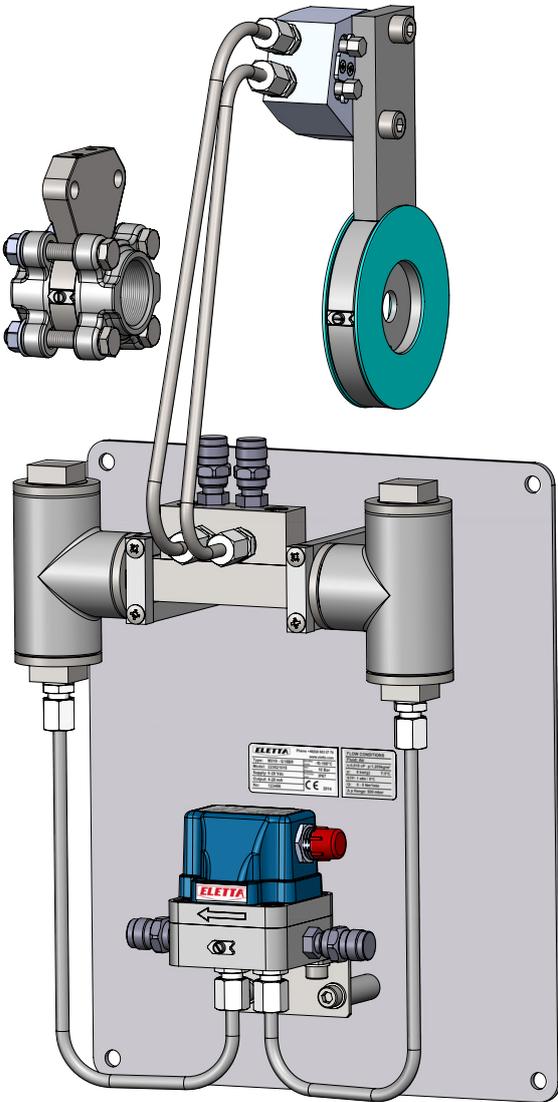




ROBUST HIGH QUALITY FLOW MONITORS

MANUAL
ELETTA STEAM - SINGLE



S-Series

V-Series

D-Series

M-Series

R-Series

ElettA Steam

SP-G

SP-GA

EF-G

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About this Manual

- This manual relates to Eletta Steam. It consists of Base Unit Steam, Control Unit and User Interface. Only sold with FSS or GSS Pipe Section.
- Note that the latest version of this manual and other documents are always available as a PDF file on web site www.eletta.com

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Distributors

Eletta has authorized distributors all over the world. More information about the closest distributor is on web site www.eletta.com or by contacting Eletta Customer Service Center.

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1.1 Safety instructions

- In this manual, this warning symbol is used to emphasize where particular care must be taken to avoid injury or damaging the product.
- The Control Unit and User Interface must not be installed in explosive environments.
- To prevent injury when installing the Control Unit, make sure that the system is not pressurized from gas or liquid flow.
- There are no serviceable parts inside the instruments. Eletta takes no responsibility for injury or damage caused by unauthorized disassembly.
- Never remove the Control Unit while the system is pressurized.
- The electrical installation must only be done by authorized personnel.
- Disconnect all power connections before installation or service.
- Never exceed the maximum static pressure, which is specified on the product label, and in this manual.
- Make sure that the correct electrical power is used.
- Always make sure the condensate pots are filled at system startup.
- If connection nipples or compression couplings are used for the threaded Pipe Section, (GSS) the inner diameter must not be smaller than pipe inner diameter:
GSS 15 = 16 mm
GSS 20 = 21 mm
GSS 25 = 26 mm



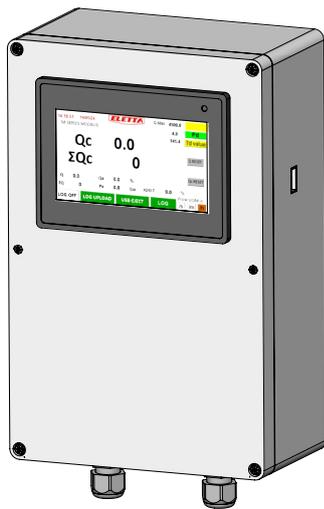
2.1 Description

Eletta Flow Monitors are used to control and measure flow of liquids, and gases in pipes from size 15 mm to 500 mm (larger pipes as an option). They have been manufactured for over 70 years and are well known for their reliability. They are used where operational safety demands, efficient supervision and rugged installation is needed.

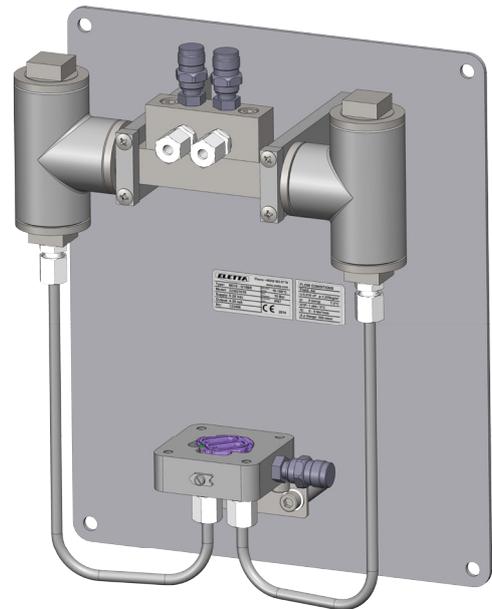
All over the world. Eletta Flow AB in Sweden is certified according to ISO9001 and ISO14001. The Eletta Flow Monitors are based on the proven and dependable differential pressure principle, using interchangeable orifice plates for different measuring ranges. Due to the working principle of the instrument, it is of utmost importance that the installation instructions (See section **10 "Installation"**) are followed carefully in order to get the proper function of the instrument.

Eletta Steam is used for measuring mass flow of saturated steam.

Eletta Steam consists of four parts mainly:



