# Technical Information
# **Liquistation CSF33**

Automatic stationary sampler for liquid media
Integrated multiparameter controller

**Application**

Liquistation CSF33 is a stationary sampler designed for the fully automated sampling, defined distribution, and temperature-controlled storage of liquid media.
The standard product version has two 0/4 to 20 mA analog inputs, two binary inputs and two binary outputs.

The sampler is designed for use in the following applications:
- Municipal and industrial sewage treatment plants
- Laboratories and Water Conservancy Boards
- Monitoring of liquid media in industrial processes

**Your benefits**

- Different kinds of housing material
- Two-door housing for reliable sample temperature regulation
- Optimal air circulation
- Two bottle trays for easy sample transportation
- Swift menu guidance, navigator and large display
- User friendly programs ranging from simple time programs to event programs
- Functionality can be extended by installing modular electronic components
- Sample can be supplied from the side or from below
- Integrated data logger for recording measured values
- Touch-safe low-voltage supply for electronic components
- Galvanically separated inputs

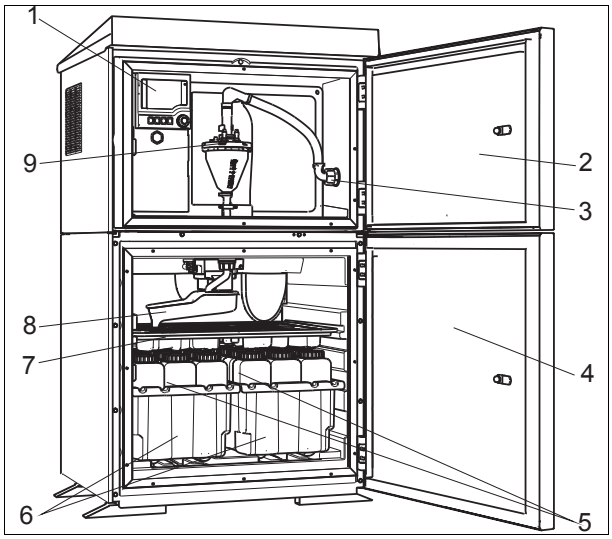
Endress+Hauser
People for Process Automation

# Function and system design

**Liquistation CSF33 sampler**

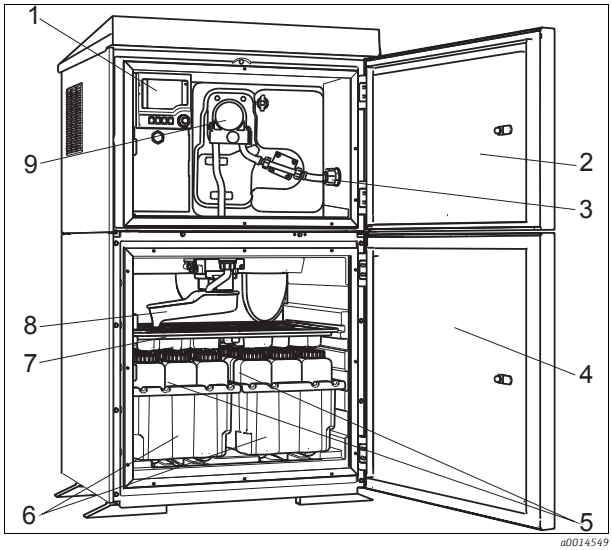
A complete sampling unit comprises:

Liquistation CSF33, with the following depending on the version ordered:
- Controller with display, soft keys and navigator
- Vacuum or peristaltic pump for sampling
- Plastic (PE) sample bottles for sample preservation
- Sample compartment temperature control for safe sample storage
- Suction line with suction strainer




1 *Controller*
2 *Dosing compartment door*
3 *Suction line connection*
4 *Sampling compartment door*
5 *Sample bottles, e.g. 2 x 12 PE 1 liter bottles*
6 *Bottle trays (depending on the sample bottles selected)*
7 *Distribution plate (depending on the sample bottles selected)*
8 *Distribution arm*
9 *Vacuum system, e.g. dosing system with conductive sample sensor*

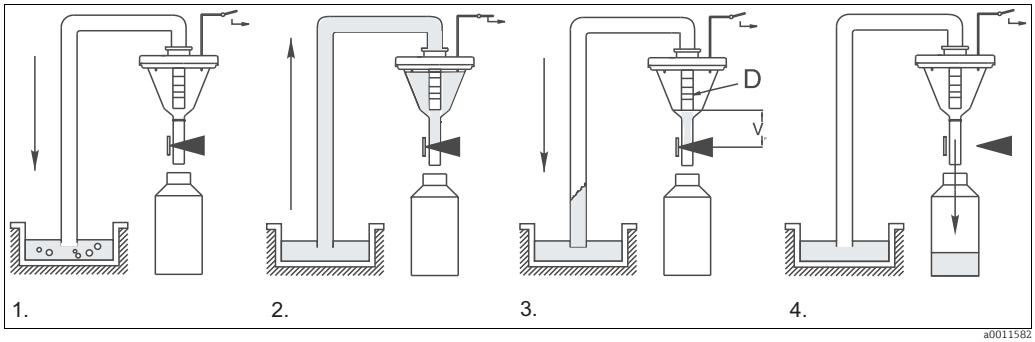
*Example of a Liquistation CSF33, version with vacuum pump*




1 *Controller*
2 *Dosing compartment door*
3 *Suction line connection*
4 *Sampling compartment door*
5 *Sample bottles, e.g. 2 x 12 PE 1 liter bottles*
6 *Bottle trays (depending on the sample bottles selected)*
7 *Distribution plate (depending on the sample bottles selected)*
8 *Distribution arm*
9 *Peristaltic pump*

