TI00479C/07/EN/18.19
71458794
2019-11-08

Technical Information
Liquistation CSF33

Automatic stationary sampler for liquid media; integrated multi-parameter controller

Applications

The 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 as well as two binary outputs.

The sampler is designed for use in the following applications:
- Communal and industrial wastewater treatment plants
- Laboratories and water management offices
- Monitoring of liquid media in industrial processes

Your benefits

- Four different kinds of housing material
- Two-door housing for reliable sample temperature regulation
- Air circulation in sample chamber with inner lining
- Swift menu guidance, navigator and large display
- Dual bottle trays for easy sample transportation
- Practice-oriented programs ranging from simple time programs to event programs
- Functionality can be extended by installing modular electronic components
- Integrated data logger for recording measured values
- Service interface for data transmission
- Touch-safe low-voltage supply for electronic components

Endress+Hauser
People for Process Automation

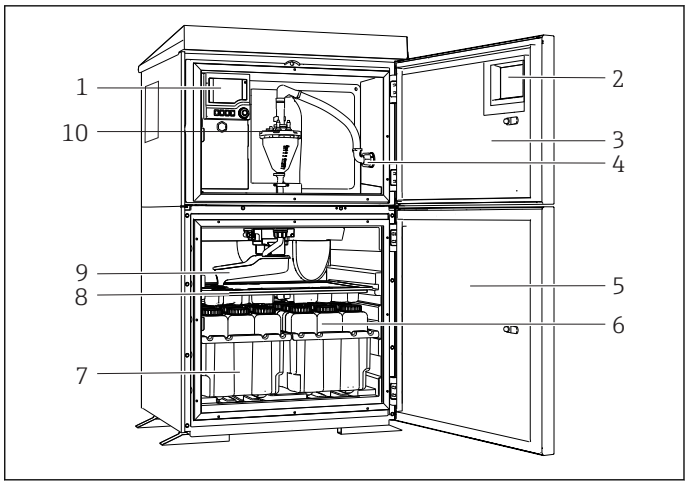
Table of contents

Function and system design

Sampler Liquistation CSF33

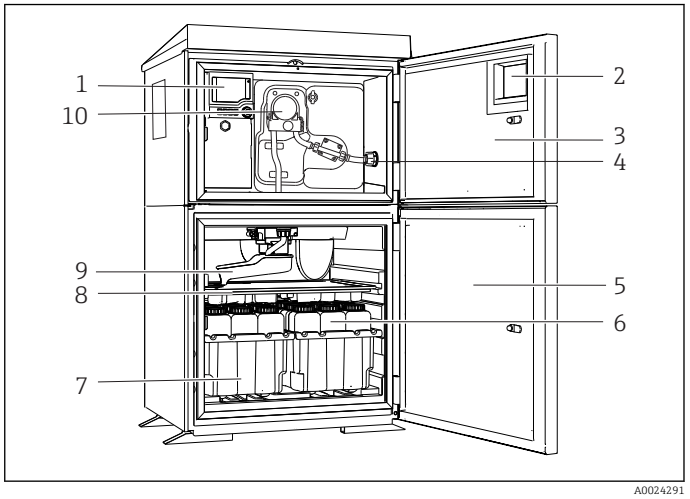
A complete sampling unit comprises:

- Controller with display, soft keys and navigator
- Vacuum or peristaltic pump for sampling
- PE or glass sample bottles for sample preservation
- Sampling chamber temperature regulator (optional) for safe sample storage
- Suction line with suction head



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

1 Example of a Liquistation, version with vacuum pump

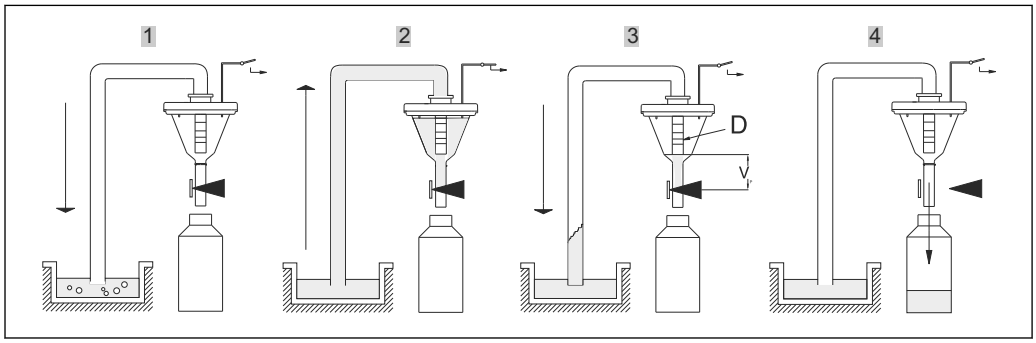


1 Controller
2 Window (optional)
3 Dosing chamber door
4 Suction line connection
5 Sampling chamber door
6 Sample bottles, e.g. 2 x 12 bottles, PE, 1 liter
7 Bottle trays (depending on sample bottles selected)
8 Distribution plate (depending on sample bottles selected)
9 Distribution arm
10 Peristaltic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

