) (see 1.4.4)
Power supply voltage*	<ul style="list-style-type: none"> • 24 V from an external DC power source**; • 187...244 V (+10%, -15%) from an AC mains supply with a frequency of (50±1) Hz
Power consumption, not more than	<ul style="list-style-type: none"> • 15 VA (for AC power); • 15 W (for DC power)
Ambient air temperature, °C	-40...+60
Relative air humidity at 35 °C, %	up to 95±3
Atmospheric pressure, kPa	84...106,7
Vibration resistance	<ul style="list-style-type: none"> • reliable operation under vibration conditions with frequencies up to 5...80 Hz; • maintaining accuracy and performance under oscillations with an amplitude up to 0.075 mm and acceleration up to 9.8 m/s²; • compliance with the operating environment of large industrial facilities with potential vibrations from equipment or transport platforms.
Electromagnetic compatibility	category of equipment intended for use in industrial environments
Cable glands (power/signal)	M20 × 1.5 (cable diameter 8...12 mm)
Pipeline connection	Butt-welded flanges according to GOST 33259-2015, 12X18H10T, steel 20, 09G2C
Enclosure protection rating	IP65
Mean time between failures, h, not less than	60 000
Mean time to recovery, h, not more than	8
Average service life, years, not less than	12
Overall dimensions	see 1.4.6
Weight, kg, not more than	
* The required power supply option for the counter must be specified when placing the order.	
** This power supply option applies to all counter models except LC Corio 6700 RS F.	

1.4.4 Characteristics and protocols of the RS-485 digital interface

The digital interface of [LC Corio](#) liquid counters complies with the RS-485 physical interface according to the EIA/TIA-485 standard.

A unique network address in the range 1...247 should be assigned to each LC Corio for identification within the network.

Up to 32 LC Corio counters can be simultaneously connected to a [Telematics terminal](#) via the RS-485 interface.

The LC Corio data transmission speed can be selected from the following values: 1200, 2400, 4800, 9600, 19 200, 38 400, 57 600, 115 200 baud.

LC Corio supports data transmission using either the Modbus RTU protocol. **The Modbus RTU protocol register map** is provided upon request by Technoton [technical support](#) at support@jv-technoton.com.

When operating in a Modbus RTU network, LC Corio always functions as a slave device.

The maximum communication line length between LC Corio and an external device via the RS-485 interface is 1200 m.

User configuration of the counter for data transmission via RS-485 (protocol selection, baud rate, etc.) is performed using the specialized Monitor software (see the Monitor software user guide).



IMPORTANT: A mandatory requirement for correct data transmission of LC Corio is the presence of **120 Ohm termination resistors** between wires **A** and **B** at each end of the RS-485 communication line.

1.4.5 Data displayed on the screen

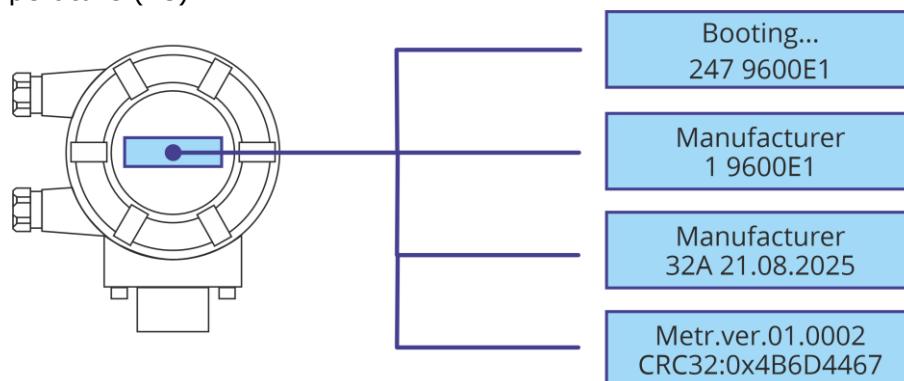
The built-in EM display allows viewing readings directly on the LC Corio counter. The display has two lines that can show measured values or service information (see figure 11).

Immediately after switching on the LC Corio power supply, the counter performs a self-test procedure of the internal software, and then four screens are displayed on the EM display in sequence, showing the following service information:

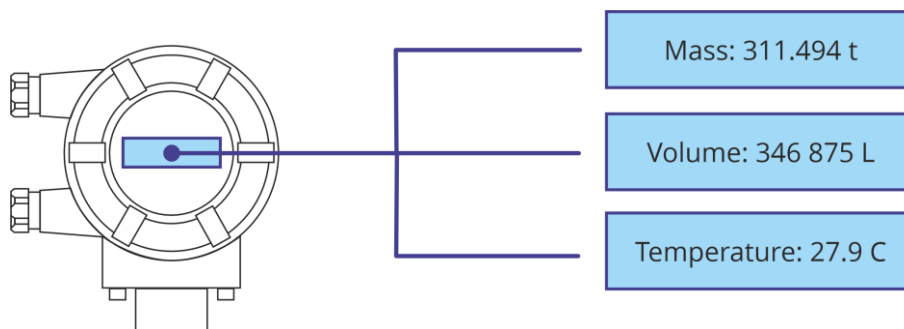
- Software boot information;
unchangeable bootloader parameters for software recovery.
- Manufacturer;
RS-485 port address, baud rate, parity.
- Manufacturer;
software version: 32A — analog / 32D — digital, release date.
- Identification number of the metrological software version;
checksum of the executable code;

When LC Corio operates in measurement mode, the current values of the measured parameters are displayed:

- Mass counter (t).
- Volume counter (l).
- Temperature (°C).



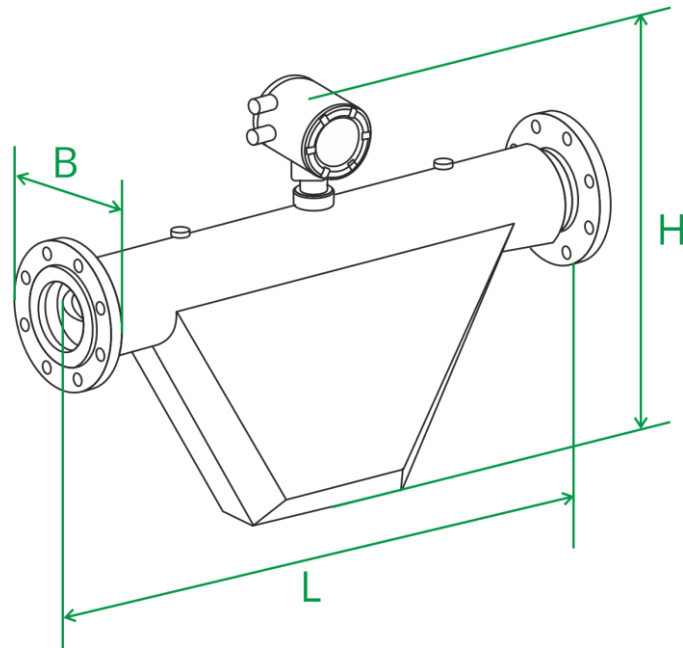
a) during the internal software self-test procedure



b) in measurement mode

Figure 11 — Data displayed on the LC Corio screen

1.4.6 Overall dimensions and weight



LC Corio model	L × H × B, mm, not more than	Weight, kg, not more than
95 RS F	404 × 403 × 157	14
380 RS F	500 × 431 × 157	27
1200 RS F	715 × 538 × 157	48
2300 RS F	900 × 617 × 157	70
3800 RS F	986 × 627 × 165	103
6700 RS F	1500 × 900 × 300	235

Figure 12 — Overall dimensions and weight of LC Corio liquid counters

2 LC Corio installation

This chapter provides general recommendations for installing [LC Corio liquid counters](#).

WARNINGS:



- 1)** To ensure proper operation of LC Corio, installation, connection to the power supply, data logging and display devices, commissioning, and maintenance must be carried out by trained, qualified personnel who have completed certified training and are authorized to perform these tasks by the equipment owner or a responsible person.
- 2)** The technical personnel performing the work must read this document in advance and follow all of its instructions.
- 3)** Responsibility for correct installation and competent use of LC Corio, starting from the moment of purchase, lies solely with the personnel in charge of installing and operating the counter.
- 4)** When installing LC Corio, it is necessary to **strictly follow the safety regulations** established at the facility, as well as safety requirements specific to the object being equipped.
- 5)** When performing welding work on the pipeline, **grounding welding equipment through the counter is prohibited**.
- 6)** The installation specialist must verify the correct connection of the counter according to the wiring diagrams and take special protective measures (for example, grounding the counter).
- 7)** Regardless of the above requirements, the safety regulations of the end user's facility governing the opening and repair of electrical devices must also be followed.
- 8)** Installation and operation of LC Corio are prohibited under conditions where the maximum allowable parameters of working liquid pressure and temperature are exceeded (see [1.4.3](#)).