*Example of a Liquistation CSF33, version with peristaltic pump*

**Mode of operation with a vacuum pump**

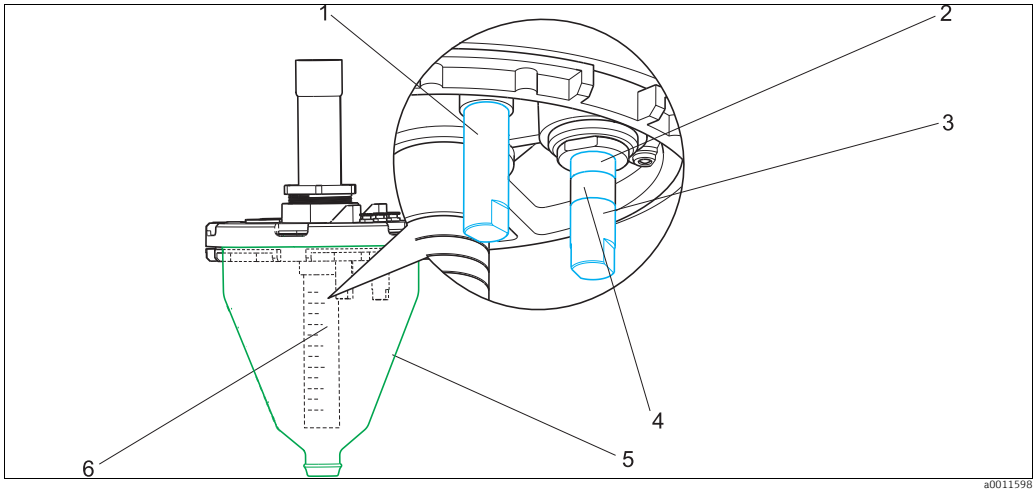



*Sampling with a vacuum pump*

Sampling takes place in four steps:

1. **Blow clear**
   The hose valve is closed. The vacuum pump blows the suction line clear via the dosing system.
2. **Intake**
   The "air manager" - a pneumatic control unit - switches the air path of the vacuum pump to "intake". The sample is drawn into the dosing beaker under vacuum. The level of liquid reaches the detectors of the dosing system.
3. **Dose**
   The intake process is completed and pressure compensation takes place. Depending on the position of the dosing tube (D), the excess sample liquid flows back to the sampling point.
4. **Drain**
   The hose clamp is opened and the sample is drained into the sample bottle.

### Dosing system with conductive sample sensor




*Conductive dosing system*

*1 Conductivity sensor 1 (common electrode)*
*2 Conductivity sensor 2 (safety electrode)*
*3 Conductivity sensor 3 (standard electrode)*
*4 Insulation*
*5 Dosing beaker (plastic version with graduated scale or glass)*
*6 Graduated dosing tube, white and blue scale*
*Not shown since hidden: hose connection for vacuum pump --> graphic for "Capacitance dosing system"*

### Level detection principle

When the sample is drawn in, the sample level reaches conductivity sensors 1 and 3. The system thus detects that the dosing chamber is filled and terminates the suction process.
If sensor 3 is heavily fouled or fails, conductivity sensor 2 switches to safety mode and turns off the system. This patented sample detection method along with predictive maintenance information prevent vacuum pump failure as a result of flooding.

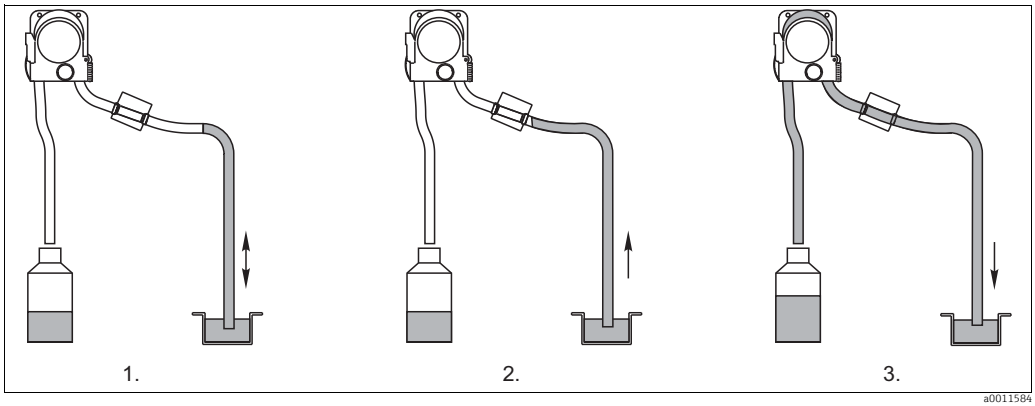
### Sample dosing with/without pressure

Sample dosing without pressure is the factory setting for all standard applications in which the sample medium is taken from an open channel or a gravity line. The excess sample can flow back under atmospheric pressure.
Sample dosing with pressure is selected for applications in which the sample is taken from a pipe, or for applications involving a low suction height and a low sample volume. In such instances, the sample medium cannot flow back on its own. The maximum pressure in the pipe must be < 0.8 bar. Pressure is applied and the excess sample is forced out of the dosing chamber and back to the sampling point.

### Adjusting sampling volume

The sampling volume is set by adjusting the dosing tube. The white "A" scale applies if dosing without pressure, and the blue "B" scale applies if dosing with pressure.
The unthoughtful relocate of the dosing tube is prevented by an Allen screw.