2 Example of a Liquistation, version with peristaltic pump

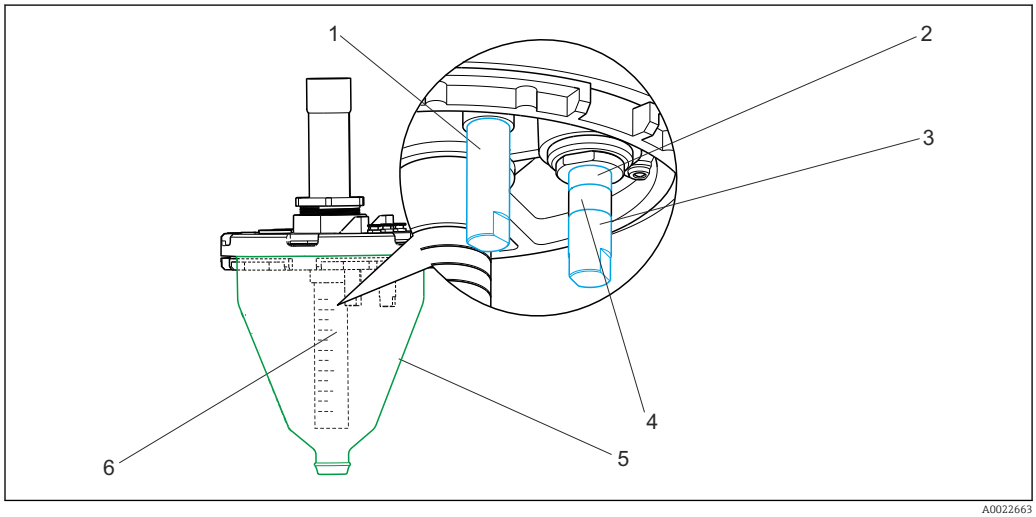
Mode of operation with a vacuum pump

Sampling takes place in four steps:



1. Blow clear
   ↳ The vacuum pump blows the suction line clear via the dosing system.
2. Intake
   ↳ The "Airmanager" (pneumatic control unit) switches the air path of the vacuum pump to "intake". The sample is drawn into the dosing beaker until it reaches the conductivity probes of the dosing system.
3. Dose
   ↳ The intake process ends. Depending on the position of the dosing tube (item 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

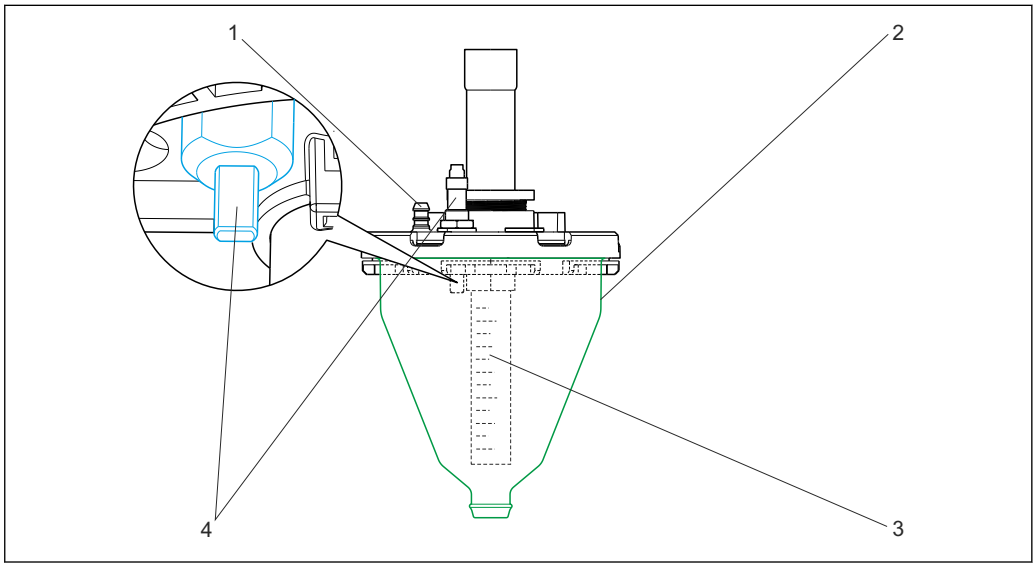


3 Conductive dosing system

1 Conductivity sensor 1 (common electrode)
2 Conductivity sensor 2 (safety electrode)
3 Conductivity sensor 3 (standard electrode)
4 Insulation
5 Measuring jug (plastic version with graduated scale or glass)
6 Graduated dosing tube, white and blue scale

Sample detection principle
When the sample is drawn in, the sample level reaches conductivity sensors 1 and 3. The system thus detects that the measuring jug 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.