User Interface

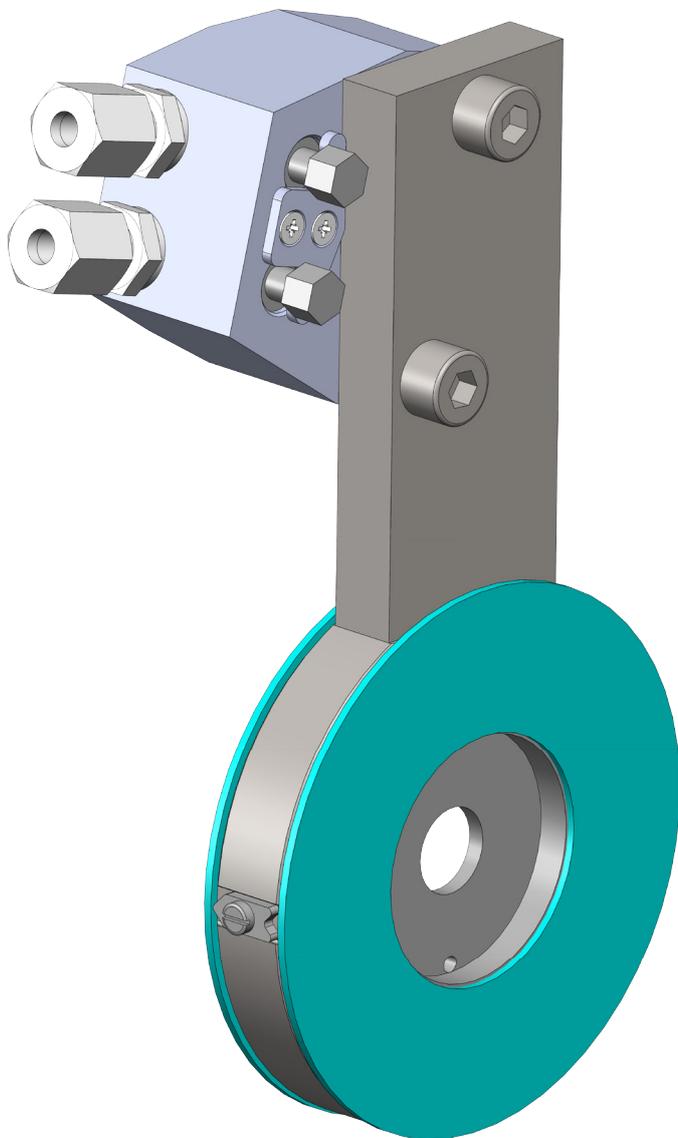


Base Unit Steam

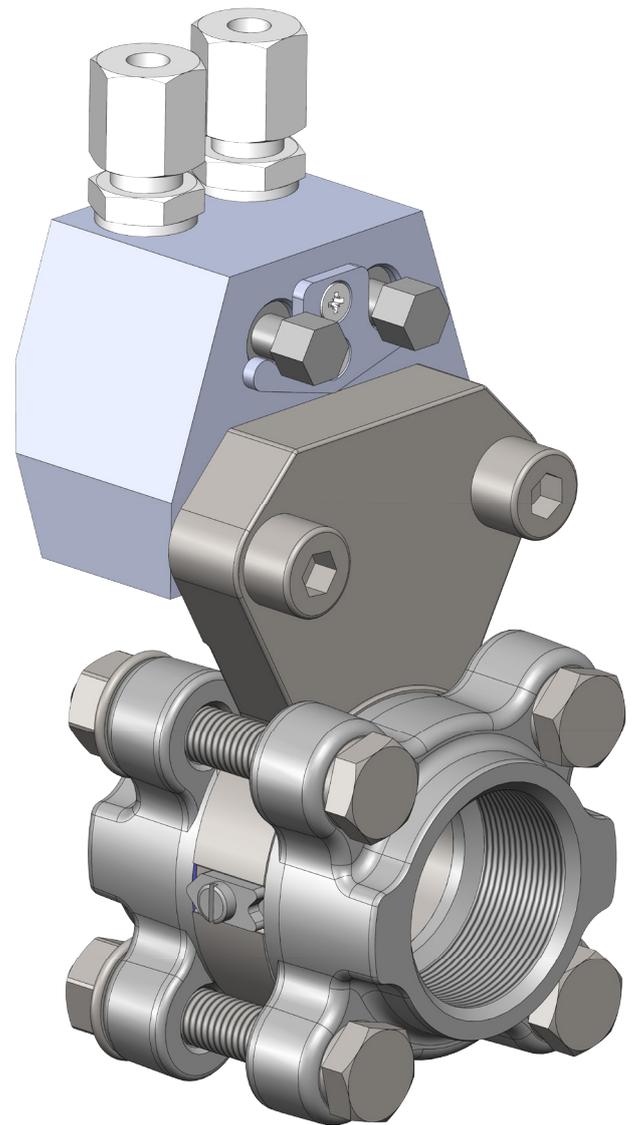


Control Unit

2.1 Description



Pipe Section FSS



Pipe Section GSS

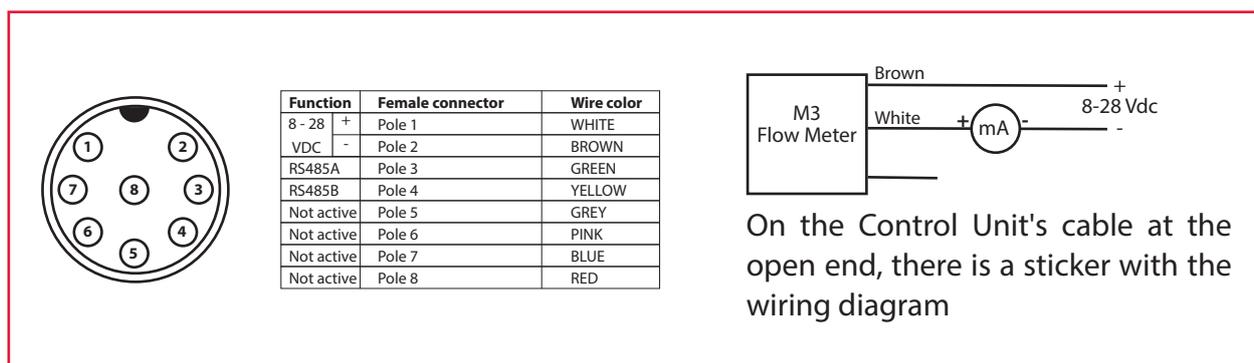
2.2 Product label

Each Eletta Steam has two identical product labels, see **Fig. 1** with description. One is placed on Base Unit Steam, the other on Control Unit



Fig. 1

- **Type:** Product type Eletta Steam and Pipe Section.
- **Model:** The article number of Eletta Steam.
- **Supply:** External supplied voltage for Control Unit
- **Output:** Output signal from Control Unit
- **No:** Serial number of Eletta Steam. Each Eletta product has their own unique ID-number, which is used for traceability.
- **Ambient Temp:** Surrounding temperature range. See section **7 Specifications** for a thorough description of available types.
- **Max Pressure:** The maximum operation pressure allowed for the flow monitor.
- **Protection class:** IP-classification (International protection rating), of the Control Unit.
- CE-marking and Year of manufacturing.
- **Fluid:** The media which the flow monitor has been designated for. E.g., Steam.
- **Pressure:** The maximum operation pressure allowed for the flow monitor.
- **Range Q:** The flow range for which the flow monitor has been manufactured.
- **Δp Range:** Differential pressure range



3. Base Unit Steam

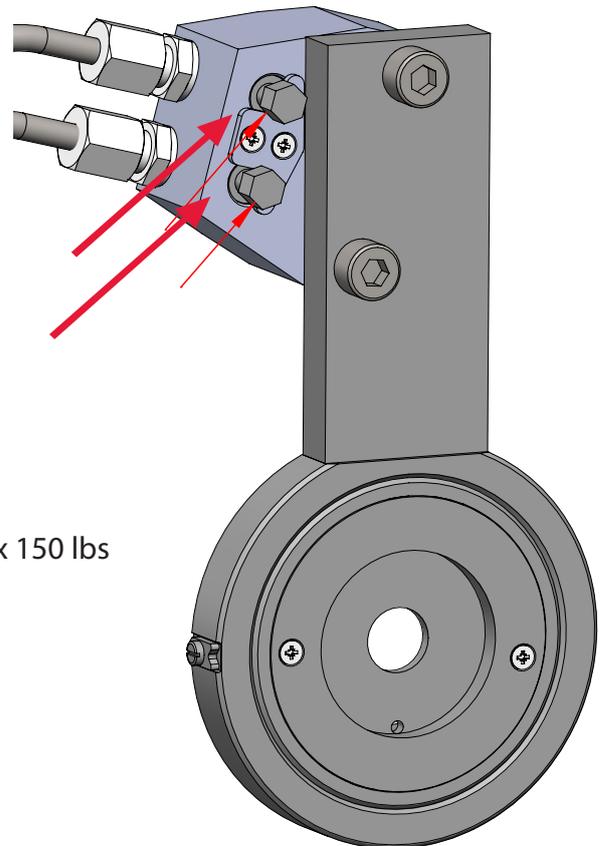


The Base Unit Steam connects the two channels with different pressure from the Pipe Section to the Control Unit. The steam transfers its pressure through the water in the condensate pots to the sensors in the Control unit. For each pressure channel, there are deaeration valves both before and after the condensate pots. Air vents and shut-off valves will allow discharge of any entrapped air/gas or condensate and also provide the possibility to even out the pressure between the plus and minus leg for zero-level verification. The mounting plate allows the Base Unit Steam to be placed at any place convenient for operators.

The pots must always contain water when the system is operating. The sealings in condensate pots and fittings must be checked on a regular basis.

4. Pipe Section

The Pipe Section is the part that is to be mounted in the process pipe. It is connected to the Steam Unit with metal pipes. The connecting block includes one shut-off valve per channel. It enables dismantling the Control Unit from the Pipe Section during full operation.



The Pipe Sections in stainless steel 316L are available in different dimensions:

FSS: DN15-DN500 for DIN max PN16
DN15-DN500 1/2"-18" for ANSI max 150 lbs

GSS: DN15-25 with BSP or NPT threads

The Control Unit M-series is used to measure DP and control flows of steam, liquids and gases in threaded pipes with sizes DN15-DN25 and flange fitted pipe sizes DN15 to DN500.

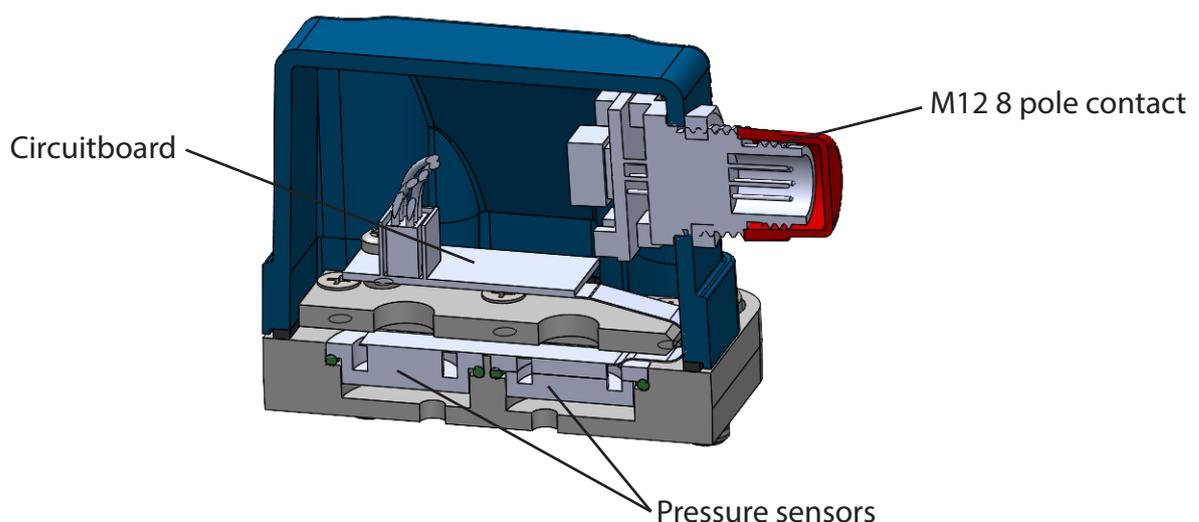
When ordered, Eletta Steam will be delivered with the Control Unit mounted on the Base Unit Steam. The Control Unit is programmed, tested and calibrated at Eletta production site and ready to connect to the Pipe Section, no on-site adjustments or calibrations are needed. At the time of order, data for the steam application is used for configuration of the unit. This enables quick and easy installation by the user. Only mechanical assembly and electrical installation are needed. No further adjustments have to be done by the user. The Control Unit connected with cable to the User Interface.