**Mode of operation with a peristaltic pump**

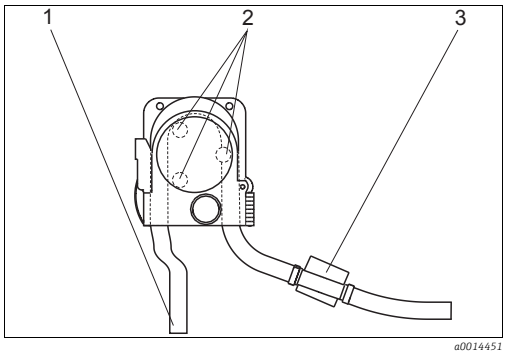



*Sampling steps with a peristaltic pump*

Sampling takes place in three steps:

1. **Rinse**
   The peristaltic pump runs in reverse and forces medium back to the sampling point.
2. **Intake**
   The peristaltic pump runs forward and draws in medium. If the medium detection system detects the sample, the pump is controlled by the flow and the specified sample volume is calculated automatically.
3. **Drain**
   The pump runs in reverse again and forces the medium back to the sampling point.

One advantage this system offers for obtaining a representative sample is the possibility of rinsing the suction line several times:
Liquid is initially drawn in until the liquid detection system reacts, then the pump switches and forces the liquid back to the sampling point. This process can be repeated a maximum of three times. The sample is then taken as described.




*1 Pump tubing*
*2 Pump rollers*
*3 Liquid detection system (patented)*

*Peristaltic pump*

The pump rollers deform the tubing, thereby causing a negative pressure and the suction effect.
The liquid detection system is based on a pressure sensor which detects the difference between a pipe that is filled and not filled.
Thanks to a patented process for automatically detecting the suction height, the user does not have to enter the suction height or suction line length. The self-learning software guarantees that the sample volume remains constant.

**Sample distribution**

CSF33 offers a wide range of bottle combinations and distribution versions. The versions can be changed or replaced easily without the need for special tools. In addition, the software makes it possible to configure individual bottles and bottle groups as well as assign them to change based on a programmed event.

**Sample preservation**

The sample bottles are located in the sample compartment. This is fitted with a seamless plastic inner shell to ensure easy and effective cleaning.
All parts that transport liquid (distribution arm, dosing system, distribution plate etc.) can be removed and cleaned easily without the need for additional tools.

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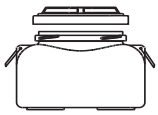
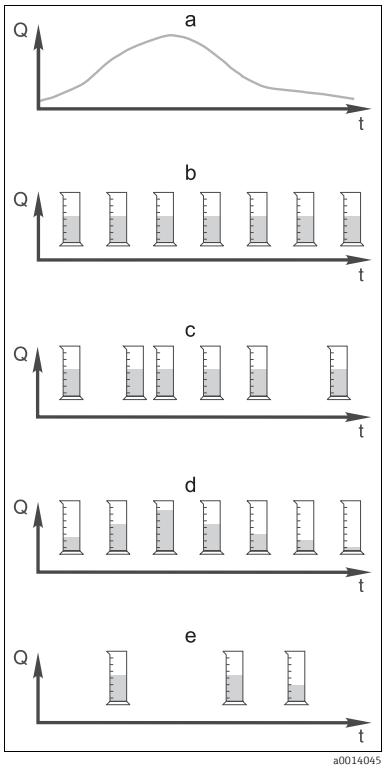
*Distribution plate, distribution arm and bottle trays*

**Bottle groups and distribution version depending on the order version:**

| | | CSF33-****** |
|---|---|---|
|  | 30 liter, PE, direct distnibution | 1 piece |
|  | 13 liter, PE, direct distnibution | 4 pieces |
|  | 3 liter, PE, plate distribution | 12 pieces |
|  | 1 liter, PE, plate distribution | 24 pieces |

## Sampling control




*Sampling control*

a. Flow curve

b. **Time-proportional sampling**
A constant sample volume (e.g. 50 ml) is taken at regular intervals (e.g. every 5 min).

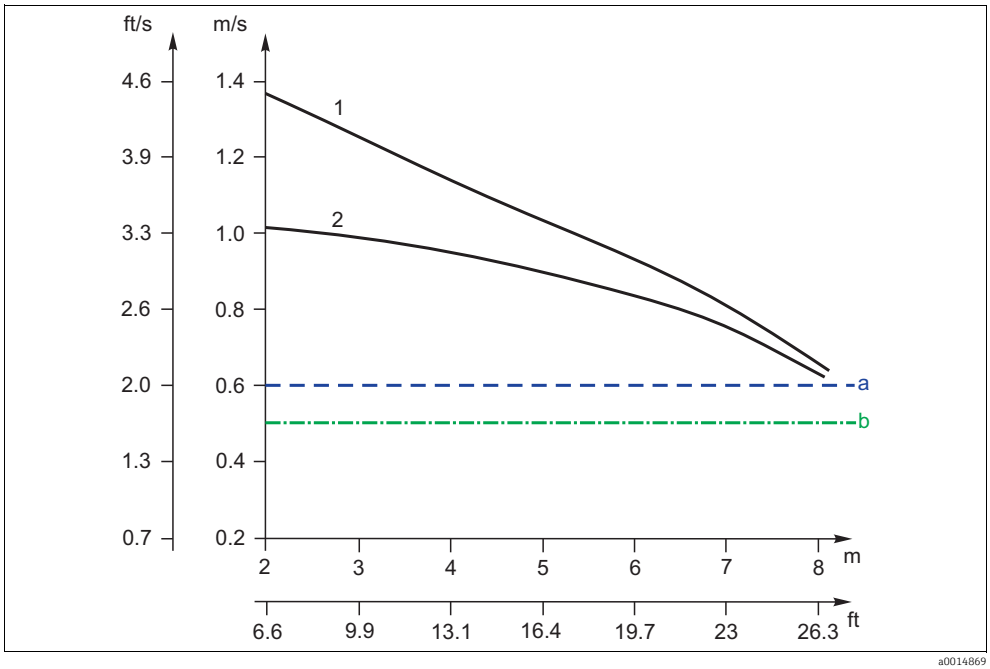
c. **Volume-proportional sampling**
A constant sample volume is taken at variable intervals (depending on the inflow volume).