Dosing system with capacitance sample sensor



4 Capacitance dosing system

1 Hose connection for the vacuum pump
2 Graduated measuring jug
3 Graduated dosing tube, white and blue scale
4 Capacitance level sensor

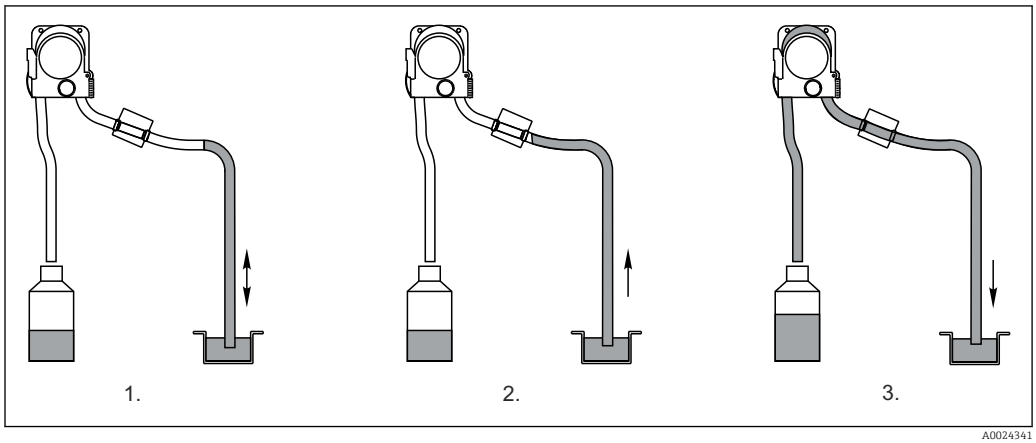
Sample detection principle

When the level of medium in the measuring jug changes, the capacitance of a capacitor partly formed by the liquid also changes..
The capacitance sensor ensures rapid sample detection in media that form foam and have a high fat content, and media with a conductivity < 30 µS/cm. Only capacitance level detection is possible in the latter type of media.

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, for example, 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 measuring jug and back to the sampling point. The sample 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.

Mode of operation with a peristaltic pump

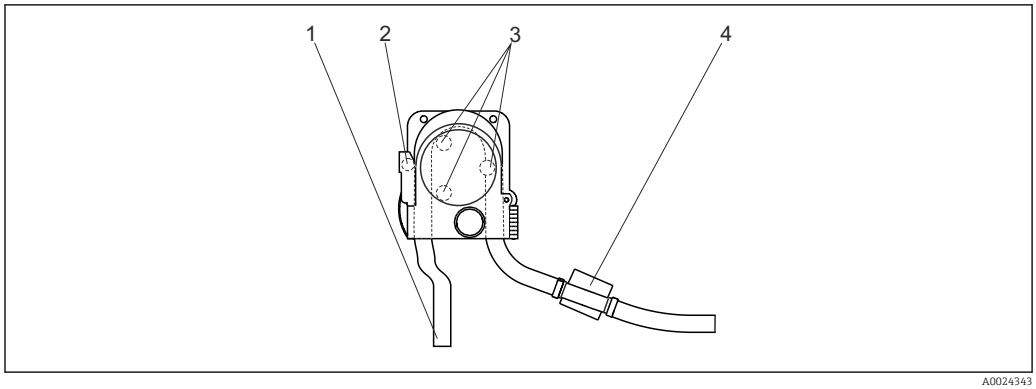


5 Sampling steps with a peristaltic pump

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: Medium is initially drawn in until the medium detection system reacts, then the pump switches and forces the medium back to the sampling point. This process can be repeated a maximum of three times. The sample is then taken as described.



6 Peristaltic pump

1 Pump tube
2 Safety switch (optional)
3 Pump rollers
4 Medium detection system (patented)

The pump rollers deform the hose, thereby causing a negative pressure and the suction effect. The medium 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. An optional safety switch integrated in the pump housing immediately switches off the pump when the pump is opened (recommended if third-party staff are performing maintenance work).

Sample distribution

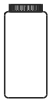
The CSF33 offers many bottle combinations and distribution versions. The versions can be changed or replaced easily without the need for special tools. In addition, the software program makes it possible to configure individual bottles and bottle groups and assign them to switchover or event programs.

Sample preservation

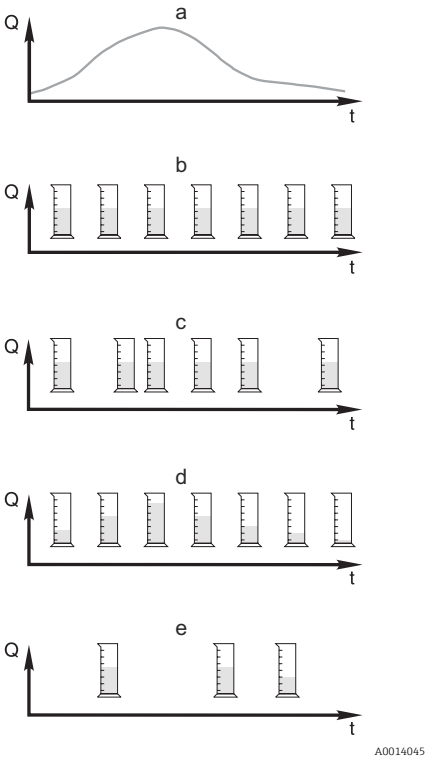
The sample bottles are located in the sample compartment. This is fitted with a seamless plastic dish to ensure easy cleaning. All parts that transport medium (distribution arm, dosing system…) can be removed and cleaned easily without the need for tools.