However, it is possible to adjust most parameters in the field after installation using the Eletta Flow Center or Modbus RTU. More information about this can be found in the manual of Eletta Flow Center.

The viewing settings on optional display version can be changed directly on the Control Unit but will not affect the Control Unit other settings.

For more information, see chapter **5.4 Control Unit options**.

The Control Unit contains the two pressure sensors, a circuit board and an electrical connector with integrated filter. The circuit board outputs 4-20 mA and Modbus RTU through the output connector. The settings are adjustable using Flow Center or Modbus. Settings for the optional display can be changed directly at the meter but will not change the measurements.



In order to get the unit to work properly with good accuracy, it is very important that the unit is installed correctly according to the installation instruction, see chapter **10.5 Installation and changing of Control unit**.

5.1 Accuracy

The M-series Flow Meter measures media pressure using two independent pressure transducers. The measured values are then converted to a flow value by the microprocessor. The flow accuracy can be separated into:

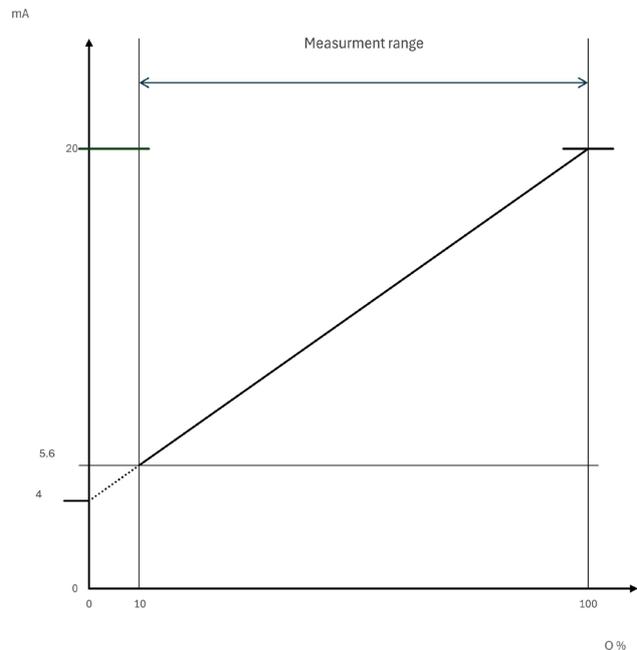
- The orifices are calculated according to ISO 5167. The measurement error, related to the orifice calculation, varies because it depends on the type of media, flow conditions and pipe dimension. At ideal conditions an accuracy within 1% FS of the calculated flow can be expected.
- Tolerances in Pipe Section and orifice bore diameter contribute to around 1% FS.

Display option: The 4-20mA signal and Modbus RTU accuracies are unchanged. The displayed value will not differ from the output during normal use but can differ up to 4.5% during high power EMC interference.

5.2 The Output Signal

Each orifice plate is designed and optimized for a specific flow range and fluid. This means that there is a maximum flow value for a specific orifice plate. This value is represented by the flow percentage 100%. A flow value higher than the maximum flow value will not be measured with the same accuracy.

The analogue output signal from the Control Unit is always in the range 4-20 mA as default. This means that the maximum flow (100%), for a specific orifice plate, corresponds to the output level 20 mA. However, the minimum flow 0% is merely theoretical since it is not possible to use the differential pressure principle if there is no flow at all. There has to be a certain minimum flow to create the different pressures on the upstream and downstream side of the orifice plate. Therefore, the Flow Meter is said to have a turn down of 1:10. In this very case, the lowest flow must be 10% of the maximum flow in order for the Flow Meter to be able to work properly.



For more information about the behavior of the output signal, see the Flow Center manual.

5.2.1 Customized range

Using the software Flow Center (can be downloaded from Eletta web site), it is possible to let the output signal range limits correspond to other values than 0% and 100 % flow. In this way, if the application always has a flow of 40-60%, it can be “zoomed in” on this range and let 4 mA correspond to 40% flow, and 20 mA correspond to 60% flow.

5.3 Control Unit options

5.3.1 Cover in stainless steel

The cover of the Control Unit is manufactured in Polyamid plastic; PA12 (Grillamid 1kn-5h). It is known to be chemical resistant to most common fluids for which the M-series is used. But in rare cases with even tougher environments M-series is also available with a stainless steel cover as an option. EN 1.4436 (grade 316) Stainless steel cover cannot be combined with a display.

5.3.2 Control Unit display

Loop powered display of OLED 128*32 pixels to show flow rate, flow total and 4-20 mA analog output value. This option is not available for Stainless cover.

The Control Unit with display has three display modes that are cycled by pressing the green centre button. The up and down arrows are exclusively for changing settings of the meter and are not needed during normal operation.

The totalized view displays the total Qa% of steam that has passed the unit.



Qa percentage measured flow of Qmax



4-20mA

5.3.3 Changing the display settings

The Control Unit's settings are independent from the values sent through Modbus RTU and Flow Center.

Press the up and down arrow down simultaneously for 5 seconds until the display changes to display "Rst total", this indicates that the meter is in "settings mode".

The meter has five menu entries;

- **Rst Total**
- **Rotate 180**
- **Unit Select**
- **Set Qmax**
- **Return.**

The menu entries are cycled by pressing the up or down arrow and selected by pressing the green button.

Rst total

Pressing the green button will reset the volume of the logged flow to zero.



Rotate 180

Pressing the green button will rotate the screen 180° (Flip it horizontally)
The buttons will automatically adjust for the viewing angle.



Unit select

Pressing the green button will bring up the unit submenu. Cycle through the different unit options by pressing the up or down arrow and selecting the wanted unit by pressing the green button. Available units of measurement: LPM, CMH, LPS, CFM, CFH and %. Other units may be available on request.



Set Qmax

The Set Qmax menu is used to set the maximum flow value which is the same maximum value set in Flow Center. Each number is increased by pressing the up arrow and decreased by pressing the down arrow. Pressing the green button will select the shown value. The chosen number will shift to the left by one for each press of the green button. Leave a value blank or a zero if no such high numbers are required. This is only used when recalibrating the display.



Return

Pressing the green button in the Return menu will bring back the main menu, showing the current flow.



5.3.4 Communication cable for Control Unit

The Control Unit is always configured according to order information when delivered from the factory. Eletta Flow Center is available for download on Eletta website together with the required drivers for the communication cable. The Communication cable is not included with the purchase of the Control Unit, it is sold separately as an option.

An external power source has to be used in order to provide enough power to the unit with display. This is done through a 2,1x5,5 mm DC plug barrel connector on the side of the communication cable. This is only mandatory for the Control Unit with display.

Interface converter with Binder socket 713/8-pin:

- Supply via USB for one connected final consumer.
- Visual status and configuration display (LED)
- Galvanic isolation
- Total length: 1,7 m
- External supply voltage: 18-20VDC

The User Interface connected with cable to the Control Unit.

Description

The User Interface is an HMI screen that designed and specially programmed to interfere with Eletta M-series for the steam applications and measurements. User Interface powers the M-series and communicate with it via Modbus RS485.

The displayed values on the screen that have been calculated by the User Interface according to the steam table formula are:

Q is the measured flow.

Q TOTALIZED is the measured flow totalizer.

Qc is the compensated measured mass flow.

Qc TOTALIZED is the compensated measured mass flow totalizer.

Qa is the percentage measured flow of Q max sent from the Control Unit.

Pa is the static pressure sent from the Control Unit.

H2O T Sensor is the Temperature of the water in condensation containers sent from the Control Unit.

The User Interface has the possibility to log the measured data internally to the internal memory of 50MB or to an attached SD card up to 4GB memory size which will be used to save logged data instead of the internal memory. It can also upload the logged data to an external USB flash drive that can be attached to the USB socket on the side of the User Interface box.

Note:

It is not possible to upload logged data to an USB flash drive if a SD card is attached, because the logged data will be saved on the SD card. To access the saved .csv file that has been saved on the SD card then the card needs to be removed and connected to a PC.

6.1 Product label

Type:	User Interface
Model:	40-91130
Supply:	100-240 VAC, 50/60 Hz
IP class:	IP65
No:	XXXXXXXXXXXX
Phone	+46(8) 603 07 70
www.eletta.com	

- **Type:** Product type User Interface
- **Model:** Part number
- **Supply:** External supplied voltage User Interface
- **IP class:** IP-classification (International protection rating), of the User Interface.
- **No:** Serial number of User Interface. Each Eletta product has their own unique ID-number, which is used for traceability
- CE-marking and Year of manufacturing.