d. **Flow-proportional sampling**
A variable sample volume (the sample volume depends on the inflow) is taken at regular intervals (e.g. every 10 min).
Only in version with peristaltic pump.

e. **Event-controlled sampling**
Sampling is triggered by an event (e.g. pH limit value). Sampling can be time-paced, volume-paced or flow-paced, or single samples can be taken.

Single and multiple samples can also be grouped in a program in addition to the sampling methods listed. Furthermore, the software allows interval sampling, switchover and event functions. The latter permit up to 24 subprograms to be active simultaneously for a variety of applications.
A sampling table makes it possible for users to program the bottle assignment, time interval and sample volume.
Signals for external control can be connected via 2 analog inputs and 2 binary inputs in the standard version of the product. Customized text is entered to ensure the correct assignment of the inputs in the memory.

## Intake speed with different suction lines




*Intake speed in m/s at suction heights in m (vertical lift)*

*a Intake speed as per Ö 5893 (Austrian standard), US EPA*
*b Intake speed as per EN 25667, ISO 5667*
*1 ID 13 mm (1/2") vacuum pump*
*2 ID 10 mm (3/8") peristaltic pump*

**Sample temperature regulation**

The temperature of the sample compartment can be adjusted using the controller. The factory setting is 4 ˚C (39 ˚F). The current temperature is shown on the display and recorded in the internal data logger.
The vaporizer and defrost heater are integrated in a special housing such that they are protected against corrosion and damage. The compressor and condenser are located in the upper section of the sampler, They can be easily accessed by removing the upper rear panel (for maintenance purposes).

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*Cooling system*

**Sampler housing**

Please note the mounting conditions in the "Installation" section and the information on materials for the different housing types in the "Mechanical construction" section.

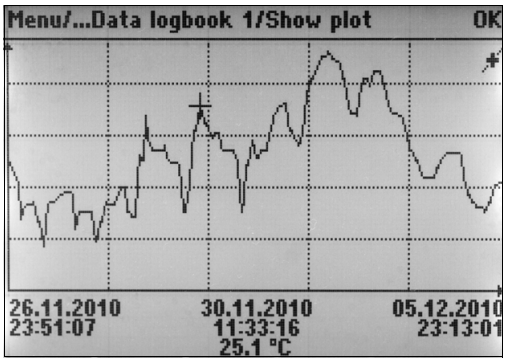
Plastic polystyrene VO can change color when exposed to direct sunlight.
The functionality is not affected by the discoloration.

# Dependability

## Maintainability

### Memory

- Independent, integrated ring memories (FIFO) or stack memories for recording
  - an analog value (e.g. flow, pH value, conductivity)
  - events (e.g. power failure)
  - sample statistics (e.g. sample volume, filling times, bottle assignment)
- Program memory: max. 100 programs
- Data logbooks
  - Adjustable scan time: 1 to 3600 s (6 h)
  - max. 8 data logbooks
  - 150,000 entries per logbook
  - Graphic display (load curves) or numeric listing
- Calibration logbook: max. 75 entries
- Hardware logbook:
  - Hardware configuration and modifications
  - max. 125 entries
- Version logbook:
  - e.g. software updates
  - max. 50 entries
- Operation logbook: max. 250 entries
- Diagnostic logbook: max. 250 entries




*Data logbook: Graphic display*

### SD card

The exchangeable storage medium enables:
- Quick and easy software updates and upgrades
- Data storage of internal device memory (e.g. logs)
- Transfer of complete configurations to a device with an identical setup (backup function)
- Transfer of configurations without the TAG and bus address to devices with an identical setup (copy function)

Endress+Hauser offers industry-approved SD cards as accessories. These memory cards provide maximum data security and integrity.
Other SD cards can also be used. However, Endress+Hauser does not accept any responsibility for the data security of such cards.

## Safety

### Real-time clock

The device contains a real-time clock. In the event of a power failure, a button cell battery is used. This ensures that if the device is restarted, the date and time settings are retained and the time stamp for the logbooks is correct.

### Data security

All settings, logbooks etc. are stored in a non-volatile memory to ensure that the data are retained even if there is a disruption to the power supply.

## Input

**Input types**

- 2 analog inputs
- 2 binary inputs

## Binary input, passive

**Span**

12 to 30 V, galvanically isolated

**Signal characteristics**

Minimum pulse width: 100 ms

**Accuracy**

±0.5 K

## Analog input, passive/active

**Span**

0/4 to 20 mA, galvanically isolated

**Accuracy**

±0.5 % of measuring range

## Output

**Output signal**

2 binary outputs:
Open collector, max. 30 V, 200 mA

## Power supply

**Electrical connection**

--> For a detailed wiring diagram, see the Operating Instructions for Liquistation CSF33

**Supply voltage**

100 to 120/200 to 240 V AC ±10 %, 50/60 Hz

**NOTICE**

**The device does not have a power switch**

▸ A fuse with a maximum rating of 10 A must be provided by the customer. Observe the local regulations for installation.