A0029681

Bottle groups and distribution version depending on the order version:

	CSF33-****
30 liter, PE, direct distribution  A0024349	1 pieces
13 liter, PE, direct distribution  A0025968	4 pieces
3 liter, PE, plate distribution  A0025971	12 pieces
1 liter, PE, plate distribution  A0025972	24 pieces

Sampling control



7 Sampling control

a. **Flow curve**

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

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

Time override can be enabled in an advanced program. This allows long, flow-controlled sample intervals to be interrupted if the flow rate is low. A time-controlled sample is collected.

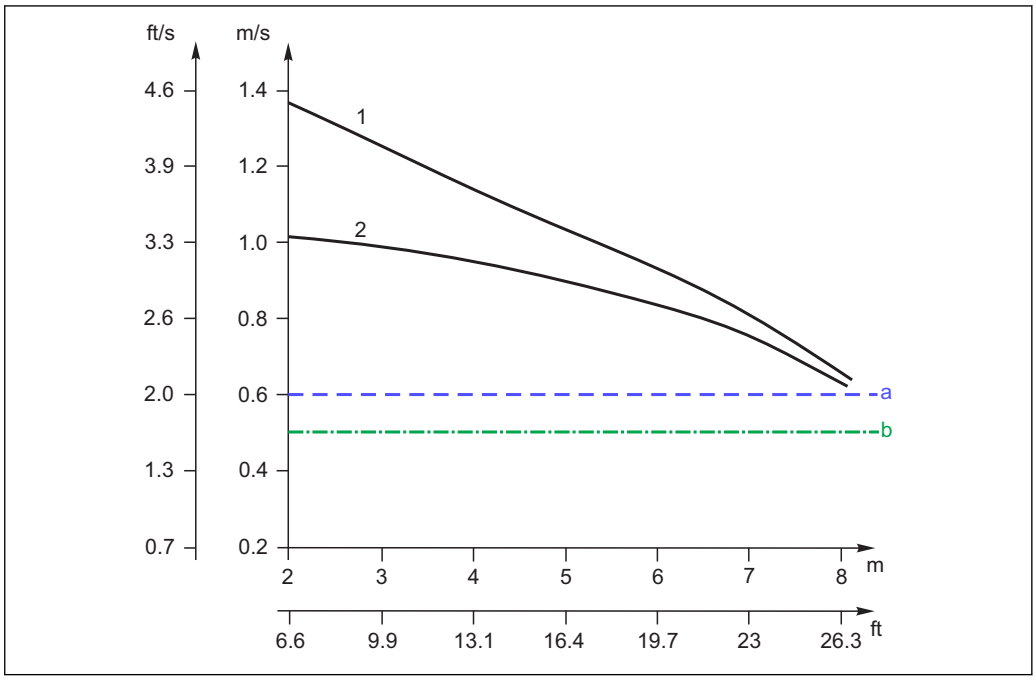
d. **Flow-proportional sampling (CTVV)**
A variable sample volume (the sample volume depends on the flow rate) is taken at regular intervals (e.g. every 10 min).

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



8 Intake speed in m/s with suction height in m

a Intake speed as per Ö 5893; US EPA
b Intake speed as per EN 25667, ISO 5667
3 ID 13 mm (1/2") vacuum pump
4 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 can be 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).

9 Cooling system

Sampler housing

Pay attention to the installation conditions in the "Installation" section and the information on the materials of the different housing types in the "Mechanical construction" section.

NOTICE

The plastic material polystyrene V0 can discolor if exposed directly to sunlight.

In the case of stainless steel housings, the frame around the window can discolor if exposed directly to sunlight.

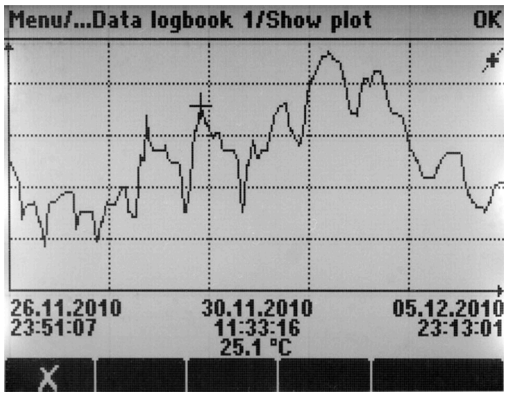
- The plastic material ASA+PC V0 is recommended for outdoor installations where a sun guard is not used. The discoloring does not affect the function and operation of the device.