Specifications

Flow range	Steam: will be calculated according to application
Flow measuring range (Turn Down)	Turn down of 1:10 for Steam applications. <ul style="list-style-type: none"> • M310, with standard pressure operating range of 5 – 500 mbar • M325, with standard pressure operating range of 12,5 – 1250 mbar • M350, with standard pressure operating range of 25 – 2500 mbar
Accuracy	+/-1% FS of the default differential pressure at reference conditions. (M310: 500 mbar, M325: 1250 mbar, M350: 2500 mbar) Display option: The 4-20mA signal and Modbus RTU accuracies are unchanged. The displayed value will not differ from the output during normal use but can differ up to 4.5% during high power EMC interference. Totalizer has an accuracy of +/- 5%
Pressure class	PN25 / ANSI 300lbs available for DN15-150
Max static pressure	<ul style="list-style-type: none"> • M310: 10 bar(g) (145 PSI) • M325: 25 bar(g) only for threaded pipes GSS15-25. FSS pipes 16 bar(g). • M350: 50 bar(g) only for threaded pipes GSS15-25. FSS pipes 16 bar(g).
Max over pressure	+ 50 % of Max static pressure
Pressure endurance	10 ⁷ pressure cycles from 0 to F.S. at 25° C
Protection class	IP67 (NEMA6) Control Unit IP65 User Interface
Temperature ranges	Ambient temp: -15 to 90°C (-5 to 194°F) Ambient temp M-Display option: -10°C to +70°C (+14°F to 158°F) Ambient temp User Interface: 0-60°C (32-140°F) Pipe Section: -10°C to +230°C (+14°F to 446°F)
Power supply	User Interface: 100-240 VAC, 50/60 Hz Control Unit: *Standard option: +8 VDC to +28 VDC (2 wire loop feed) *Display option: +18 VDC to +28 VDC (2 wire loop feed)
Output	RS485 for external communication

Materials

O-rings	FPM (Fluorinated rubber)
Control unit	Plate: Stainless steel 316L. Cover: Plastic PA12 Grilamid Ikn-5h. EMC shielding inside Option: Stainless steel EN 1.4436 Connector: 8-poles LTW
Connection cable	PUR Standard cable 2,5 m (10 m cable available as option) 8 x 0,25 mm ²
Pipe Section	Stainless steel 316L
Orifice plate	Stainless steel 316L
Base Unit Steam	Stainless steel 316L
User Interface enclosure	ABS (UV Resistant)

User Interface HMI Touch screen:

Screen size: 4.3 inch 16:9 aspect ratio.
Resolution: 480 x 272 pixels
Touch: Analog resistive
Memory: 50 MB internal memory for logging. Possibility of connecting a maximum 4 GB SD card. USB socket to upload log file to a USB flash drive.

User Interface enclosure:

Mounting: Wall mounting
Electrical insulation: Totally insulated
Flammability rating: UL 94 HB

CE and UKCA approvals:

Eletta Flow Meters conform with the following EU directives:

M-series Flow monitors comply with the EMC directive 2004/108/EC through the following harmonized standards:

- EN 61 000 – 6 – 3:2007 Generic Emission – Residential, commercial and light industry.
- EN 61 000 – 6 - 2:2005 Generic Immunity – Industry

- M-series Flow monitors with display comply with the EMC directive EN/IEC 61000-6-2:2019 and EN/IEC 61000-6-3:2007+A1 through the following harmonized standards:
 - EN/(IEC) 61000-4-2:2009. Immunity to electrostatic discharges.
 - EN/(IEC) 61000-4-3:2020. Immunity to radio frequency electromagnetic fields.
 - EN/(IEC) 61000-4-4:2012. Immunity to fast transients.
 - EN/(IEC) 61000-4-5:2014+A1. Immunity to surge transients.
 - EN/(IEC) 61000-4-6:2014. Immunity to conducted radio frequency disturbances.
 - CISPR 16-2-3:2016. Measurement of radio frequency electromagnetic field.

- Low voltage. 2014/35/EU

- For electromagnetic compatibility, EMC directive 2004/108/EC (EN 61 000 – 6 – 3:2007 and EN 61 000 – 6 - 2:2005)

- Electrical Safety regulation 2016

User Interface comply with CE, UKCA, UL (Class 1 Div.2)

PED-Directive:

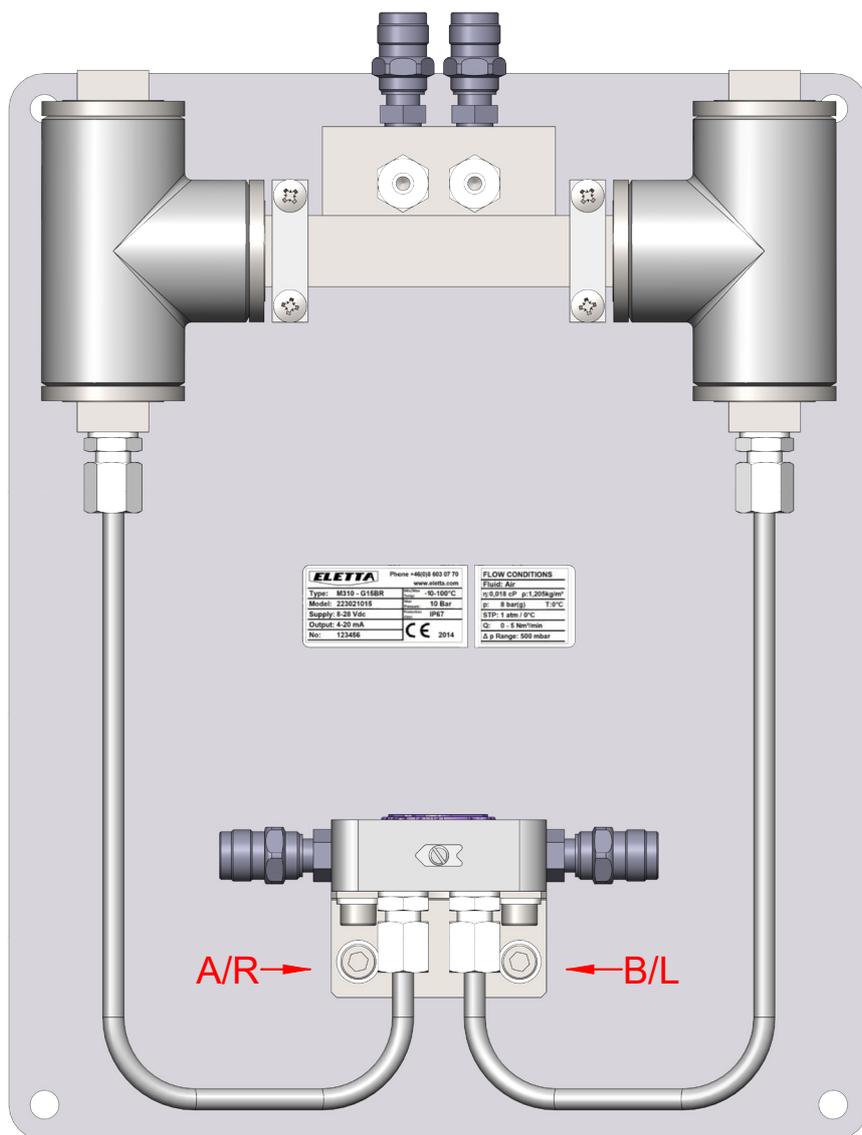
Complies with applicable parts in Pressure Equipment Directive 2014/68/EU. Conformity assessment has been performed according to module A. Internal production control combined with module A2. Internal manufacturing checks with monitoring of the final assessment, for category 2. Performed by Kiwa Inspecta AB. PED Declaration of conformity will be supplied upon request. They are also available on www.eletta.com

9. Ordering



To specify when ordering Eletta Steam:

1. Flow ton/h
2. Pressure bar
3. Pipe type: FSS or GSS
4. Pipe dimension and standard DIN or ANSI
5. Type of Control Unit
6. Media temperature, if possible, to confirm
7. Flow direction alternatives at the Control Unit:



Example: Eletta Steam FSS, Control Unit with display, plastic cover, dimension: DN200 ANSI, range: 4–40 ton/h, 10 bar(g), installation: B/L.

10.1 Unpacking

Compare the delivered products to the Packing List. Make sure to check the box for external damage before opening. If damage of the packing material has damaged the Eletta Steam inside; contact the delivery company to claim replacement or economical compensation. Compare the product labels to the purchase order.

The packaging material is made from recycled, environmentally friendly material and can be re-used or recycled to have as little impact to the environment as possible.

10.2 Procedures before installation

1. Check if the planned flow direction in the system matches the one indicated on the Control Unit. There is a red flow direction arrow on the Pipe Section, Control Unit's connection block and an arrow on the casted plate.
If there is a mismatch; see section **13 "Change of Flow Direction"**
2. Check that the Pipe Section has correct threading or correct flange dimension to match piping or counter flange. Bend \varnothing 6mm stainless steel pipes to connect the Pipe Section with the Base Unit Steam. It is mandatory that the pipes have equal length \pm 2mm.

10.3 Installation of Pipe Section

- **Note: Before any installation or maintenance work, disconnect all electrical power.** ◀
Check that the system is empty, unpressurized and cool.

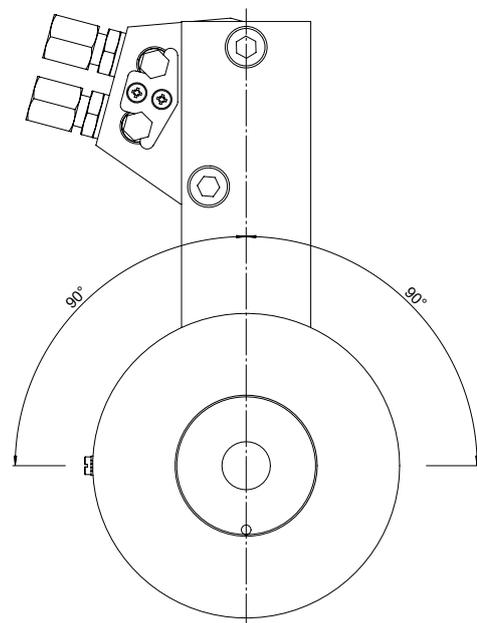


The direction-arrow on the Pipe Section indicates the direction of the flow. It is particularly important that the Pipe Section is mounted with the condensate hole on the orifice plate at the lowest position to avoid water-hammer. The piping shall be rigid and free from vibrations.