**Cable entry**

Depending on version:
- 1 x M25, 7 x M20 cable gland
- 1 x M25, 1 x M20 cable gland

**Permitted cable diameter**:
- M20x1.5 mm: 7 to 13 mm (0.28 to 0.51")
- M25x1.5 mm: 9 to 17 mm (0.20 to 0.67")

**Mains fuse**

Optional fuses on DIN rail
- T3.15A (for 230V power supply)

**Power consumption**

- Version with vacuum pump: 290 VA
- Version with peristaltic pump: 290 VA

**Power failure**

- Real-time clock: lithium battery, type CR2032

# Performance characteristics

**Sampling methods**

**Vacuum pump / peristaltic pump:**
- Event sampling
- Single and multiple samples
- Sampling table

**Vacuum pump:**
- In proportion to time
- In proportion to volume

**Peristaltic pump:**
- In proportion to time
- In proportion to volume
- In proportion to flow

**Dosing volume**

- **Vacuum pump:**
  20 to 350 ml (0.7 to 12 fl.oz.)
- **Peristaltic pump:**
  10 to 10,000 ml (0.3 to 340 fl.oz.)
  A sample volume < 20 ml can vary in dosing accuracy and repeatability, depending on the application.

**Dosing accuracy**

- **Vacuum pump:**
  ±5 ml (0.17 fl.oz.) or 5 % of the set volume
- **Peristaltic pump:**
  ±5 ml (0.17 fl.oz.) or 5 % of the set volume

**Repeatability**

- **Vacuum pump:** 5 %
- **Peristaltic pump:** 5 %

**Intake speed**

> 0.5 m/s (> 1.6 ft/s) for ≤ 13 mm (1/2") ID, in accordance with EN 25667, ISO 5667
> 0.6 m/s (> 1.9 ft/s) for 10 mm (3/8") ID, in accordance with Ö 5893 (Austrian standard); US EPA

**Suction height**

- **Vacuum pump:**
  max. 6 m (20 ft) or max. 8 m (26 ft), depending on the version
- **Peristaltic pump:**
  Max. 8 m (26 ft)

**Hose length**

Max. 30 m (98 ft)

**Temperature control**

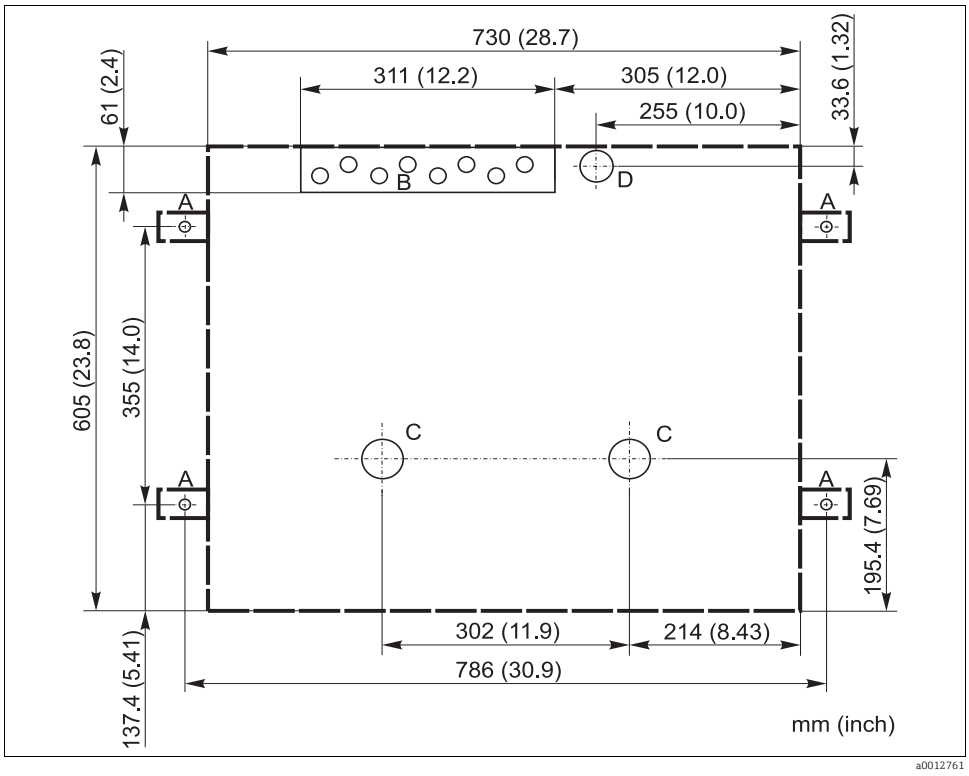
**Temperature sensors:**
- Sampling chamber temperature

**Temperature regulator:**
- Sample temperature range: 2 to 20 ˚C (36 to 68 ˚F)
  - Factory setting: 4 ˚C (39 ˚F)
- Automatic defrost system
- Cooling speed in accordance with Ö 5893 (Austrian standard):
  4 liters of water at 20 ˚C are cooled to 4 ˚C in less than 210 minutes
- Temperature stability of the sample at 4 ˚C for the ambient temperature range of -15 to 40 ˚C (5 to 105 ˚F)