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. sampling volume, filling times, bottle assignment)
- Program memory: max. 100 programs
- Data logbooks:
  - Adjustable scan time: 1 to 3600 s (1 h)
  - Max. 8 data logbooks
  - 150,000 entries per logbook
  - Graphic display (load curves) or numerical list
- Calibration logbook: max. 75 entries
- Hardware logbook:
  - Hardware configuration and modifications
  - Max. 125 entries
- Version logbook:
  - Including software updates
  - Max. 50 entries
- Operations logbook: max. 250 entries
- Diagnostic logbook: max. 250 entries



A0024359

10 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. logbooks)
- 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 has a real-time clock, which is backed up by a button cell in the event of a power failure. This ensures that the device continues to keep the correct time and date if it is restarted and that 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 in the event of a disruption to the power supply.

Input

Types of input	▪ 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
Communication	▪ 1 service interface ▪ Commubox FXA291 (accessory) required for communication with the PC

Power supply

Electrical connection

--> For a detailed connection plan, see the Operating Instructions for Liquistation CSF33

Supply voltage

Depending on version:
100 to 120/200 to 240 V AC ±10 %, 50/60 Hz

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 entries

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:

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/sampling assembly:
- Event sampling
- Single and multiple samples
- Sampling table

Vacuum pump:
- Time-paced
- In proportion to volume

Peristaltic pump:
- Time-paced
- In proportion to volume
- Flow proportional sampling/time override (CTVV)

Dosing volume

Vacuum pump:
20 to 350 ml (0.7 to 12 fl.oz.)

Peristaltic pump:
10 to 10000 ml (0.3 to 340 fl.oz.)

The dosing accuracy and the repeatability of a sample volume < 20 ml can vary, depending on the specific 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

5 %

Intake speed

> 0.5 m/s (> 1.6 ft/s) for ≤ 13 mm (1/2") ID, as per EN 25667, ISO 5667, CEN 16479-1

> 0.6 m/s (> 1.9 ft/s) for 10 mm (3/8") ID, in accordance with Ö 5893; 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)

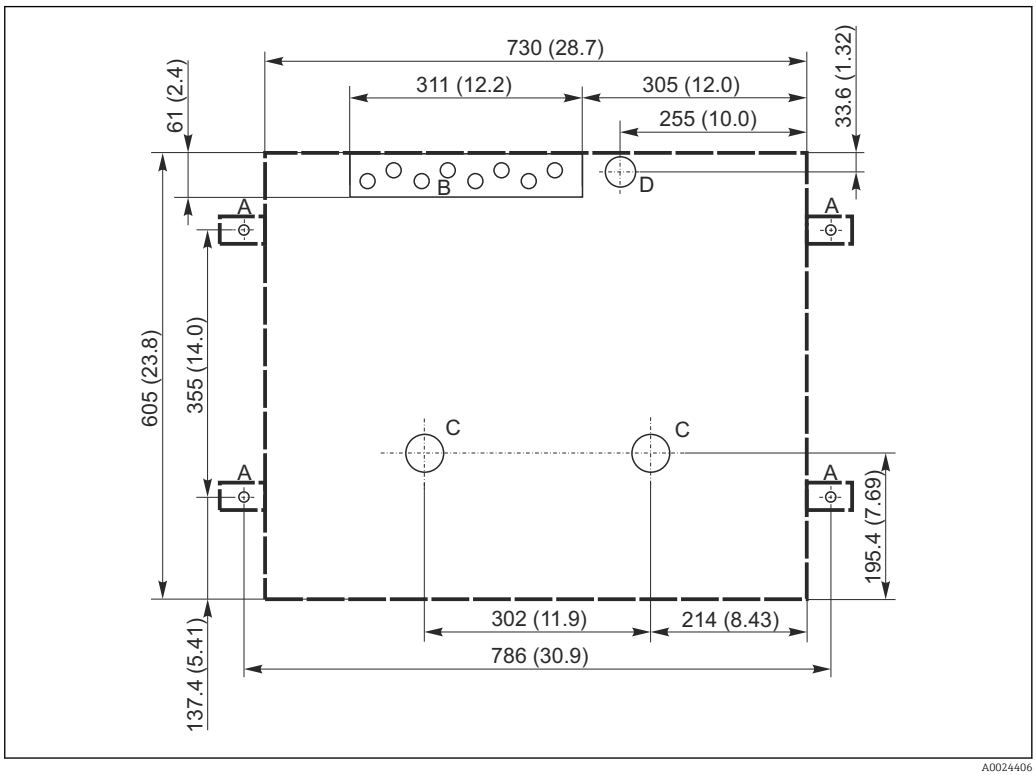
Temperature control

Temperature sensors:
Sampling compartment temperature

Cooling module:
- Sample temperature range: 2 to 20 °C (36 to 68 °F)
  Factory setting: 4 °C (39 °F)
- Automatic defrost system
- Cooling rate in accordance with Ö 5893 (Austrian standard):
  4 liters of water at 20 °C cool down to 4 °C in less than 210 minutes
- Temperature constancy of sample at 4 °C over the operating temperature range of -15 to 40 °C (5 to 105 °F)