2.1 External inspection before starting work

Before starting work, check the integrity of the LC Corio factory packaging and its contents for any signs of damage. Verify the completeness of the delivery, ensuring that all necessary components are included and that the delivered items match the order.

Inspect the LC Corio unit externally for any possible defects caused during transportation, storage, or improper handling.



IT IS PROHIBITED to operate counters that have:

- 1)** Damage to the PT and connection elements, EM, display, cable glands, or cables.
- 2)** Looseness of components relative to each other or gaps between them.

If any defects are detected, contact the counter supplier.

2.2 Assessment of the condition of the measured liquid consumer



IMPORTANT:

1) Before installing the [LC Corio liquid counter](#), **study the technical description of the object to be equipped** (for example, a process line, power unit/diesel generator/boiler, etc.), evaluate the condition of the pipelines and electrical system, and determine whether installation is feasible.

2) Ensure that the **pipeline specifications do not exceed the maximum rated values of the counter's key parameters** (kinematic viscosity of the working liquid, measurement range, pressure, operating temperature, nominal diameter (DN)) (see [1.4](#)).

In general, the assessment of the condition of the measured liquid consumer includes the following steps:

- 1)** Check the operation of the consumer for (5...10) minutes in idle mode and (5...10) minutes under load. The liquid in the pipeline must flow evenly, without hydraulic shocks.
- 2)** Check the return line flow (if present). A high return flow increases the measurement error, as the excess liquid returns to the tank and is re-counted by the counter.
- 3)** Use a pressure gauge to check the system pressure. The hydraulic resistance introduced by the counter at nominal flow should not reduce the system pressure by more than 5 %.
- 4)** Inspect all pipelines for damage and leaks.
- 5)** Check the quality of grounding of the object being equipped. The resistance between any grounding point and the "-" terminal of the counter's external power supply should not exceed 1 Ohm.
- 6)** Use a voltmeter to check the voltage of the counter's external power source. The voltage value must not exceed the limits specified in the operating documentation.
- 7)** Check and eliminate any possible sources of external interference at the installation site.

Based on the inspection results, an **Act on examination of the consumer of the fluid which is to be measured** must be prepared and signed (see [annex A](#)).

Before starting LC Corio installation work, the owner of the object must eliminate any malfunctions identified in the Act.

2.3 Transportation and lifting to the installation site

When **transporting** [LC Corio](#) to the installation site, follow the instructions below:

- The counter must be transported in its original factory packaging.
- The protective caps installed on the PT connection elements prevent mechanical damage to the sealing surface and the ingress of foreign objects into the measuring tubes during transportation and storage. The caps may only be removed immediately before installing the counter.

When **lifting** heavy LC Corio models (weighing more than 20 kg) during installation, as well as lighter models to the required height or into hard-to-reach locations, the following rules must be observed:

- The installation organization is responsible for ensuring safety during the installation process. Its specialists must follow safety rules and regulations at the facility, as well as specific handling instructions for the lifting and installation equipment being used.
- The work must be performed by qualified specialists with professional knowledge, proper equipment, tools, and fixtures.
- The surfaces of the PT connection elements must be protected with plugs, which should only be removed immediately before installation.
- LC Corio must be lifted strictly by the PT housing, taking into account the center of gravity position (see figure 13).

WARNINGS:



- 1)** Slipping of LC Corio during transportation or lifting may cause injury. All necessary measures must be taken to prevent accidental rotation of the counter around its axis and slipping. **The center of gravity of the counter must not be above the points around which the lifting loops are placed!**
- 2)** LC Corio **must not be** lifted by the EM or cables.
- 3)** Transport and lift LC Corio carefully and smoothly, **avoiding sudden jerks**. Take all necessary precautions to prevent dropping and/or impacts on the housing.

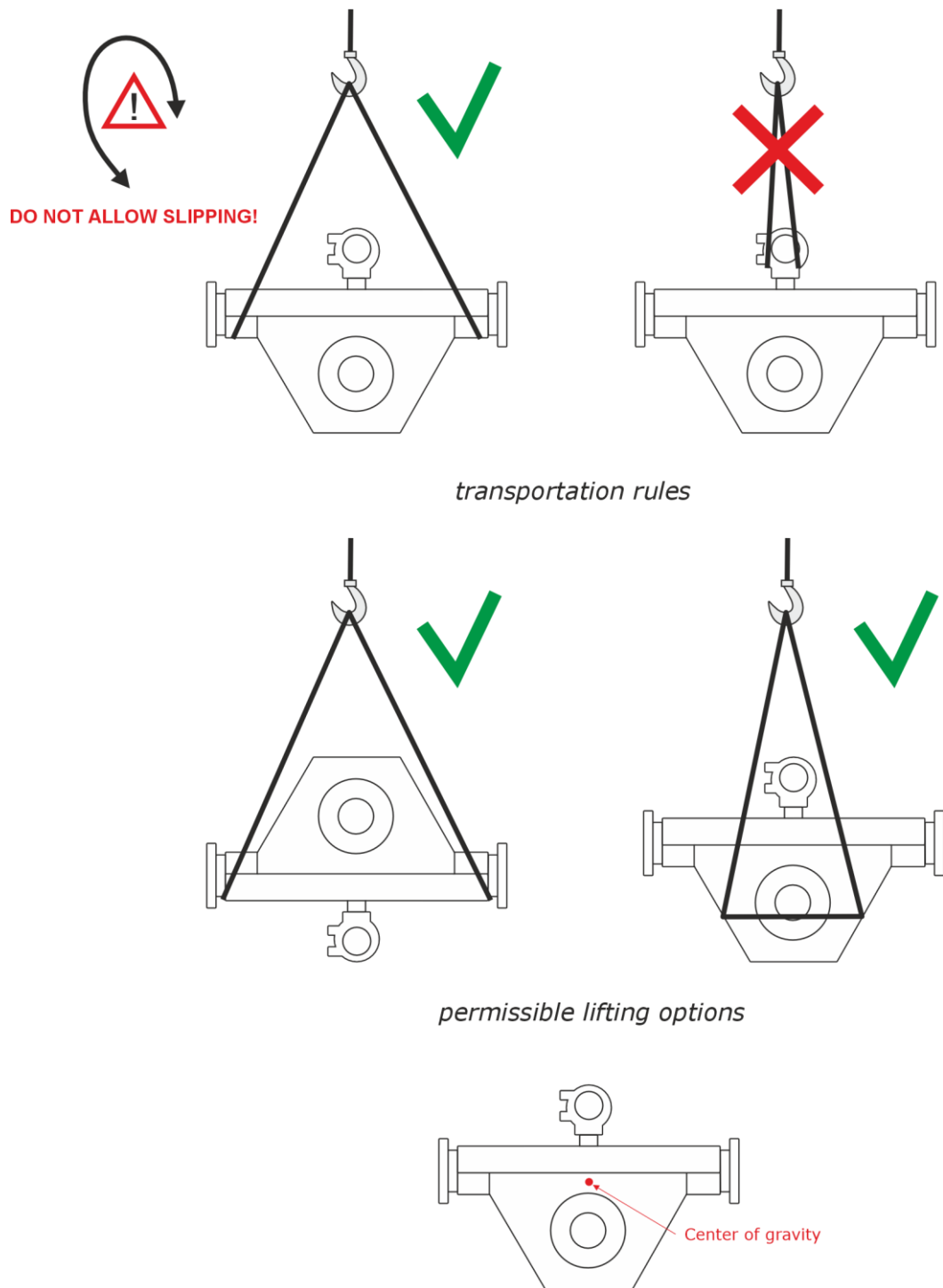


Figure 13 — Transportation and lifting of heavy LC Corio counters to the installation site

2.4 General mounting instructions



RECOMMENDATIONS:

- 1) It is strongly recommended to perform [LC Corio](#) mounting and electrical connection at a **positive ambient temperature**.
- 2) To correctly select the installation location for LC Corio, study the **technical documentation** of the object to be equipped in advance.