# Installation

## Installation instructions

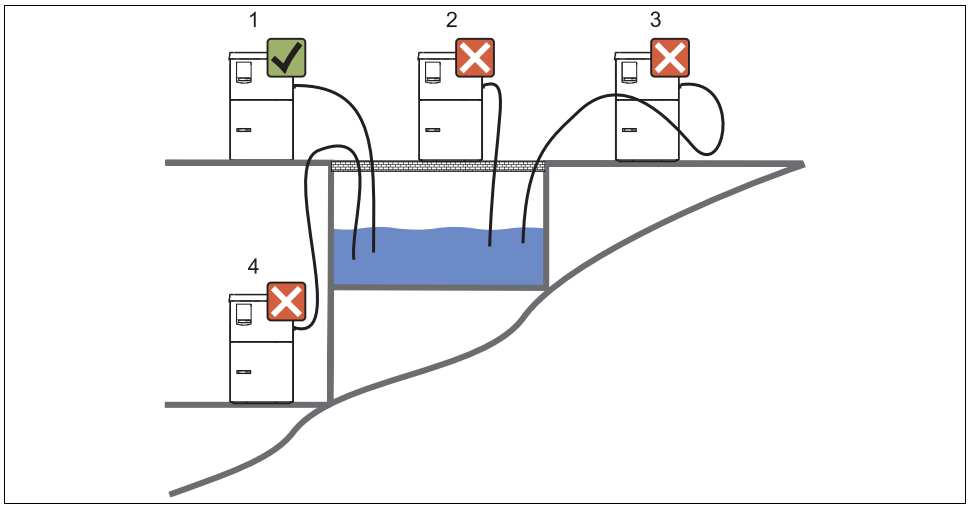
### Foundation plan




*Foundation plan*

*A Fasteners (4 x M10)*
*B Cable inlet*
*C Outlet for condensate and overflow > DN 50*
*D Sample supply from below > DN 80*
*- - - Liquistation dimensions*

## Mounting conditions for Liquistation CSF33




*Mounting conditions for Liquistation CSF33 for open channels*

1. **Correct**
   The suction line must be routed with a downward gradient to the sampling point.
2. **Incorrect**
   The sampler should never be mounted in a place where it is exposed to aggressive gases.
3. **Incorrect**
   Avoid siphoning effects in the suction line.
4. **Incorrect**
   The suction pipe should never be routed with an upward gradient to the sampling point.

Note the following when erecting the device:
- Erect the device on a level surface.
- Protect the device against additional heating (e.g. from heaters).
- Protect the device against mechanical vibrations.
- Protect the device against strong magnetic fields.
- Make sure air can circulate freely at the side panels of the cabinet. Do not mount the device directly against a wall. Allow at least 150 mm (5.9") from the wall to the left and right.
- Do not mount the device directly above the inlet channel of a wastewater treatment plant.

## Environment

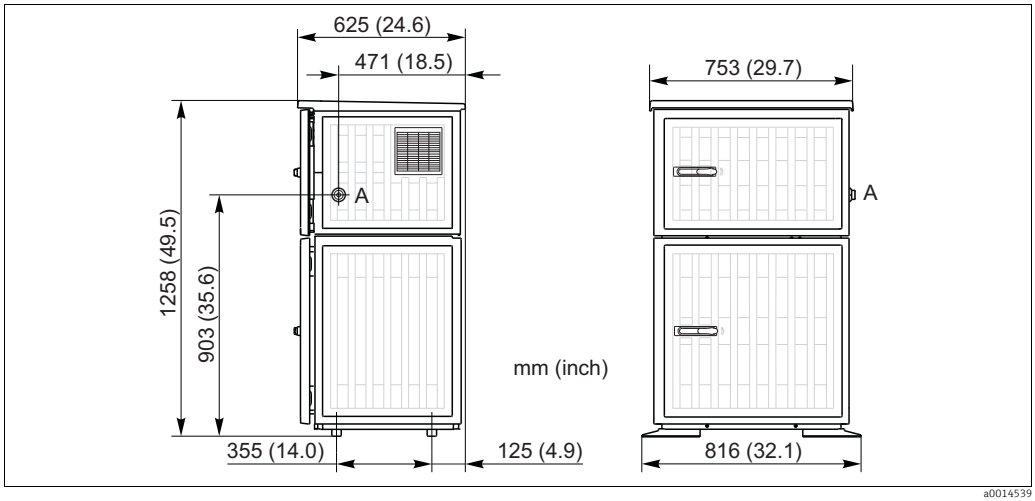
| | |
|---|---|
| **Ambient temperature range** | ▪ For stainless steel housing: -20 to 40 °C (0 to 100 °F)<br>▪ For plastic polystyrene housing: 0 to 40 °C (32 to 100 °F) |
| **Storage temperature** | -20 to 60 °C (0 to 140 °F) |
| **Degree of protection** | ▪ Dosing compartment (front): IP 54<br>▪ Dosing compartment (back): IP 33<br>▪ Control (front panel): IP 65<br>▪ Sample compartment: IP 54 |
| **Electromagnetic compatibility** | Interference emission and interference immunity as per EN 61326-1: 2006, class A for industry |
| **Electrical safety** | In accordance with EN 61010-1, protection class I, environment ≤ 2000 m (6500 ft) above MSL. The device is designed for contamination level 2. |
| **Relative humidity** | 10 to 95%, not condensing |