Installation

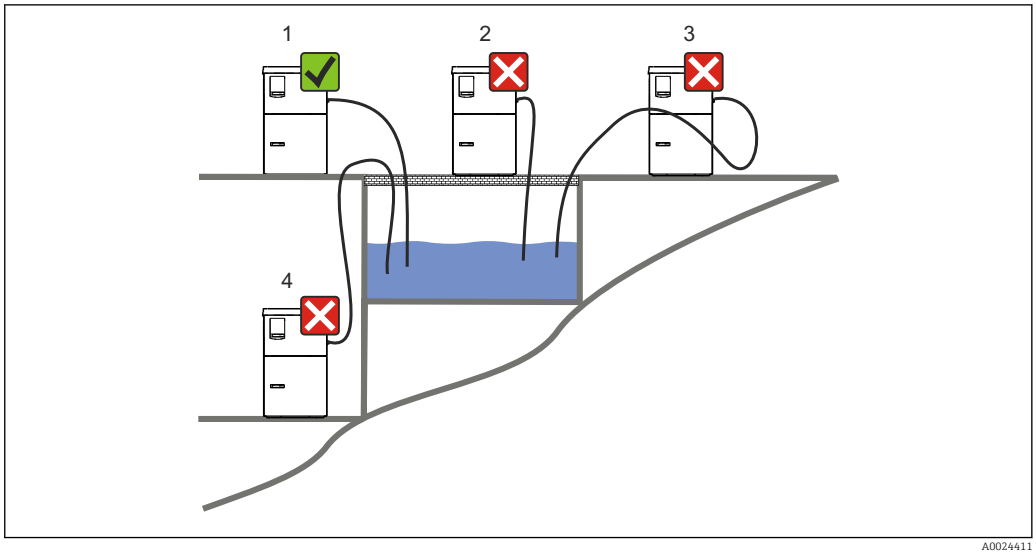
Installation instructions



11 *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
--- Dimensions of Liquistation

Mounting conditions



12 *Liquistation mounting conditions*

1. Correct
   ↳ The suction line must be routed with a downward slope 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.
- Securely connect the device at the fastening points to the surface underneath.
- Protect the device against additional heating (e.g. heater or direct sunlight in the case of PS housing).
- 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 erect the device directly above the inlet channel of a wastewater treatment plant.

Environment

Ambient temperature range	With ASA+PC or stainless steel housing:	-20 to 40 °C (0 to 104 °F)
	With plastic polystyrene housing:	0 to 40 °C (32 to 104 °F)
Storage temperature	-20 to 60 °C (-4 to 140 °F)	
Degree of protection	▪ Front dosing compartment: IP 54 ▪ Rear dosing compartment: IP 33 ▪ Front panel with display (internal): IP 65 ▪ 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 pollution degree 2.	
Relative humidity	10 to 95%, not condensing	

Process

Process temperature

2 to 50 °C (36 to 122 °F)

Process characteristics

Vacuum pump
Capacitance level measurement used for:
- Sample media has to be free of abrasive substances.
- Media that tend to create a lot of foam or contain fats and grease
- Media with a conductivity < 30 µS/cm

Peristaltic pump
Sample media has to be free of abrasive substances.

Pay attention to the material compatibility of the wetted parts.

Process pressure

- Unpressurized, open channel (unpressurized sampling)
- Max. 1.8 bar (26.11 psi) piping (only with shutoff/inlet valve)

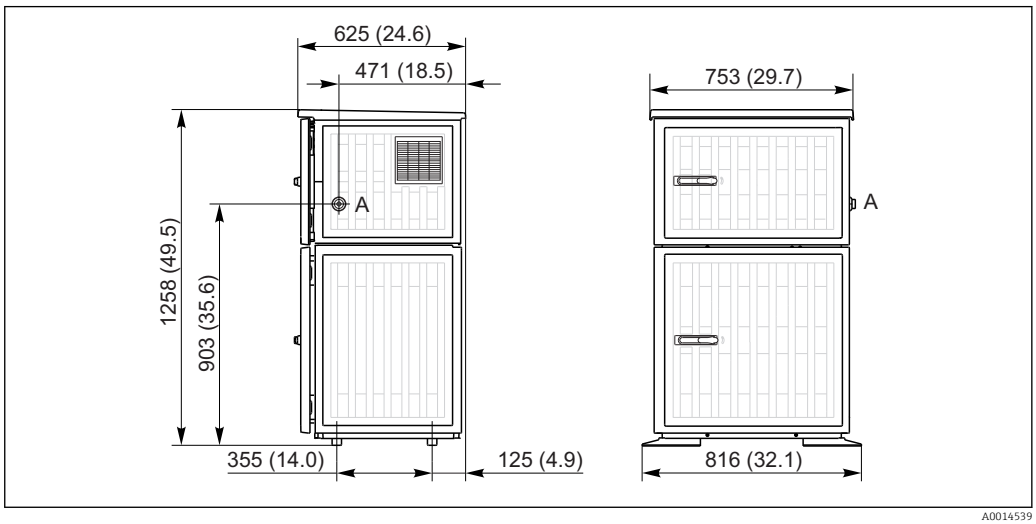
Sampling assembly:
Max. 6 bar

Process connection

- **Vacuum pump:**
  Suction line ID 10 mm (3/8"), 13 mm (1/2"), 16 mm (5/8") or 19 mm (3/4")
- **Peristaltic pump:**
  Intake hose ID 10 mm (3/8")