When mounting LC Corio, the following rules must be observed:

- The counter should be installed in locations that allow easy access to the built-in display for reading measurements and convenient technical maintenance.
- The pipeline must have a nominal diameter (DN) matching the DN of the counter and must be equipped with a **shut-off valve** that ensures a smooth increase in flow during startup.
Before installation, gently close the shut-off valves and use a pressure gauge to make sure there is no pressure in the pipeline!
- Prepare the pipeline and installation site for the counter according to the length of its PT. If necessary, add a suitable intermediate pipeline section.
The inner surface of the inlet pipeline must be thoroughly cleaned of welding scale, sand, dirt, and other solid particles.

1) Selecting the mounting location

When selecting the mounting location for LC Corio, consider hazardous areas, the technological configuration of the pipelines, and the positioning of the counter's EM module and valves.

Pipeline system

- For proper operation of the LC Corio counter, straight pipeline sections before and after the PT are not required.
- To avoid pipeline damage caused by heavy PTs, especially in areas with strong vibration, it is recommended to provide pipeline supports before and after the counter installation point.
- When connecting the counter to the pipeline, do not allow contamination of flanges and threaded connections. **Use only new sealing elements!**
- Install flanges and threaded connections on the pipeline evenly, avoiding mechanical stress and misalignment.
- It is necessary to ensure that the PT remains constantly filled with the working liquid during operation.
- The presence of air or gas bubbles in the measuring tubes of the counter may increase measurement error. When measuring light petroleum products, if foam or air bubbles are present in the pipeline, a **deaeration system** is required.



IMPORTANT: It is **not recommended** to install the counter in the following locations of the pipeline system (see figure 14):

- 1)** At the highest point of the pipeline — due to possible air accumulation.
- 2)** Directly before a free discharge from a vertical pipeline.

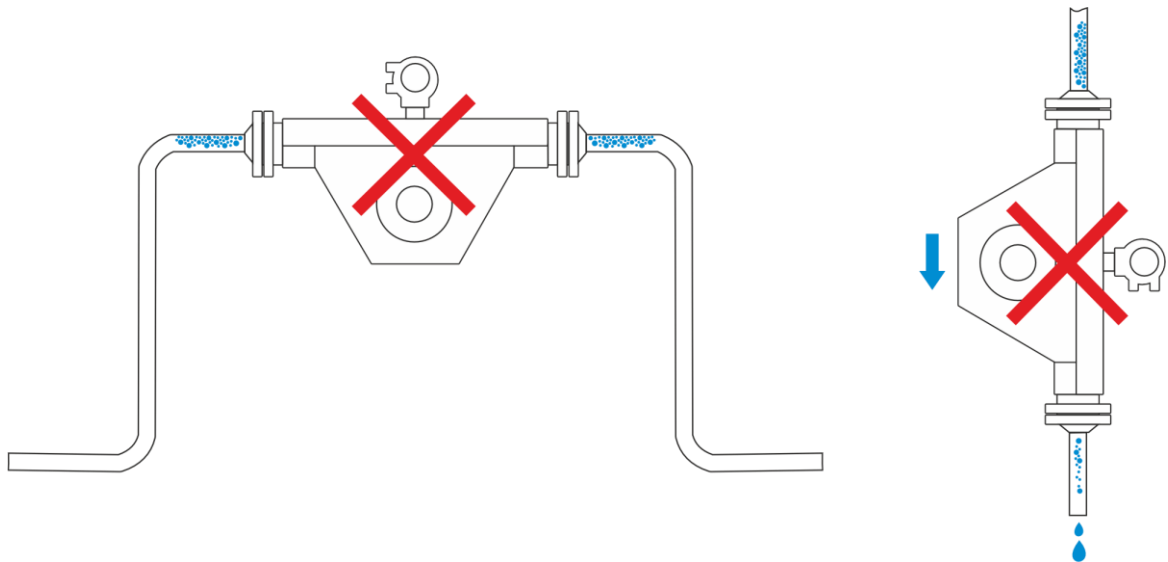


Figure 14 — Improper installation locations for LC Corio

Temperature limitations

- The ambient temperature at the counter's operating location and the temperature of the working liquid must be within the specified limits (see [1.4.2](#)).
- To prevent possible overheating of the EM due to direct sunlight, it is recommended to use a **sunshade** at the installation site.
- When operating the counter at very low negative temperatures or when there is a technological need to reduce heat loss, it is recommended to use **heating systems** and **thermal insulation**.

Using valves

- To prevent backflow when the main pipeline pump is turned off, it is recommended to install a **check valve** at the counter's inlet.
- After completing the counter installation, a zero calibration procedure is required (see [2.6](#)), during which the PT must be filled with the working liquid, and the flow through the PT must be completely stopped. To shut off the flow passing through the counter, it is recommended to install a **shut-off valve** at the counter's outlet (upstream).

System pressure

- Cavitation must be prevented, as it can affect the oscillation of the PT measuring tubes. When working with liquids that have properties close to water under normal conditions, no special measures are required.
- For liquids with a low boiling point (hydrocarbons, solvents) or when using the PT on suction pipelines, it is important to prevent the liquid from boiling and its pressure from dropping below vapor pressure.
- When working with liquids in which gases are naturally formed, it is also important to prevent degassing by maintaining sufficiently high system pressure.

IMPORTANT: It is **recommended to install the counter** in the following locations of the pipeline system:



- 1) After the pipeline pressure pump, as there is no risk of vacuum formation.
- 2) At the lowest point of a vertical pipe.

2) Orientation of the primary transducer on the pipeline

When installing [LC Corio](#), it is necessary to select the correct orientation of its PT on the pipeline.

The PT must be installed so that the **flow direction indicator arrow** on the counter housing (see [1.3](#)) matches the actual direction of the working liquid flow.


The PT can operate in any position where the measuring tubes remain filled with the working liquid. To ensure the specified measurement accuracy, it is recommended to choose the preferred orientation option for PT installation according to Table 3. Using an alternative orientation may reduce measurement accuracy.

Table 3 — Selection of the LC Corio primary transducer orientation when mounting it into the pipeline

Measured medium	Orientation option of the PT	
	Preferred	Alternative
Liquids		

Measured medium	Orientation option of the PT	
	Preferred	Alternative
Pulp		

Features of horizontal mounting

 **ATTENTION:** Due to the curvature of the PT measuring tubes, when installing [LC Corio](#) on a horizontal section of the pipeline, it is necessary to choose the operating position of the PT taking into account the specific type of liquid and its properties.

For different types of liquids, the following features apply (see figure 15):

- When working with **liquids containing solid particles**, it is not recommended to install the counter with the measuring tubes facing downward, as solid particles may accumulate in the tube bends. For such liquids, install the counter with the tubes facing upward.
- When working with **liquids releasing gases**, it is not recommended to install the counter with the tubes facing upward, as gas may accumulate in the tube bends. For such liquids, install the counter with the tubes facing downward.

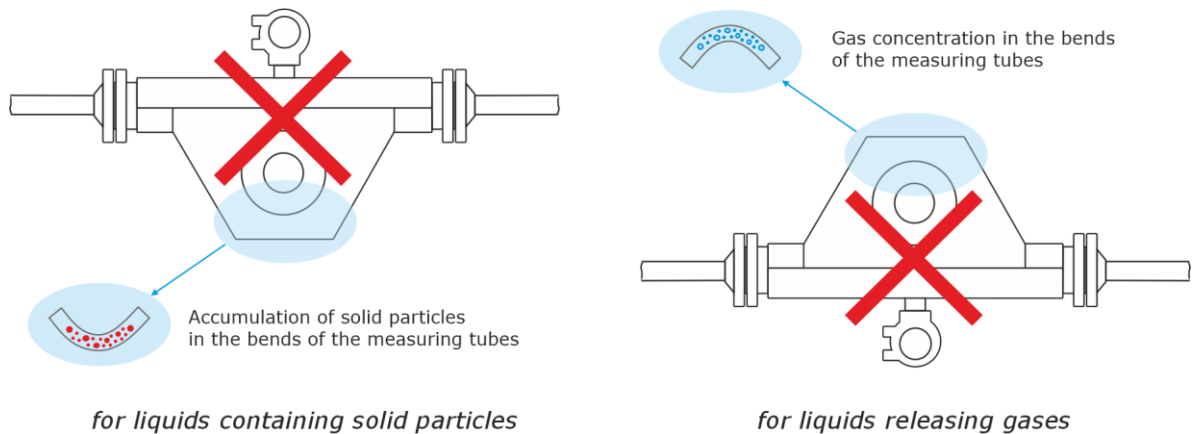


Figure 15 — Unacceptable LC Corio horizontal mounting options

Rotation of the electronic module housing

For convenient reading of the built-in display, the EM housing of the counter can be rotated by 90° or 180° in either direction (see figure 16). To do this:

- Loosen the lock nut at the base of the EM.
- Rotate the EM housing to the desired position (up to two 90° turns in either direction).
- Tighten the lock nut.