## Process

| | |
|---|---|
| **Medium temperature range** | 2 to 50 °C (36 to 122 °F) |
| **Medium properties** | **Liquistation with vacuum pump**<br>Capacitance level measurement used for:<br>▪ Media that tend to create a lot of foam or contain fats and grease<br>▪ Media with a conductivity < 30 µS/cm<br>**Liquistation with peristaltic pump**<br>▪ Sample media have to be free of abrasive substances.<br>**Caution!**<br>Pay attention to the material resistance of the wetted parts. |
| **Process pressure (absolut)** | **Vacuum pump / peristaltic pump:**<br>▪ unpressurized, open channel<br>▪ max. 1.8 bar piping (only with shutoff / inlet valve) |
| **Process connection** | ▪ Vacuum pump:<br>Intake hose ID 10 mm (3/8"), 13 mm (1/2"), 16 mm (5/8") or 19 mm (3/4")<br>▪ Peristaltic pump:<br>Intake hose ID 10 mm (3/8") |

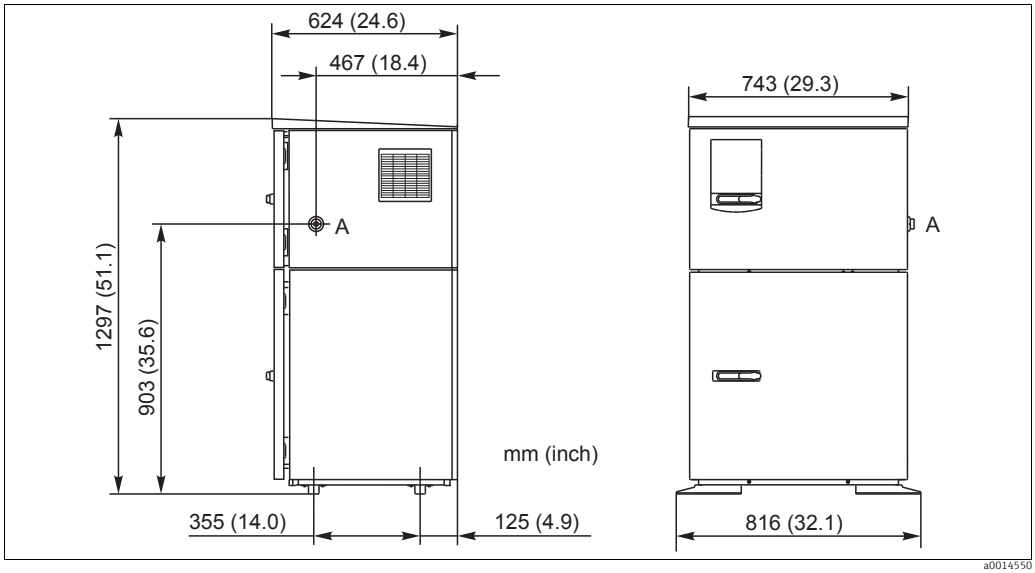
# Mechanical construction

## Dimensions




*Dimensions of plastic version of Liquistation CSF33*

*A Suction line connection*




*Dimensions of stainless steel version of Liquistation CSF33*

*A Suction line connection*

## Weight

| CSF33 sampler version | Weight |
|---|---|
| Plastic version with refrigeration | 101 kg (223 lbs) |
| Stainless steel version with refrigeration | 118 kg (260 lbs) |

**Material**

Plastic polystyrene VO can change color when exposed to direct sunlight.
The functionality is not affected by the discoloration.

| **Non-wetted parts** | |
|---|---|
| Cabinet housing | Plastic polystyrene V0<br>For standard applications in wastewater treatment plants and environmental monitoring<br>Stainless steel V2A (1.4301)<br>For standard applications in wastewater treatment plants and environmental monitoring |
| Sample compartment inner shell | Plastic PP |
| Insulation | Plastic EPS "Neopor" |

| **Wetted parts** | **Vacuum pump** | **Peristaltic pump** |
|---|---|---|
| Dosing tube | Plastic PP | - |
| Dosing chamber cover | Plastic PP | - |
| Conductivity sensors | Stainless steel V4A (1.4404) | - |
| Dosing chamber | Plastic PMMA | - |
| Dosing system outflow tubing | Silicone | - |
| Pump tubing | - | Silicone |
| Distribution arm | Plastic PP | |
| Distribution arm cover | Plastic PE | |
| Distribution plate | Plastic PS | |
| Composite container/bottles | Plastic PE | |
| Suction line | Plastic PVC | |
| Suction line connection | Plastic PP | |

# Operability

**Operating concept**

The simple and structured operating concept sets new standards:
- Intuitive operation with the navigator and soft keys
- Fast configuration of application-specific measurement options
- Easy configuration
  and diagnosis thanks to plain-text display
- All languages that can be ordered are available in every device

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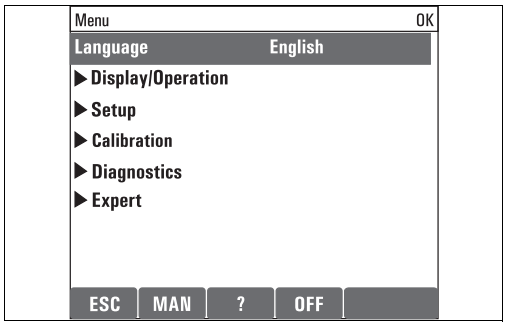
*Easy operation*