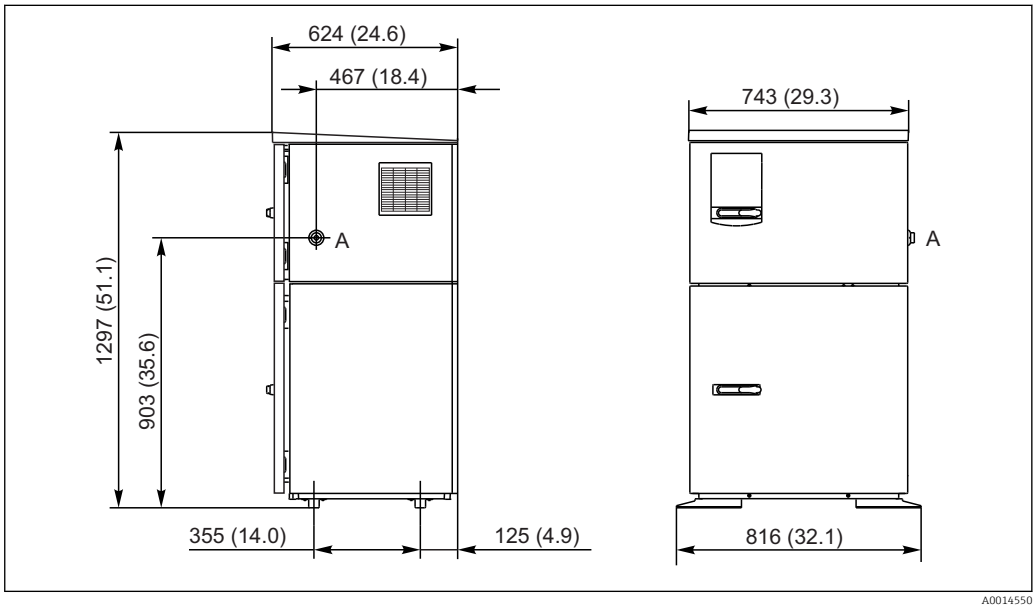
Mechanical construction

Dimensions



13 *Dimensions of Liquistation CSF33 plastic version, dimensions in mm (in)*

A Suction line connection



14 *Dimensions of Liquistation CSF33CSF33 stainless steel version, dimensions in mm (in)*

A Suction line connection

Weight

Sampler version	Weight
Plastic version with refrigeration	101 kg (223 lbs)
Stainless steel version with refrigeration	118 kg (260 lbs)

Materials

Plastic polystyrene VO can change color when exposed to direct sunlight. For outdoor use without a weather protection cover, the use of Plastic ASA+PC V0 is recommended. The functionality is not affected by the discoloration.

Non-wetted parts	
Cabinet housing	**Plastic polystyrene V0** For standard applications in wastewater treatment plants and environmental monitoring **Stainless steel V2A (1.4301)** For standard applications in wastewater treatment plants and environmental monitoring
Sample compartment inner lining	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)	-
Conductivity sensors	Stainless steel V4A (1.4404)	-
Dosing chamber	PMMA, glass (depending on version)	-
Dosing system outflow hose	Silicone	-
Pump tubing	-	Silicone
Process seal	-	-
Distribution arm	Plastic PP	
Distribution arm cover	Plastic PE	
Distribution plate	Plastic PS	
Composite container/bottles	Plastic PE, glass (depending on version)	
Intake hose	Plastic PVC, EPDM (depending on version)	
Hose connection	Plastic PP	
Rinse connection	-	-

Choose process seal depending on the application. Viton is recommended for standard applications involving watery samples.

Vacuum pump only	
Pneumatic hoses	Silicone
Air Manager housing	PC
Air Manager sealing plate	Silicone
Pump head	Aluminum, anodized
Pump membrane	EPDM