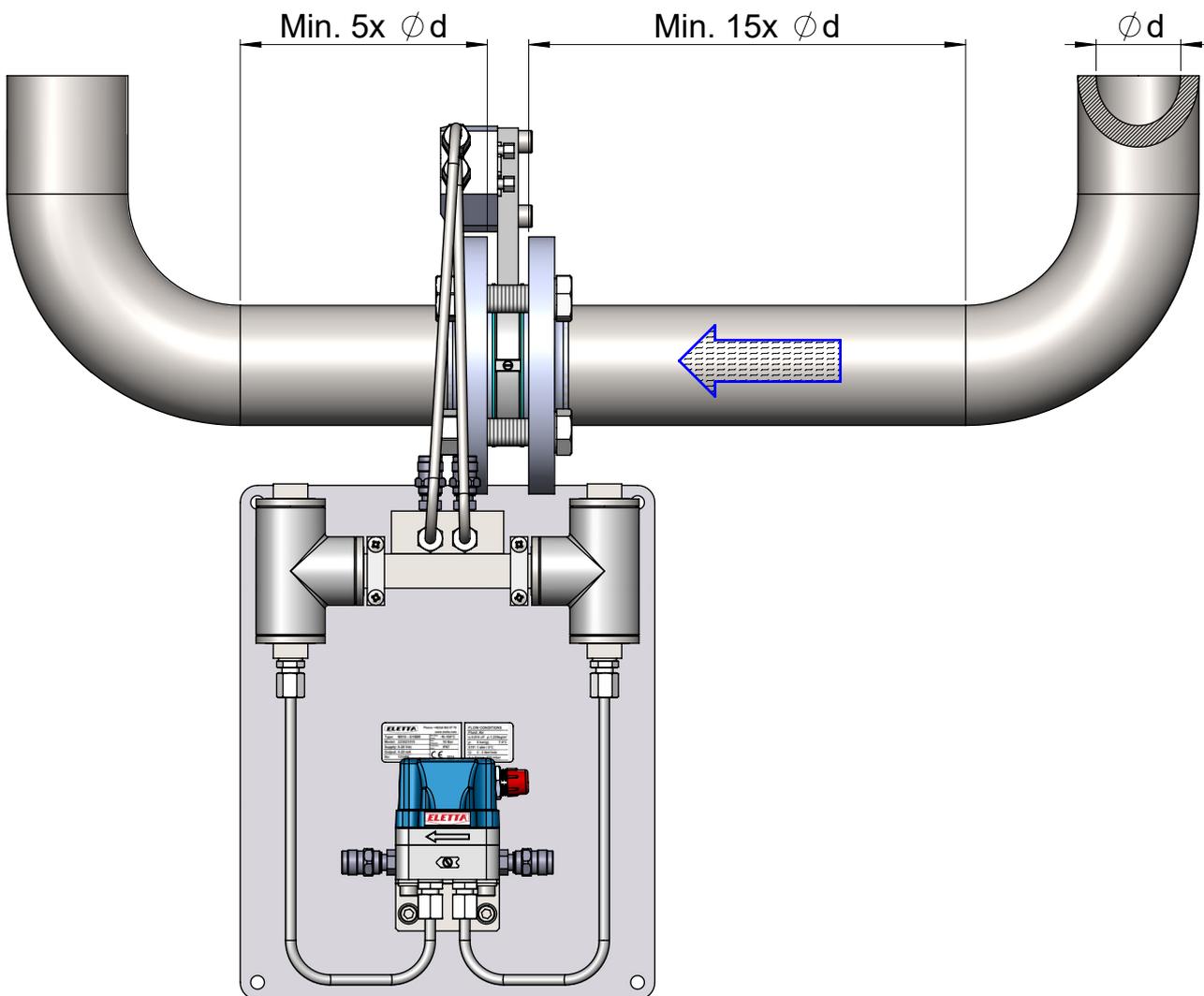
As tubing will lead the pressure to the Control Unit, it is possible to mount the Pipe Section vertically or horizontally with the pressure ports pointing up or to the side. It is recommended to have the pressure channels directed upwards.

Important: Adjust the orifice plate, so the condensate hole is at the lowest point

The straight pipe-runs before and after the Pipe Section should not be too short to avoid disturbances, which can cause incorrect values. It is recommended to allow at least 15 pipe diameters upstream and 5 pipe diameters downstream. The straight runs must be free from valves, bends, or changes in pipe diameters.



Recommended installation of Pipe Section



It is difficult to predict when the flow is stable after disturbances in the piping, so these recommendations serve as a guideline only.

The following inside diameters apply for the threaded Pipe Sections:

GSS 15 =	16 mm
GSS 20 =	21 mm
GSS 25 =	26 mm

Consider using a filter in the pipeline if the steam may contain particles.

The flanged FSS-versions must be aligned with the counter flange and the bolts must be tightened evenly. Flange-gaskets are included in the delivery, and it is recommended to use these, as they are dimensioned to suit the installation. Make sure the gaskets are properly aligned to not disturb the flow. It is also of utmost importance that the connecting pipe and flange have the same inside diameter and standard as the Pipe Section. A mismatch can cause incorrect readings of the flow.

10.4 Connecting Pipe Section and Control Unit

There is no actual limitation in the length of the tubing, but it is recommended to place the units as close to each other as possible to make troubleshooting easier.

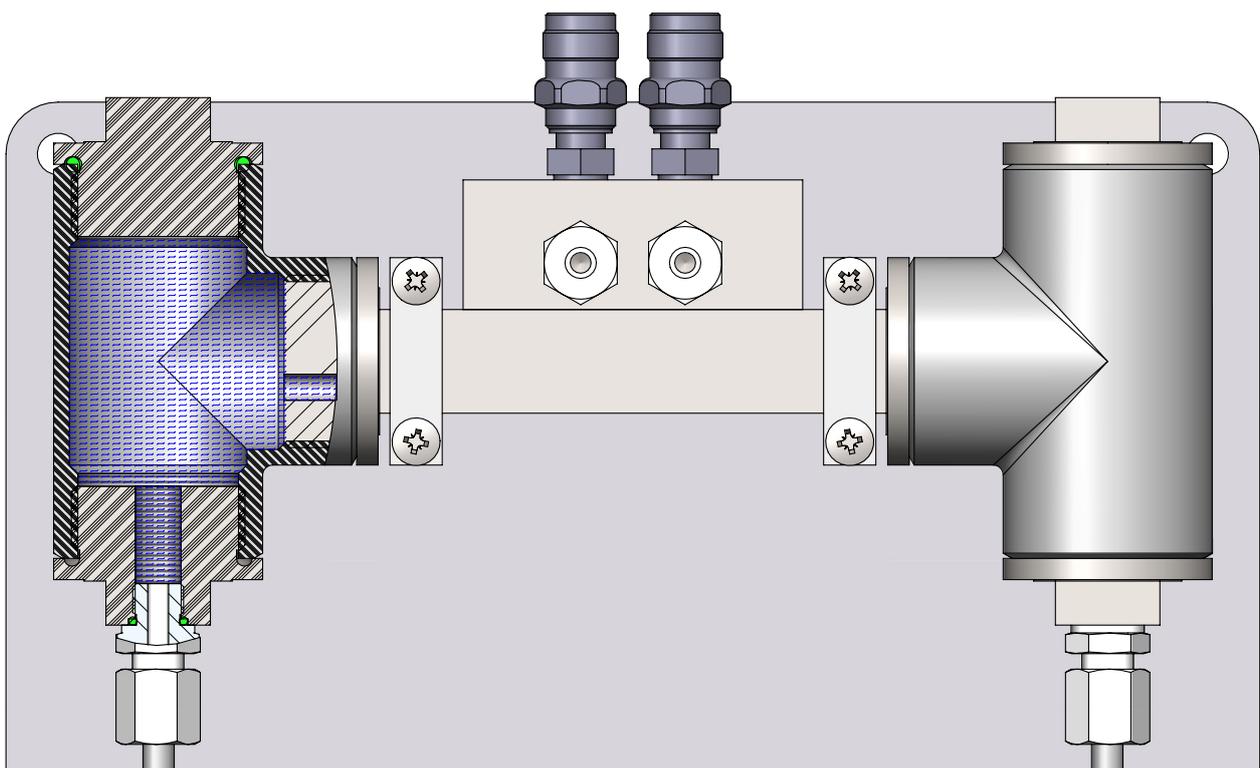
► **Note: The hoses/tubing must have the same length to avoid uneven pressure. $\pm 2\text{mm}$** ◀

Find a suitable place for the Steam Unit to be mounted. Attach the supplied plate to a wall, pipe, or another rigid support. Place it with respect to surrounding piping and obstacles. The condensate pots must be in upright position, see pictures.

Install the tubing starting at the Pipe Section. Check that there is enough length to cover the distance between the Pipe Section and Base Unit Steam. Press the tube ends into the couplings and tighten with care. Proceed to the Control Unit and repeat the step.