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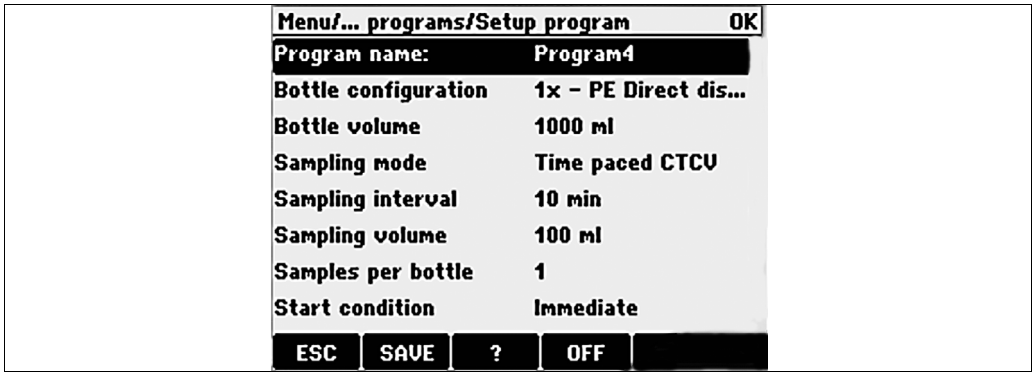
*Plain-text menu*

**Display**

Graphic display:
- Backlight with switch-off function
- Red background display for alarms alerts users to errors
- Transflective display technology for maximum contrast even in bright environments

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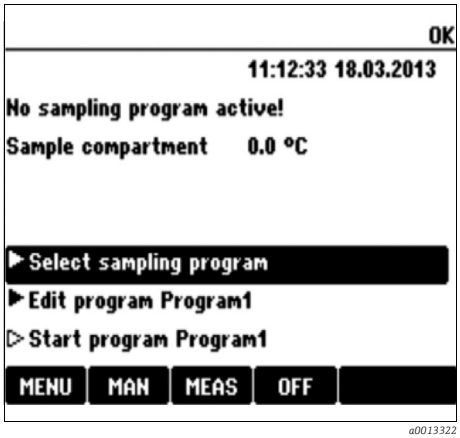
*Example of program setup*

**Local operation**

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- *Liquid crystal display, backlighting*
- *160 x 240 pixels*
- *4 operating keys (soft key function) and navigator*
- *Menu-guided operation*

**Communication**

- 1 service interface
- Commubox FXA291 (accessory) required for communication with the PC

# Ordering information

**Product structure**

You can create a valid and complete order code online using the Configurator.

Enter the following URLs in your browser to access the relevant product page:
www.products.endress.com/csf33

1. You can choose from the following options on the right of the product page:

| Product page function |
| --- |
| :: Add to product list |
| :: Price & order information |
| :: Compare this product |
| :: Configure this product |

2. Click "Configure this product".
3. The Configurator opens in a separate window. You can now configure your device and you will receive the complete order code valid for that device.
4. Now export the order code as a PDF file or Excel file. To do so, click the appropriate button at the top of the page.

**Scope of delivery**

The scope of delivery comprises:
- 1 Liquistation CSF33 with:
  - The ordered bottle configuration
  - Suction line with strainer
  - Optional hardware
- Accessories kit
  - Connection nipple for suction line with various angles (straight, °90°), Allen key (for version with vacuum pump only)
- 1 "Commissioning" Operating Instructions
  (In the preferred language if the "Default operating language" order option is selected. Otherwise, the Brief Operating Instructions supplied are in English)
- 1 CD-ROM with Operating Instructions in all available languages, an application handbook and simulation software
- Optional accessories

# Certificates and approvals

**CE mark**

**Declaration of Conformity**
The product meets the requirements of the harmonized European standards.
As such, it complies with the legal specifications of the EC directives.
The manufacturer confirms successful testing of the product by affixing to it the CE mark.

# Accessories

The most important accessories that could be delivered at the time this document went to print are listed below.
For accessories not listed here, please contact your service department or sales center.

## Accessories for Liquistation CSF33

| Order no. | Bottle tray + bottles + cover |
|---|---|
| 71111152 | Bottle tray + 6 x 3 liter (0.79 US gal.) PE+ cover |
| 71111154 | Bottle tray + 12 x 1 liter (0.26 US gal.) PE + cover |

| | Distribution plate; locating insert |
|---|---|
| 71111158 | Distribution plate for 2 x 6 bottles |
| 71111159 | Distribution plate for 2 x 12 bottles |

| | Bottles + covers |
|---|---|
| 71111164 | 1 liter (0.26 US gal.) PE + cover, 24 pcs. |
| 71111167 | 3 liter (0.79 US gal.) PE + cover, 12 pcs. |
| 71111169 | 13 liter (3.43 US gal.) PE + cover, 1 pc. |
| 71111172 | 30 liter (7.92 US gal.) PE + cover, 1 pc. |

| | Complete suction line |
|---|---|
| 71111233 | Suction line ID 10 mm (3/8"), PVC clear, reinforced fabric, length 10 m (33 ft), suction head V4A |
| 71111235 | Suction line ID 13 mm (1/2"), PVC green, reinforced spiral wire, length 10 m (33 ft), suction head V4A |

| | Suction line coil |
|---|---|
| 71111482 | ... m, suction line ID 10 mm (3/8"), PVC clear |
| 71111485 | ... m, suction line ID 13 mm (1/2"), PVC green |

| | Suction head |
|---|---|
| 71111184 | Suction head V4A for ID 10 mm (3/8"), 1 pc. |
| 71111185 | Suction head V4A for ID 13 mm (1/2"), 1 pc. |

| | Terminated hose; vacuum pump |
|---|---|
| 71111188 | Dosing hose to distributor, 2 pcs, material: silicon |
| 71111189 | Dosing hose to distributor, 25 pcs, material: silicon |

| | Terminated hose; peristaltic pump |
|---|---|
| 71111191 | Pump tubing, 2 pcs; material: silicon |
| 71111192 | Pump tubing, 25 pcs; material: silicon |

| | Communication; software |
|---|---|
| 71110815 | SD card, 1 GB, Industrial Flash Drive |

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