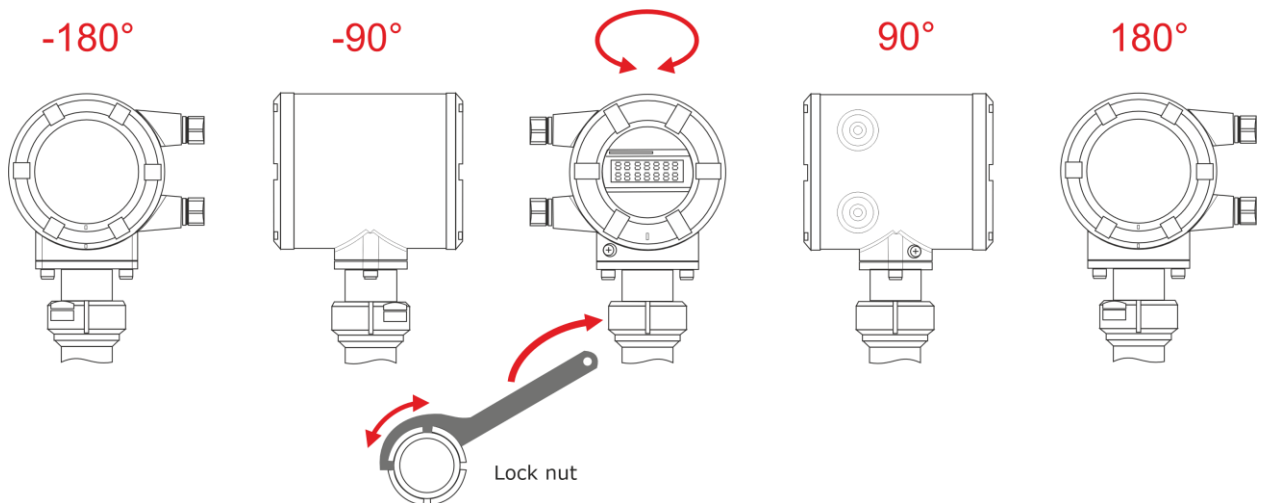


Figure 16 — Rotation of the LC Corio electronic module

3) Mounting into the pipeline

When mounting [LC Corio](#) into the pipeline, the following points must be considered:

- The PT can be installed without external support (except in areas with strong vibration). The flanges provide secure fixation in any position. External impacts are absorbed by the design, particularly by the PT protective cover.
- Minimize torsional mechanical stresses and bending loads at the PT-to-pipeline connection points.
- Use **only new sealing gaskets** to ensure proper tightness. When installing the gasket, avoid shifting it into the inner cavity of the pipeline.



WARNING: To avoid measurement errors and/or damage to the counter, it is **not allowed** to align misaligned pipes using the weight of the installed LC Corio or to use counter components as supports for the pipeline.

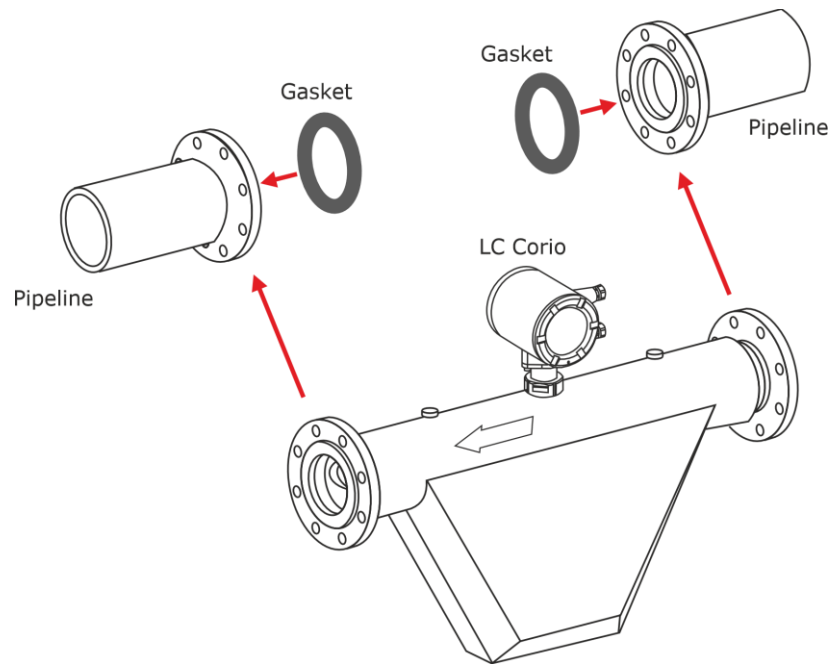


Figure 17 — Mounting LC Corio into the pipeline

Additional mounting conditions

- **Heating:** if necessary, at the PT installation site, electric heating, hot water or steam pipes, or heating jackets can be used.
- **Thermal insulation:** to prevent heat loss at the PT installation site, any type of thermal insulation can be used, such as thermal covers or thermal cabinets.

When using electric heating controlled by phase-shift regulation or pulse packages, the influence of the magnetic field strength (**>30 A/m**) on measurement results cannot be excluded. In such cases, it is recommended to use magnetic shielding for the PT. The PT can be shielded, regardless of flow direction, using white tin or sheet electrical steel with a relative magnetic permeability of at least **300** and a sheet thickness of at least **0.35 mm**.

WARNINGS:



- 1)** The use of heating and thermal insulation is allowed only if, during the operation of the LC Corio EM, the **ambient temperature does not exceed the maximum permissible value** (see [1.4.3](#)).
- 2)** It should be noted that the heat generated by the internal electronic components during LC Corio operation may cause an additional increase of up to **10 °C** on the external surface temperature of the PT. Additionally, when hot liquid passes through the PT, its surface temperature may approach the temperature of the working medium itself. When operating the counter at high working temperatures, appropriate safety measures must be taken.

2.5 Electrical connection

WARNINGS:



- 1)** For proper operation of [LC Corio](#), its electrical connection must be carried out only by certified specialists who have completed [authorized training](#).
- 2)** When electrically connecting LC Corio, it is necessary to strictly follow safety regulations for repair work, as well as the safety requirements established at the facility.
- 3)** Before starting the connection work, to avoid electric shock, disconnect the power circuits of the equipped object (switch off the onboard network).
- 4)** Installation and electrical connection work on the counter must not be performed after power is applied. Failure to follow these requirements may result in electric shock and/or damage to the counter's electronic components.
- 5)** Before applying power, connect the protective grounding to the grounding terminal on the EM housing (not applicable to power sources with galvanic isolation).
- 6)** To avoid damaging the counter, make sure the connected power supply voltage and network frequency comply with the technical specifications (see [1.4.3](#)).

Procedure for electrical connection:

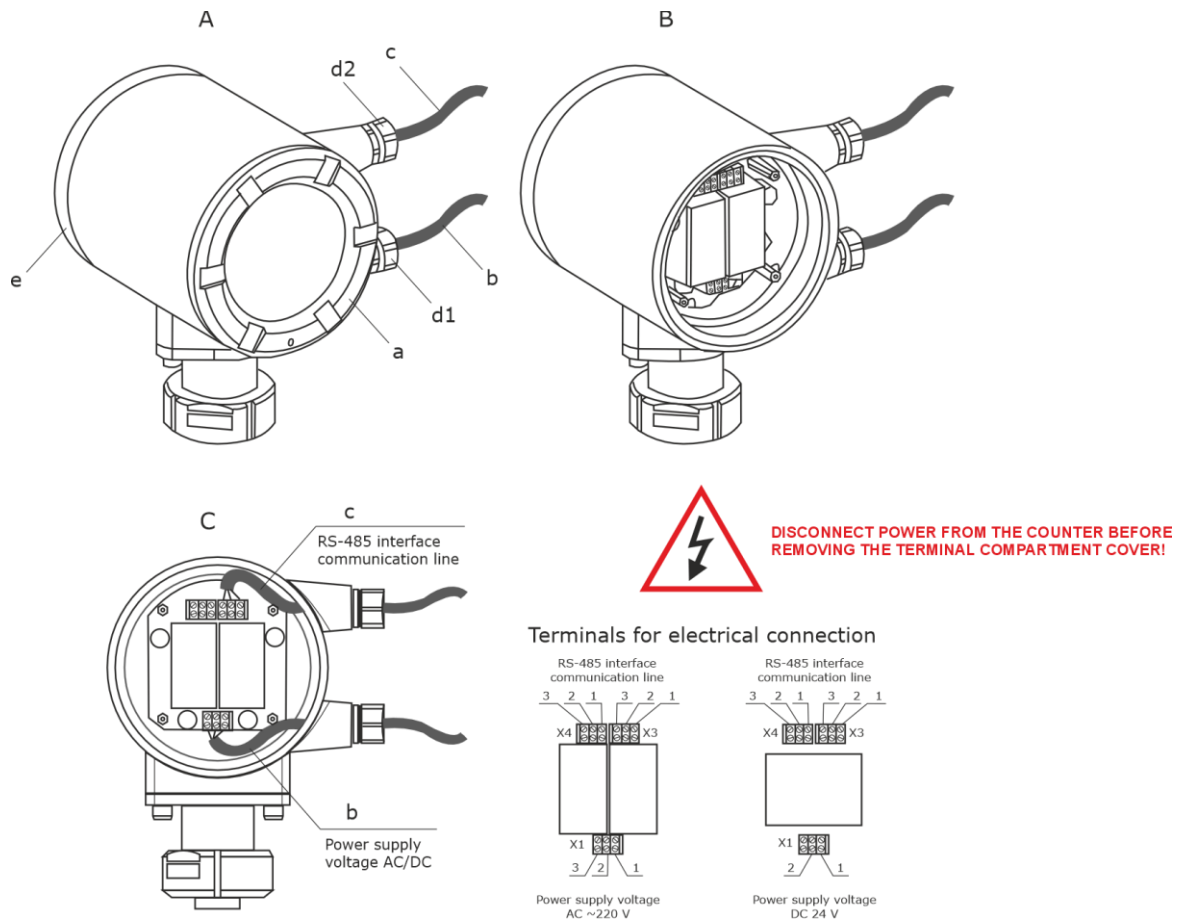
- Unscrew the cover (a) of the EM terminal compartment (see figure 18).
- Pass the power cable (b) and the signal cable (c) through the corresponding cable glands (d1, d2).
- Connect the power wires and the RS-485 interface communication line (see table 4) to the corresponding terminals.
- Screw the cover (a) of the EM housing back on.

Table 4 — Cable specification for RS-485 interface connection

Indicator name	Value
Wave impedance	135...165 Ohm at measurement frequency 3...20 MHz
Cable capacitance	< 30 pF/m
Cable conductor cross-section	0.34 mm ² , according to AWG 22
Cable type	Twisted pair
Loop resistance	< 110 Ohm/km
Signal uniformity	Maximum 9 dB across the entire cross-section of the cable
Shield	Copper braided shield or braided shield combined with foil shield

RS-485 interface connection requirements:

- Counters must be connected using a bus topology (communication line) according to EIA/TIA-485.
- When using cable according to Table 4 and a data transfer rate of 115 200 baud, the maximum RS-485 (Modbus RTU) segment length is **1200 m**. The total length of branch connections must not exceed **6.6 m**.
- The maximum allowed number of terminal devices per segment is **32 units**.
- A **120 Ohm termination resistor** must be installed at the end of each segment.
- To increase the total bus length or the number of connected devices, a repeater should be used.



- A – EM housing assembly;
- B – EM housing with terminal compartment cover removed;
- C – terminals for connecting power cable (AC/DC) wires and RS-485 interface communication line;
- a – terminal compartment cover;
- b – power cable;
- c – signal cable;
- d1, d2 – cable glands;
- e – EM computing compartment cover;
- X1 – terminal block for connecting power cable wires, depending on the counter's power supply version (see [1.4.3](#)):
 - for AC 220 V connection: 1 – phase "L"; 2 – neutral "N"; 3 – ground "PE";
 - for DC 24 V connection: 1 – 24 V "-"; 2 – 24 V "+";
- X3 – terminal block for connecting the RS-485 interface communication line (data transmission in operating mode, parameter changes without restrictions):
 - 1 – terminal for connecting cable shield "RSG";
 - 2 – MODBUS RS-485 "A";
 - 3 – MODBUS RS-485 "B";
- X4 – terminal block for connecting the RS-485 interface communication line (data transmission in service mode, network address – 247, baud rate – 9600, even parity, fixed, cannot be changed):
 - 1 – terminal for connecting cable shield "RSG1";
 - 2 – MODBUS RS-485 "A1";
 - 3 – MODBUS RS-485 "B1".

Figure 18 – LC Corio electrical connection

IMPORTANT:

1) When connecting the counter to an external power source, it is recommended to install a **fuse** in the power circuit (rated current 2 A).

2) The "+" power wire and "-" ground wire should be connected to the same points of the power supply network to which the corresponding wires of the terminal (recording and display device) are connected.



3) The power wires must have a cross-section of at least **0.8 mm²** and a length not exceeding **300 m**.

4) Before starting electrical connection work, special attention should be paid to checking the quality of the grounding of the equipped object. The resistance between any grounding point and the "-" terminal of the counter's external power supply must not exceed **1 Ohm**.

5) It is **strongly recommended** to route the counter's signal cable through the designated wiring areas of the equipped object, at a positive ambient temperature, and secure it with **cable ties** every **50 cm** (see figure19).

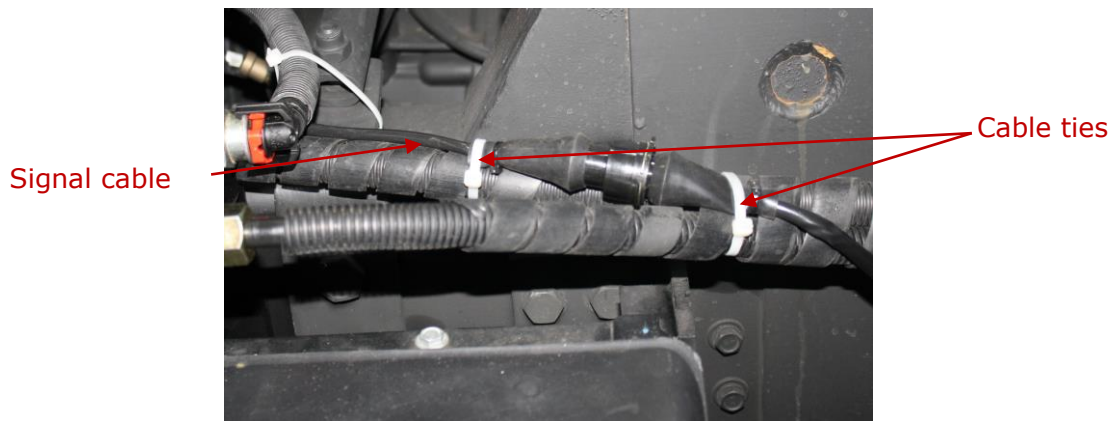


Figure 19 — Signal cable routing

To connect the power wires and the signal cable, it is recommended to use **connectors** (purchased separately) (see figure 20).

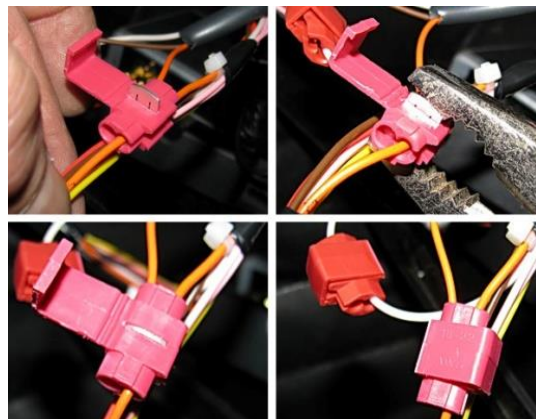


Figure 20 — Using connectors for wire connection

Protection against dust and moisture

When electrically connecting [LC Corio](#), to ensure its IP65 protection rating (see [1.4.3](#)), the following requirements must be met:

- The EM housing seals must be inserted into their respective grooves dry, clean, and undamaged. Replace them if necessary.
- The EM housing screws and threaded covers must be tightly secured.
- The cables used for connection must be undamaged and match the size of the cable gland.
- Cable glands must be tightly fastened.
- Unused cable glands should be sealed with plugs.
- The cable should form a U-shaped loop just before entering the cable gland to prevent liquid from entering the EM. This arrangement stops liquid from penetrating the gland when flowing along the cable.
- Do not remove the insulating sleeves from the cable glands.