Before start-up it is important to fill the condensate pots with water. Make sure that all entrapped air in the piping between the Pipe Section and Control Unit is removed. Open the air valves until some water leaks. The air can otherwise, as it is a compressible media, cause faulty Flow readings.

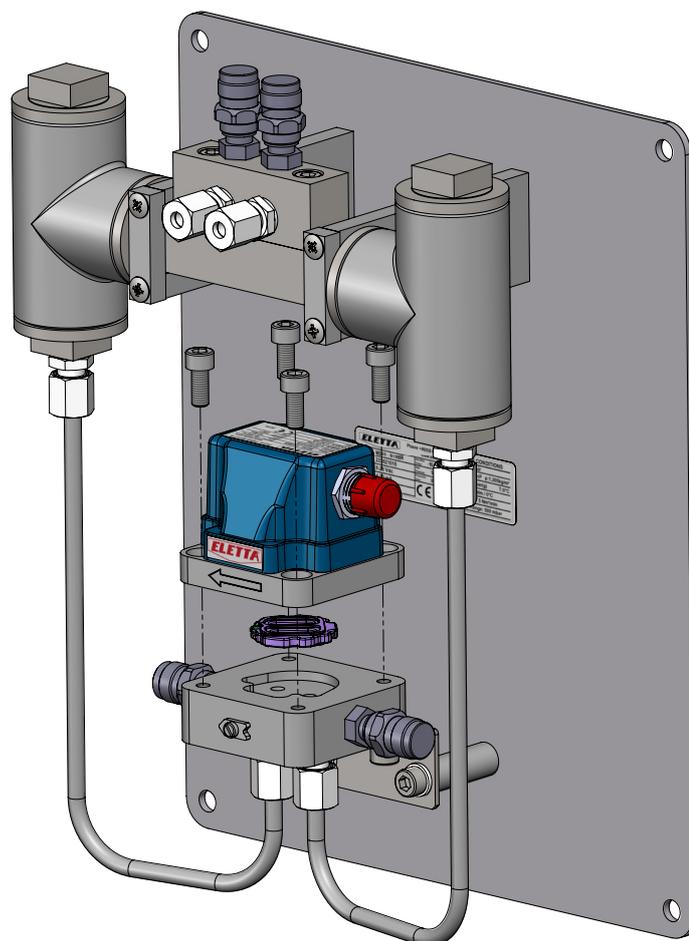


10.5 Installation and changing of Control Unit

As all Eletta Flow Monitors are designed in segments to achieve a modular, versatile Flow Monitor, there is a possibility to upgrade/rebuild them and adding other features to the already installed Monitor, by changing the Control Unit or Pipe Section.

All Eletta DP Flow Monitors are working with the same differential pressure within their specific range (See section **2.1 "Description"**). If changing Control Unit make sure the settings is for steam.

1. Close the shut-off valves.
2. Let the Base Unit Steam cool down. Turn the electric power supply off and then disconnect the cables from the User Interface and Control Unit.
3. Loosen the four (4) Allen screws that hold the Control Unit and replace the Flow direction selector sealing, if necessary. Install the new Control Unit and tighten the four (4) screws firmly again.
4. Connect the electrical cables according to the new Control Unit's specification. For detailed information regarding wiring, see section **10.6 "Electrical installation"**.
5. Before starting check that there is water in the condensate pots and deaerate.



10.6 Electrical Installation

- ▶ **Note** Only authorized personnel should make all electrical installations. ◀
Before any circuit is connected/disconnected, make sure that all power is off

Before any cables are connected, make sure that the correct power supply is used (see section 7 “**Specifications**”).

10.6.1 User Interface



Do not install the User Interface in Ex-hazardous areas.

10.6.2 Mounting the interface enclosure

Determine the mounting location by considering the enclosure specifications and the purpose of the User Interface unit. Ensure that the box is easily accessible and convenient for its intended use. It is also important to check local building codes and regulations to ensure compliance and safety. The enclosure is to be wall mounted by 4 screws.

10.6.3 Wiring and electrical installation

10.6.4 Power supply connection through cable gland.

Connect the power supply main lines L & N according to the wiring diagram shown in **Diagram 1** and Wiring description in **Table 2.**

10.6.5 Electrical Installation

Connecting the M-series wiring **DC24**, **DC0**, **A+** and **B-** to the User Interface according to the wiring diagram shown in **Diagram 2** and Wiring description in **Table 2**.

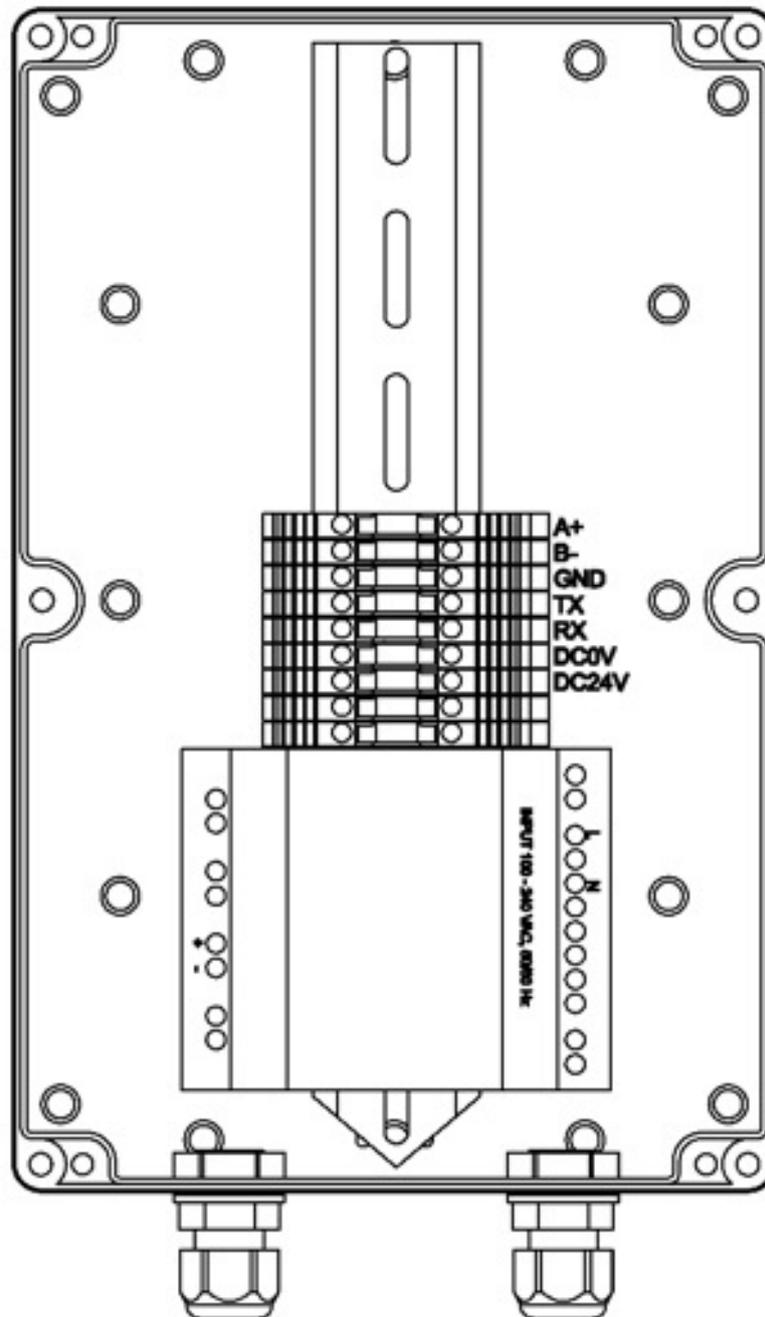


Diagram 1 Wiring diagram

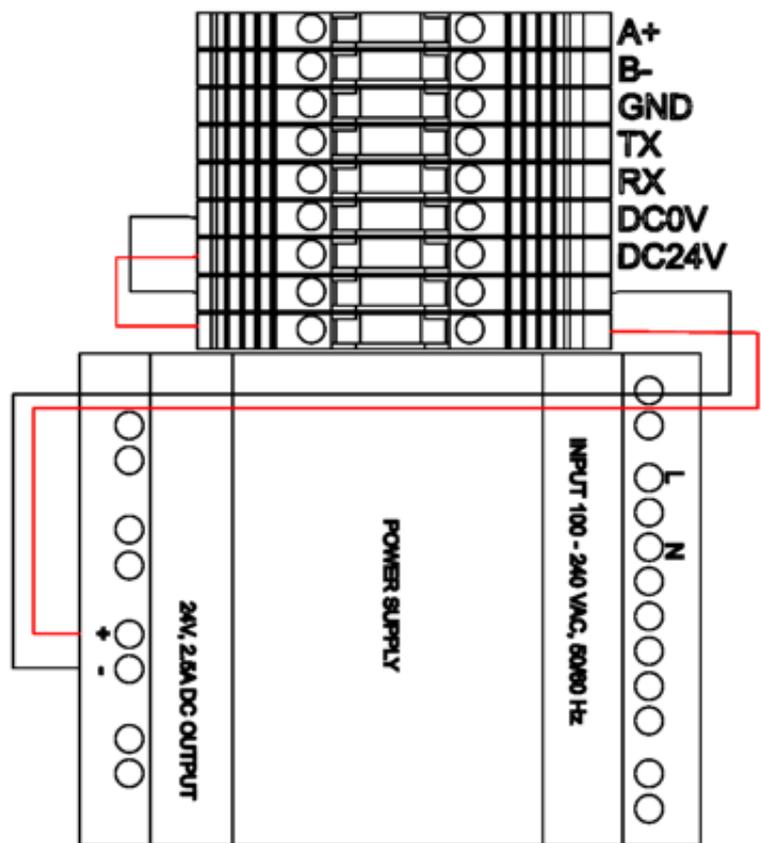


Diagram 2 Wiring diagram

Function	User Interface	Control Unit (wire color)
+	DC24V	WHITE
-	DC0V	BROWN
RS485A	A+	GREEN
RS485B	B-	YELLOW
AC Line	L	-
AC Neutral	N	-
RS232 TX	TX	-
RS232 RX	RX	-
S485/RS232 GND	GND	-