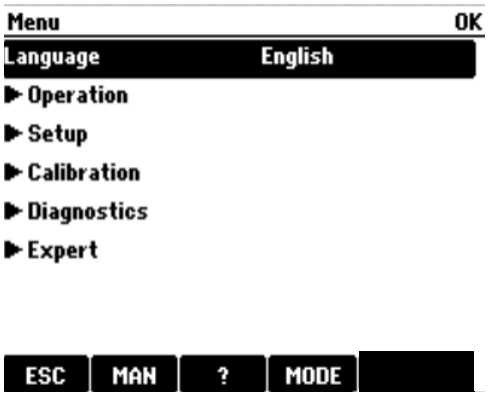
Operability

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

A0024560

15 Easy operation

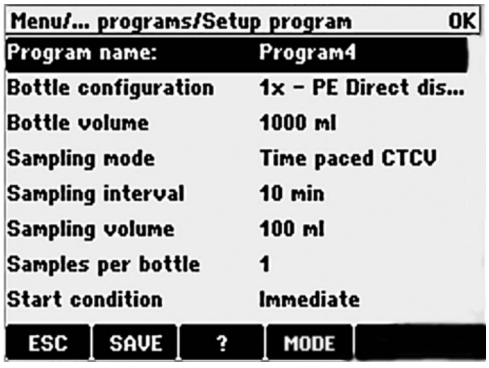


A0024443-EN

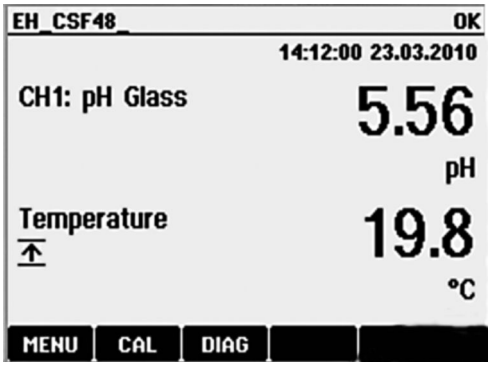
16 Plain-text menu

Display

Graphic display:
- Resolution: 240 x 160 pixel
- Back light with switch-off function
- Red display background for alarms alerts users to errors
- Transflective display technology for maximum contrast even in bright environments
- User-definable measuring menus mean you can always keep track of the values that are important for your application.



17 Example of program setup



18 Example of measuring menu

Local operation

A0024469

- LCD, illuminated (with red background in the event of an error)
- 160 x 240 pixels
- 4 operating keys (soft key function) and navigator (jog/shuttle and press/hold function)
- Menu-guided operation

Communication

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

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 EU directives. The manufacturer confirms successful testing of the product by affixing to it the CE mark.

Ordering information

Product page

www.endress.com/CSF33

Product Configurator

On the product page there is a **Configure** button to the right of the product image.

1. Click this button.
   ↳ The Configurator opens in a separate window.
2. Select all the options to configure the device in line with your requirements.
   ↳ In this way, you receive a valid and complete order code for the device.
3. Export the order code as a PDF or Excel file. To do so, click the appropriate button on the right above the selection window.

For many products you also have the option of downloading CAD or 2D drawings of the selected product version. Click the **CAD** tab for this and select the desired file type using picklists.

Scope of delivery

The scope of delivery comprises:
- 1 Liquistation CSF33 with:
  - The ordered bottle configuration
  - Optional hardware
- Accessories kit
  -
  - Connection nipple for suction line with various angles (straight, 90°), Allen key (for version with vacuum pump only)
- Suction line:
  - Suction line ID 13 mm (1/2"), PVC, reinforced spiral wire, length 10 m (33 ft), suction head V4A for vacuum version
  - Suction line ID 10 mm (1/2"), PVC, reinforced spiral wire, length 10 m (33 ft), suction head V4A for peristaltic version
- 1 print version of Brief Operating Instructions in the language ordered
- Optional accessories

Accessories

The following are the most important accessories available at the time this documentation was issued.

- For accessories not listed here, please contact your Service or Sales Center.

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

Order no.	Distributor plate; centering plate
71111158	Distributor plate for 2 x 6 bottles
71111159	Distributor plate for 2 x 12 bottles

Order no.	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.

Order no.	Complete suction line
71111233	Suction line ID 10 mm (3/8"), PVC clear, reinforced fabric, length 10 m (33 ft), suction head V4A
71111234	Suction line ID 10 mm (3/8"), EPDM black, 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
71111236	Suction line ID 13 mm (1/2"), EPDM black, length 10 m (33 ft), suction head V4A
71111237	Suction line ID 16 mm (5/8"), PVC green, reinforced spiral wire, length 10 m (33 ft), suction head V4A
71111238	Suction line ID 16 mm (5/8"), EPDM black, length 10 m (33 ft), suction head V4A
71111239	Suction line ID 19 mm (3/4"), PVC green, reinforced spiral wire, length 10 m (33 ft), suction head V4A
71111240	Suction line ID 19 mm (3/4"), EPDM black, length 10 m (33 ft), suction head V4A
71111482	... m; suction line coil ID 10 mm (3/8"), PVC
71111485	... m, suction line ID 13 mm (1/2"), PVC green

Order no.	Terminated hose: vacuum pump
71111188	Dosing hose to distributor, 2 pcs, material: silicon
71111189	Dosing hose to distributor, 25 pcs, material: silicon

Order no.	Terminated hose: peristaltic pump
71111191	Pump tubing, 2 pcs; material: silicon
71111192	Pump tubing, 25 pcs; material: silicon

Order no.	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.

Order no.	Communication; software
71110815	SD card, 1 GB, Industrial Flash Drive
	Activation code for PROFIBUS DP

www.addresses.endress.com

Endress+Hauser

People for Process Automation