WARNING: Do **not loosen the screws** securing the EM to the PT. Otherwise, the declared IP65 protection rating is not guaranteed.

Grounding

Transient processes caused by welding, lightning, powerful electrical equipment, or switches can lead to distorted readings or even damage to LC Corio. For protection, the **counter must be grounded** by connecting the grounding terminal on the EM housing to the earth using a high-current conductor (see figure 21).

It is recommended to use a copper wire with a cross-section of at least **2.0 mm²** as the grounding conductor. The grounding wire must be as short as possible, with a resistance of no more than **1 Ohm**. The EM can also be grounded through a pipeline that provides grounding. No potential should be induced or applied to the grounding conductor.

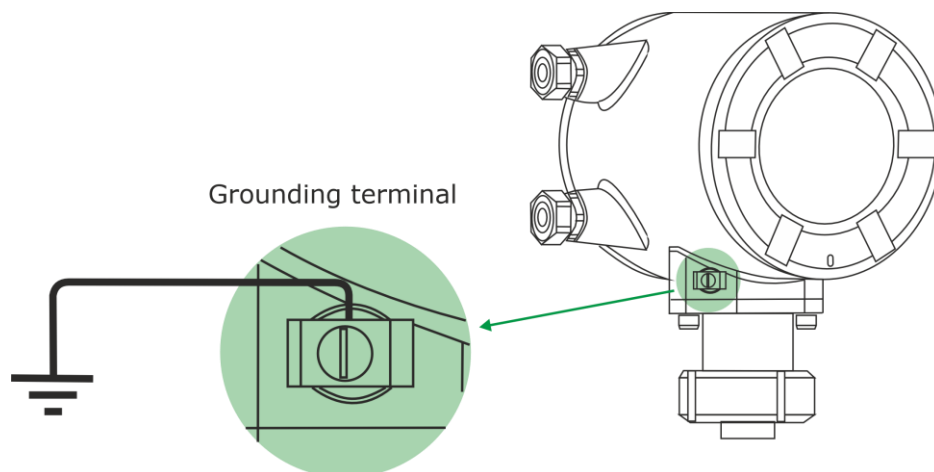


Figure 21 — LC Corio grounding

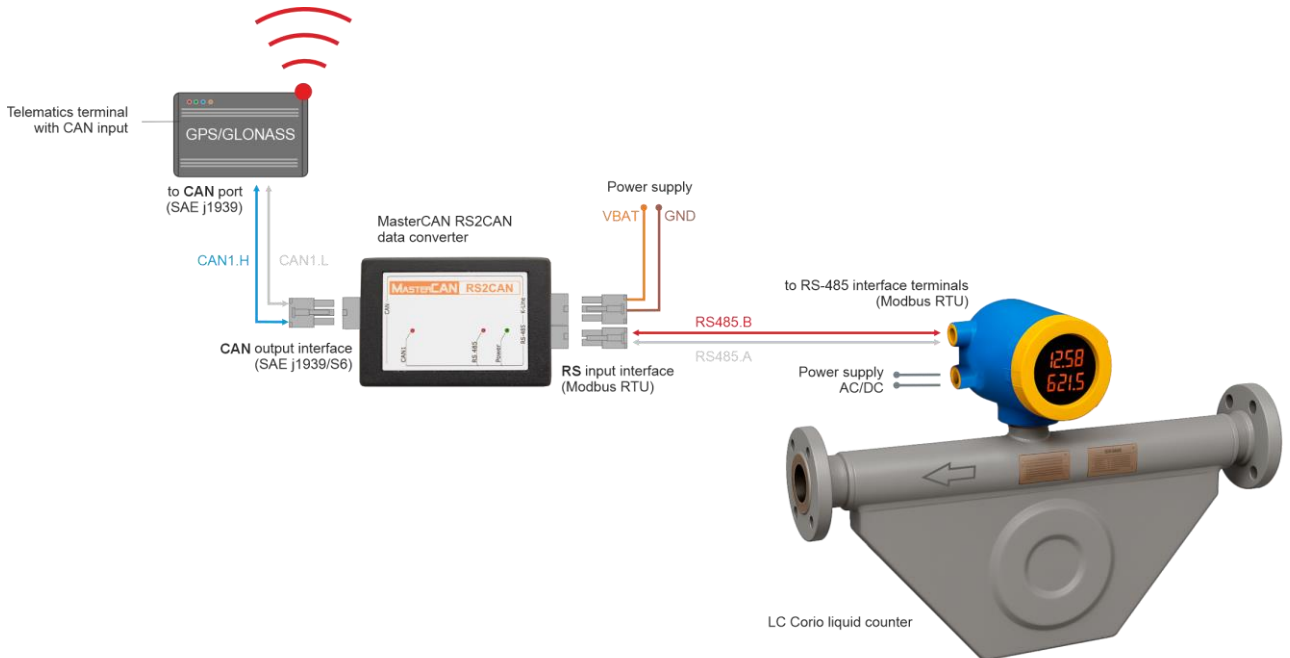
Examples of [LC Corio](#) connection diagrams to recording and display devices are shown in figure 22.



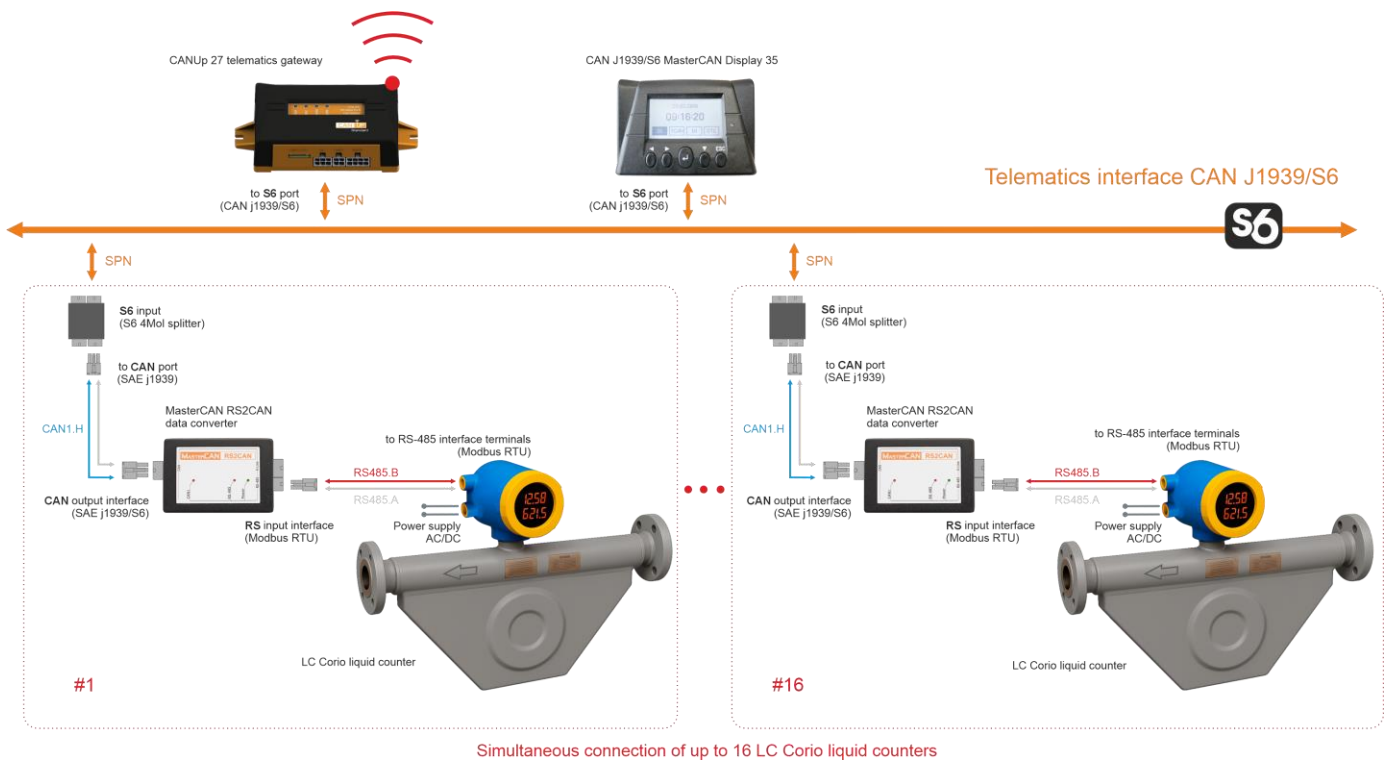
a) connecting LC Corio via the RS-485 interface to the [CANUp 27 Genset](#) telematics gateway