Table 2 Wiring description

10.7 Screen setup.

- **Q max:** maximum flow value
- **UoM:** Unit of measurement
- **Td:** reference temperature
- **Pd:** reference pressure
- **Q:** measured flow value
- **Q totalizer:** measured flow totalizer
- **Qc:** compensated measured flow value
- **Qc totalizer:** compensated measured flow totalizer
- **Qa:** percentage measured flow of Q max
- **Pa:** static pressure
- **H2O T:** Temperature of the water in condensation pots/containers.

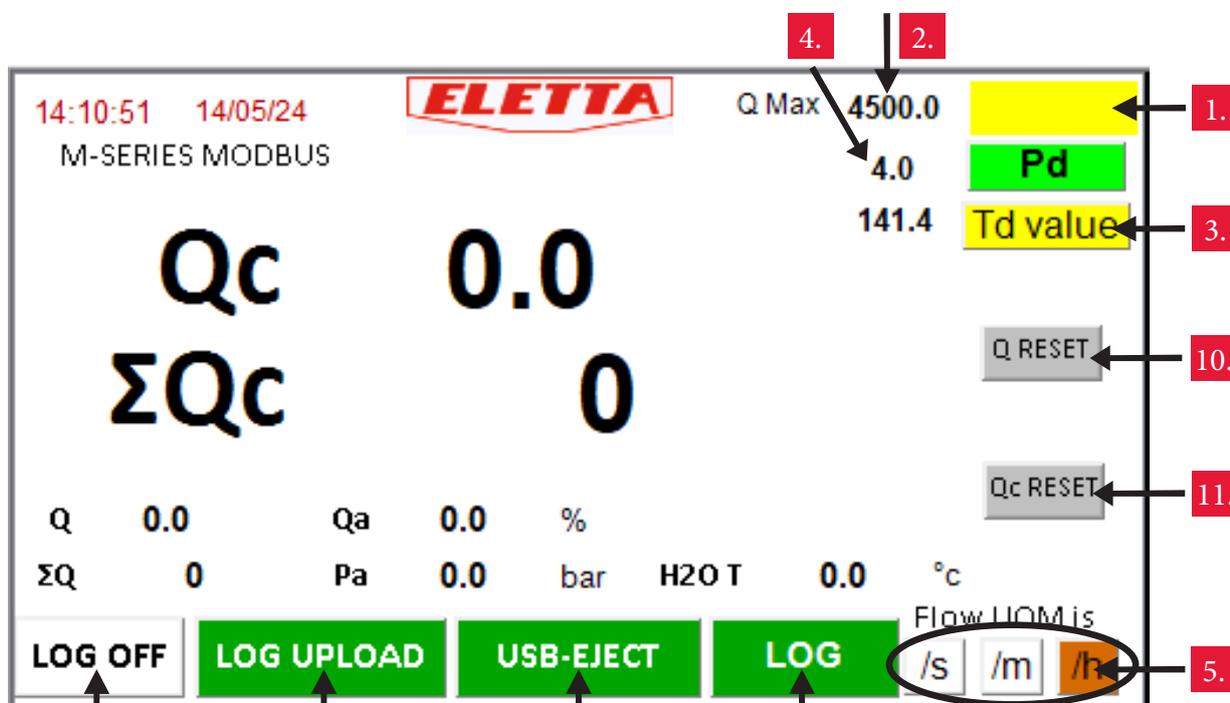


Image1:

Main screen and touch points.

1. Unit of measurement: touch to type UoM
2. Maximum flow measurement: touch to type Q Max
3. Calculation reference: touch to switch between inputting reference pressure(Pd) or reference temperature(Td).
4. Calculation reference value: touch to type the value of reference Pd/Td
5. Time-unit of UoM: touch to choose between seconds, minutes, or hours.
6. Logging: touch to start or stop logging.
7. Log upload: touch to upload the logging file to a USB flash drive.
8. USB eject: touch to eject the USB flash drive before removal.
9. Log: touch to open logging screen.
10. Q reset: touch to reset the measured flow totalizer.
11. Qc reset: touch to reset the compensated measured flow totalizer.

Screen setup.

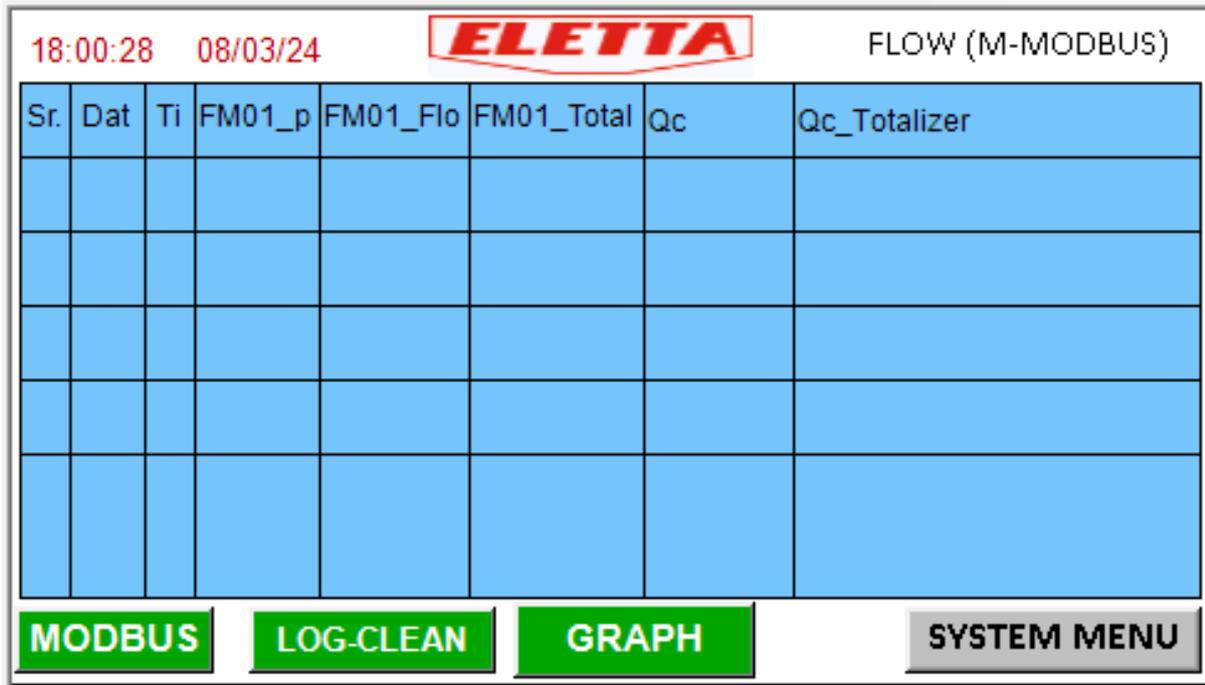


Image 4: Logging chart.

Screen Operating

- A. Power up the User Interface by connecting the main power lines.
- B. Setup the screen to start measuring:
 - I. Touch **1.** to type the UoM.
 - II. Touch **2.** to type the Q Max.
 - III. Touch **4.** to type the reference value (Td/Pd).
 - IV. Touch **5.** to choose the Time-unit.