WARNINGS: When electrically connecting the LC Corio counter to an external device via the RS-485 interface, the presence of **120 Ohm termination resistors** between wires **485A** and **485B** at both ends of the communication line is a mandatory requirement for correct data transmission.



b) connecting LC Corio using the [MasterCAN RS2CAN](#) data converter to a telematics terminal with a CAN (SAE j1939) interface



c) connecting multiple LC Corio counters (up to 16 units) via [S6 Technology](#) to a telematics gateway and CAN display



WARNINGS: When electrically connecting the [LC Corio](#) counter to an external device via the CAN (SAE j1939) interface, the presence of **120 Ohm termination resistors** between the **CAN LOW** and **CAN HIGH** wires at both ends of the communication line is a mandatory requirement for correct data transmission.

Figure 22 — Examples of LC Corio liquid counter connection options



RECOMMENDATION: When electrically connecting LC Corio, it is recommended to provide the possibility to disconnect its power during periods when there is no measured flow. This will prevent false accumulation of readings of the internal mass and volumetric flow Counters ("self-run") when there is no fluid flow.

2.6 Adaptation to operating conditions

All [LC Corio](#) counters are calibrated by the manufacturer and supplied ready for use. For connecting LC Corio to an external device or adapting it to specific operating conditions, additional configuration of the counter via the RS-485 interface (Modbus RTU protocol) is possible.

LC Corio configuration is performed using the specialized "Monitor" software. The procedure for working with the "Monitor" software is provided in the ["Monitor" software user manual](#).



WARNING: When configuring the counter, writing data to **its internal memory is possible only when the hardware write protection is disabled** (see [2.7](#)).

Zero point correction. The LC Corio zero calibration point value, corresponding to zero flow, is set by the manufacturer during counter calibration for standard operating conditions and is specified in the product passport. After installing the counter, it is recommended to perform a zero point correction for specific operating conditions.

When correcting the zero point, the following factors must be considered:

- The correction is performed only for liquid media that do not contain gas or solid particles.
- A mandatory requirement for proper correction is the complete filling of the measuring tubes with the working liquid at zero flow (flow velocity = 0 m/s). This condition can be achieved, for example, by using shut-off valves installed in the pipeline section directly before and/or after the PT.

Zero point correction procedure:

- 1 Wait until the counter readings stabilize.
- 2 Stop the flow ($V = 0$ m/s).
- 3 Check the shut-off valves for leaks.
- 4 Make sure the working liquid pressure is within the allowed range (see [1.4.3](#)).
- 5 Perform the zero point correction in the "Monitor" software.



IMPORTANT: It should be taken into account that when there is no fluid flow through the LC Corio counter, a slight zero-point drift is possible. This feature may occur in measuring instruments based on the [Coriolis principle](#).

To prevent false accumulation of readings of the internal mass and volumetric flow [Counters](#) ("self-run") when there is no flow, it is recommended to disconnect the LC Corio power during periods when measurements are not required.

* In some versions of LC Corio counters, hardware write protection may be absent.

2.7 Commissioning

IMPORTANT: To ensure reliable operation of the installed LC Corio (see figure 23) and maintain high measurement accuracy, the following **general requirements** must be observed:



- 1)** To avoid damaging the measuring tubes of the counter due to water hammer, open and close the valves on the supply pipeline **smoothly**.
- 2)** The counter should not operate for more than **2 hours per day** at flow rates close to the upper limit of the measurement range.
- 3)** The counter must be used with liquids whose kinematic viscosity **corresponds** to the nominal value specified in the counter's factory configuration.
- 4)** Before switching on the counter for the first time, **make sure** that the power supply voltage matches the technical specifications (see [1.4.3](#)).



Figure 23 — Example of an LC Corio liquid counter installed in a pipeline at an industrial facility

Enabling/disabling write protection

To avoid incorrect LC Corio readings, it is recommended to enable hardware write protection (if available) before starting operation. When write protection is enabled, it is **not possible** to write metrological parameter settings into the counter's internal memory via the RS-485 (Modbus RTU) interface.

Hardware write protection is enabled or disabled using the microswitch on the EM digital board (see figure 24) as follows:

- Turn off the power supply.
- Unscrew the EM computing compartment cover.
- Enable or disable hardware write protection by setting the microswitch contacts to the required position.
- Screw the EM computing compartment cover back in place.

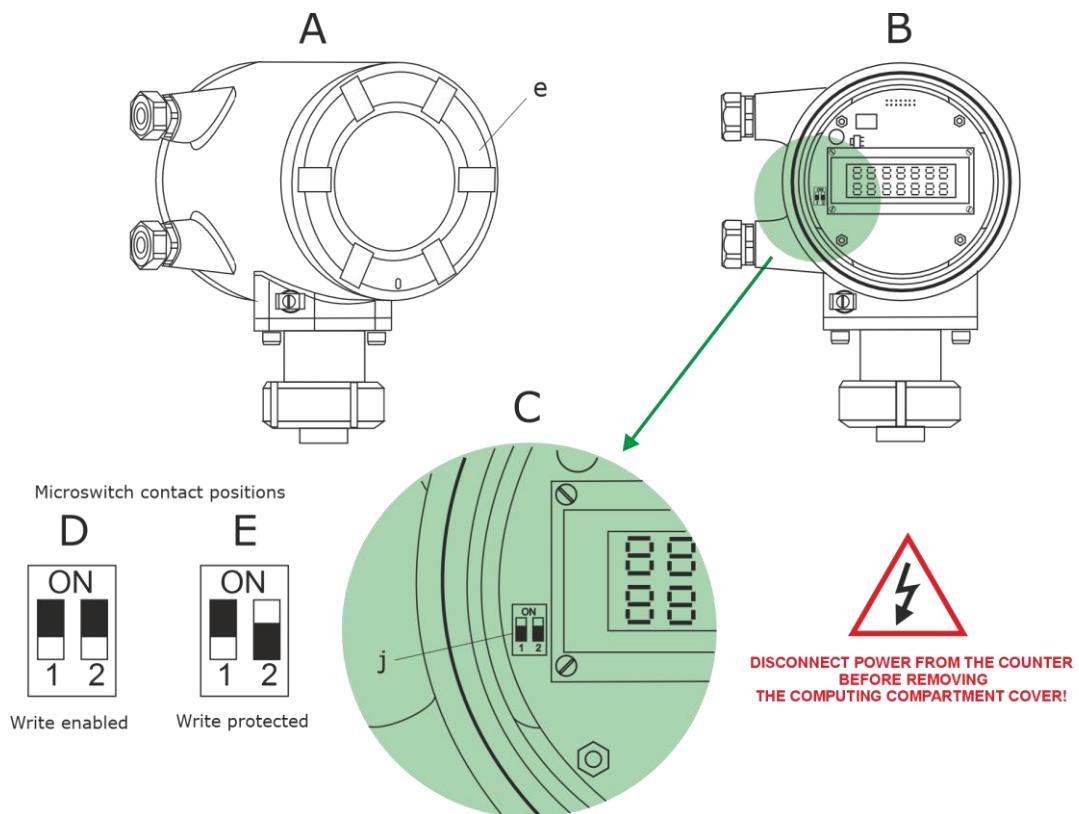


WARNING: To avoid electric shock, make sure the counter's power supply is turned off before removing the EM computing compartment cover.

Verification of functionality

After completing the installation and adapting [LC Corio](#) to the operating conditions, supply the counter with the appropriate power voltage. Immediately after powering on, the LC Corio will automatically start the internal software self-test procedure, during which the built-in display will show software identification data and other information (see [1.4.5](#)).

Once the self-test procedure is completed, the counter will automatically switch to measurement mode, and the display will show real-time measured values of the liquid flow parameters (mass and mass flow, volume and volumetric flow, temperature, and density).



- A – EM housing;
- B – EM without the computing compartment cover;
- C – microswitch location;
- D – microswitch contact position when data writing via the RS-485 (Modbus RTU) interface is **enabled**;
- E – microswitch contact position when data writing via the RS-485 (Modbus RTU) interface is **disabled**;
- e – EM computing compartment cover;
- j – microswitch*.

Figure 24 — Enabling/disabling LC Corio write protection via the RS-485 (Modbus RTU) interface

* In some versions of LC Corio counters, hardware write protection and microswitches may be absent.

3 Diagnostics and troubleshooting

In case of malfunctions in the operation of the [LC Corio](#), you should contact the product supplier.

LC Corio repair works can be carried out only by certified **Regional Service Centers** ([RSC](#)). Full list of service centers can be found at <https://jv-technoton.com/>.

It is allowed to eliminate some LC Corio malfunctions independently (see table 5).

Table 5 — LC Corio malfunctions that can be eliminated independently

Type of malfunction	Possible cause and troubleshooting method
No output signal and no data displayed on the built-in display.	<ol style="list-style-type: none"> 1) Check the presence of supply voltage on the terminals of connector X1 (see figure 18). 2) The EM digital board is faulty. Replacement is required.
Output signal present, but no data displayed on the built-in display.	<ol style="list-style-type: none"> 1) Make sure the built-in display connector is properly connected to the digital board of the counter. 2) The built-in display is faulty. Replacement is required. 3) The EM digital board is faulty. Replacement is required.
Display frozen — no updates of the displayed measurement results.	Turn off the power to the counter and restore power after 10 seconds.
Data displayed on the built-in display, but no output signals.	<ol style="list-style-type: none"> 1) Make sure the counter's signal cable is properly connected to the terminals of connector X3 (see figure 18). 2) The counter's power supply board is faulty. Replacement is required. 3) The EM digital board is faulty. Replacement is required.
No liquid flow, but the counter shows non-zero flow readings.	<ol style="list-style-type: none"> 1) "Drift" of the zero calibration point due to changes in environmental conditions (temperature/pressure) relative to the initial values for which the zero point was recorded. Zero point correction is required (see 2.6). 2) A low threshold flow value is set. It must be adjusted using the "Monitor" software.
Unable to save counter settings changes to internal memory.	The microswitch contacts on the EM digital board are set to the position that disables data writing via the RS-485 (Modbus RTU) interface (see figure 24).

4 Verification

When using the [LC Corio liquid counter](#) as a measuring instrument for commercial liquid metering, it may require verification within the national measurement regulation system in accordance with the legislation of the respective owner's country.

5 Maintenance

The [LC Corio liquid counter](#) does not require any special maintenance.

1) To ensure measurement accuracy, it is recommended to perform a **preventive external inspection** of the liquid counter at least once a year, or more frequently under harsh operating conditions, to check:

- compliance with operating conditions;
- conformity of power supply to technical specifications;
- integrity of the liquid counter's labeling;
- cleanliness of the counter's external surfaces;
- tightness of the PT connections to the pipeline;
- tightness of the EM housing seals;
- absence of external damage to the liquid counter.



ATTENTION: Failure to comply with the LC Corio operating conditions may result in malfunction or exceeding the permissible measurement error.

2) When **cleaning the external surfaces** of the liquid counter, use cleaning agents that do not affect the housing surface or seals.

To clean the measuring tubes from contamination and deposits, use one of the following methods:

- steaming;
- compressed air;
- cleaning agents that do not affect the surface of the tubes.



WARNING: When steaming the measuring tubes, the maximum permissible operating temperature of the LC Corio **must not be exceeded**.

3) Before sending the LC Corio to the [RSC](#) for repair or calibration, all traces of hazardous substances **must be removed** from both the external and internal surfaces of the liquid counter. This is especially important if the substance is harmful to human health, flammable, toxic, caustic, carcinogenic, etc.

Pay special attention to the grooves for seals and gaps where residues of substances may remain. If necessary, attach specific handling instructions for the respective hazardous substances.

A properly completed **Certificate of absence of hazardous substances** must be sent along with the LC Corio (see [annex B](#)).



WARNING: In case of injuries, burns, or other damages, as well as any expenses related to eliminating contamination caused by improper cleaning, **full responsibility lies with the owner** operating the liquid counter.

6 Packaging

The [LC Corio liquid counter](#) set is supplied in a sealed plywood crate (see figure 25).



Figure 25 — LC Corio packaging

A label is affixed to both sides of the LC Corio packaging, containing information about the product name and model, serial number, embedded software version, production release date, weight, quality control stamp, and QR code (see figure 26).



Figure 26 — LC Corio packaging label

Note — Label design and contents can be modified.

7 Storage

[LC Corio liquid counters](#) should be stored in their packaged form in enclosed, dry areas prior to installation. To avoid excessive heating of the surface, the counter must be protected from direct sunlight during storage.

LC Corio storage is permitted only in the original factory packaging, at temperatures from -55 °C to +80 °C and relative humidity up to 95±3 % at 35 °C. The recommended storage temperature is +20 °C.

Do not remove protective caps or covers from the counter's connection elements until it is fully prepared for installation.

LC Corio must not be stored in the same area as substances that cause metal corrosion and/or contain aggressive impurities.

Extended storage of LC Corio at ambient temperatures below -40 °C is not recommended. The storage period for LC Corio must not exceed 24 months.

8 Transportation

[LC Corio liquid counters](#) must be transported in enclosed vehicles of any type, ensuring protection against mechanical damage and preventing atmospheric precipitation from reaching the packaging.

The air inside the transport vehicles must not contain acidic, alkaline, or other aggressive impurities.

Transport containers with packaged LC Corio units must be sealed. The counters, when packed in transport containers, are resistant to transportation shocks and can withstand vibration with acceleration up to 49 m/s^2 and displacement amplitude up to 0.35 mm.

9 Utilization/re-cycling

[LC Corio liquid counters](#) do not contain precious metals in quantities subject to accounting.

Contacts

Distribution, technical support and service



TECHNOTON

**Technoton's quality management system is certified
for compliance with ISO 9001:2015**

sales@jv-technoton.com

support@jv-technoton.com



Annex A

Act on examination of the consumer of the fluid which is to be measured

_____/_____/20_____
 Date Month Year

We, the undersigned representatives of the Customer
 _____,
 and representatives of the Contractor
 _____,
 have conducted fluid consumer (power plant) inspection

Consumer type _____
 Brand, model _____
 Registration number _____

for conformity to LC Corio installation requirements, and have concluded the following:

Requirement	Conforms/ Does not conform	Notes
Hydraulic system hermeticity		Measurement accuracy cannot be guaranteed if leaks are present in the pipelines.
Hydraulic system pressure		If the liquid pressure supplied by the main pump is insufficient, the proper operation of the liquid counter cannot be guaranteed.
State of return line		Increased return flow may significantly affect measurement accuracy.
Power supply voltage		If the supply voltage is insufficient, the proper operation of the liquid counter cannot be guaranteed.
State of grounding		If there is significant resistance or oxidation of the contacts, the proper operation of the liquid counter cannot be guaranteed.

representative of the CUSTOMER:

representative of the CONTRACTOR:

 name, signature

 name, signature

Annex B

Certificate of absence of hazardous substances

_____/_____/20_____
Date Month Year

Order number _____

Returned liquid counter _____

Number _____

List of chemicals and working fluids that have been in contact with the liquid counter:

#	Chemical name	Description	Health hazard

I, the undersigned, confirm that the returned LC Corio liquid counter has been cleaned and decontaminated in accordance with industrial standards and regulations. This product does not present any health hazards due to contamination.

Signature _____

Name _____

Position _____

Company name _____

Date _____

Annex C Videography

1) Video clip **CANUp Telematics gateway**

Check out the link:  <https://youtu.be/1PgmVpr1rDw>

2) Video clip **Configuring CANUp for receiving data from sensors over S6 Technology**

Check out the link:  <https://youtu.be/ttymylf1mfo>

3) Video clip **Wireless BLE sensors connection to CANUp**

Check out the link:  https://youtu.be/9jg_89B8QY

4) Video clip **Configuring CANUp reports. Telematics gateway setup**

Check out the link:  <https://youtu.be/untuzXsOtkA>

5) **DFM Marine Fuel Flow Meters** video.

Link:  https://www.youtube.com/watch?v=9IC4_RzfLik

6) Check out YouTube channel for other **Technoton videos** at:

 <https://www.youtube.com/channel/UCq7EF3DHrgl7fOWB2ynsR-A>