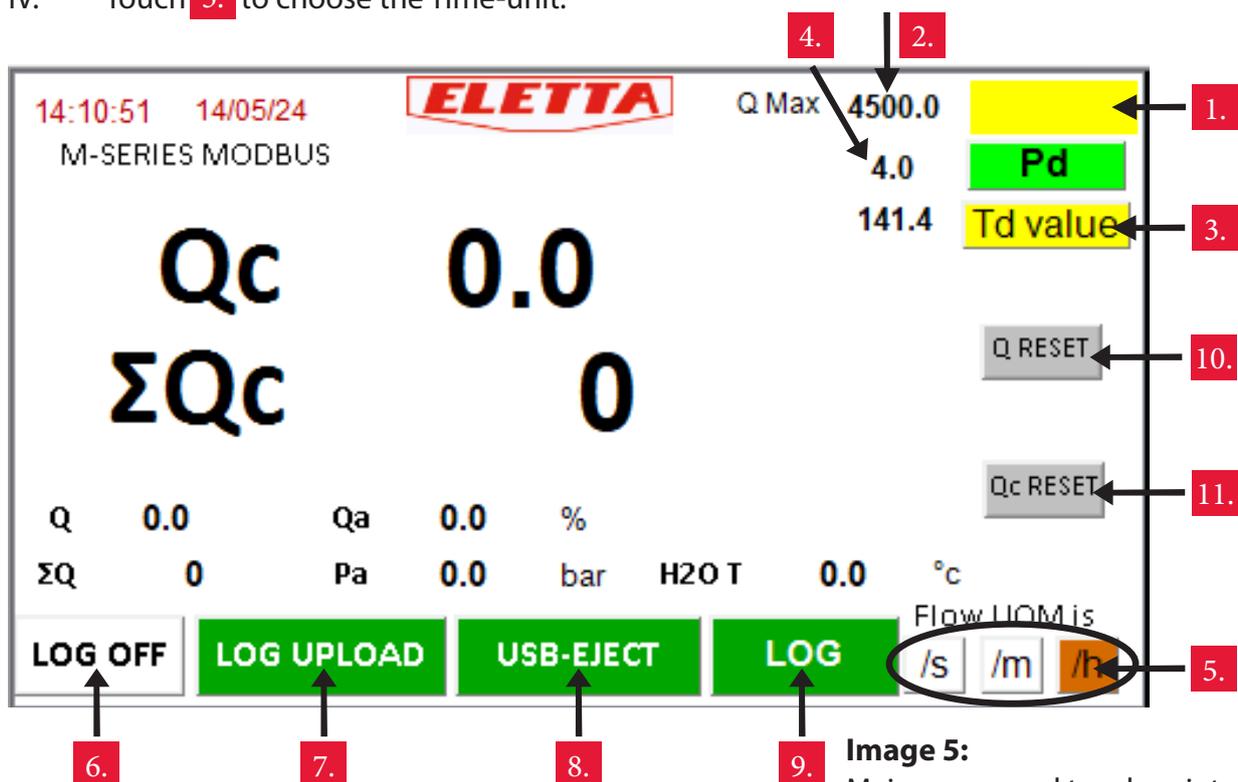


Image 5: Main screen and touch points.

10.7.1 Measuring

The User Interface receives three values from the Control Unit. They are shown on the left side of the main screen. These are Qa as flow in %, Pa as static Pressure in bar, and H2O T in °C at Sensors as Temperature of water from condensate pots and impulse tubing that is touching the Control Unit sensors. (This is not the Steam's temperature, but as a safety display if the condensate pots get too dried up its water temperature will rise close to 100°C, which is the sensor's limit).

On the right side, the main screen displays the calculated values, starting from Q the flow value as a scaling of Qa to the Q-Max, the totalization for the same. Then the Qc as Flow Compensated for Pressure and Temperature variations against the Design Pressure and Temperature, and the totalization thereof.

10.7.2 Logging

Logging can be switched on or off for logging for Pa, Q, QT, Qc, QcT every second. The Log can be uploaded to a USB flash drive if no SD-card inserted. Log can also be viewed on the log screen as table or as a graph of differences between Q and Qc.

10.7.3 External communication

The User Interface can simultaneously act like a Modbus slave yielding Modbus outputs and all logged values here are available as online Modbus outputs with registers as below:

COM 1
Baud Rate: 9600
Parity: None
Data Bit: 8
Stop Bit: 1
Node Address: "1".

Real Type Data for:
Pressure, Pa: 400001
Flow Measured, Q: 400003
Flow Total, QT: 400005
Flow Compensated, Qc: 400007
Qc Total, QcT: 400009

10.7.4

Control Unit



Do not install the Control Unit in Ex-hazardous areas

The connection cable is included in the purchase of the Control Unit. The cable has eight wires and a M12-female connector with screw locking and one end open. The standard cable length is 2,5 m. A 10-meter cable is available as an option.

In the case splicing the cable in order to extend the cable further than 10 meters, make sure that the conductive area of the wires for the output signal is at least 0,25 mm² (0,00039 inch²). Maximum output load is 1kΩ.

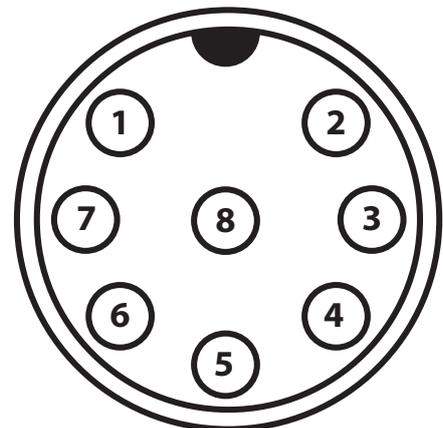
Make sure that the correct power supply is used, the allowed voltage range is between +8 to +28 VDC.

A wiring diagram is attached on the cable at delivery.

Wiring connection for the M12 M3XX unit. The configuration is referenced looking at the female of the cable connecting to M unit.



Function		Female connector	Wire color
8 - 28	+	Pole 1	WHITE
VDC	-	Pole 2	BROWN
RS485A		Pole 3	GREEN
RS485B		Pole 4	YELLOW
Not active		Pole 5	GREY
Not active		Pole 6	PINK
Not active		Pole 7	BLUE
Not active		Pole 8	RED



M12 - 8 pin

11.1 Principle of operation with DP

The function of the Eletta Flow Meters and Monitors is based on the proven and dependable differential pressure principle. The instruments use interchangeable sharp-edged orifice plates designed for different measurement ranges.

This is probably one of the oldest and most widely used principles for flow measurements. The principal benefits from simplicity and low cost. In addition, it exists a large amount of research data and experience, which is useful when predicting the behaviour of a certain orifice plate.

Inserted into the Pipe Section, the orifice plate constitutes an area restriction that causes a pressure drop after the orifice plate. This pressure drop varies with the flow rate. It means that in the flow direction, there is one pressure before the orifice plate, and another after the plate. The first pressure will be slightly higher than the second.

The two pressures, before and after the orifice plate, are lead through two separate channels to separate pressure sensors in the Control Unit. The two pressures are measured and the difference is calculated. This is called differential pressure.

The flow (Q) and the differential pressure (ΔP) are proportional to each other. The relation can be approximated by the formula $Q = \sqrt{\Delta P}$

11.2 Pressure drop

Since the Eletta Flow Meter is based on the Differential Pressure Principle, it is inevitable that a small permanent system pressure drop is caused. The reason is that the orifice plate reduces the flow area inside the pipe, and this will affect the pressure.

It is important to fully understand two types of pressure drops. The first is the actual pressure drop created between both sides of the orifice plate. The second is the permanent pressure drop that will slightly affect the system.

The actual pressure drop is a temporary state that occur over the orifice plate. On the downstream side of the Pipe Section the pressure will try go get back to the same conditions as on the upstream side. Normally, the flow profile will be recovered on the downstream side after approximately 10-15 times the inner diameter of the pipe. However, due to friction losses caused by the orifice plate, the system pressure will be somewhat less on the downstream side. The size of this loss, the permanent pressure drop, can be calculated using two mathematical formulas.

The **permanent pressure drop** can be calculated approximately by:

$$\Delta\rho(p) = \Delta\rho(a) \cdot (1 - \beta^2)$$

$\Delta\rho(p)$ = Permanent pressure loss

$\Delta\rho(a)$ = Actual pressure loss for a certain flow

$\Delta\rho$ = Differential pressure flow measurement

β = **d/D** ratio (ratio between bore and inner diameter of the pipe)

Within the normal β range (0.2-0.7) a typical permanent pressure loss range $0.96\Delta\rho - 0.51\Delta\rho$ can be expected.

The **actual pressure drop** can be calculated approximately by:

$$\Delta\rho(a) = (Q/Q_{\max})^2 \times \Delta\rho(\max)$$

$\Delta\rho(a)$ = actual pressure loss

$\Delta\rho(\max)$ = maximum allowed differential pressure, see "Flow conditions" on the label.

Q = actual flow

Q_{\max} = maximum flow for the orifice plate, see "Flow conditions" on the label.

Example:

Assuming the following:

Q range: 0-10 l/min

Q = 5 l/min

d = 5,9 mm

D = 16.0 mm

Media pressure = 5 bar

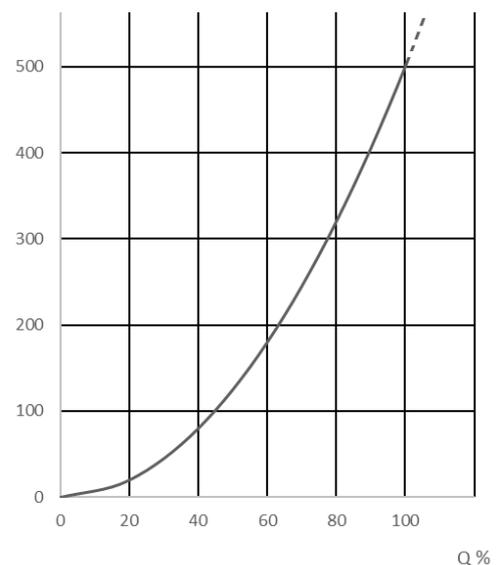
$\Delta\rho(\max)$ = 500 mbar

This gives a β of $5,9/16.0 = 0,36875$,

which results in $(1 - \beta^2) = 0,864$

Hence, $\Delta\rho(p) = \Delta\rho(a) \times 0,864$

A flow of 5 l/min results in an actual pressure drop of $(5/10)^2 \times 500 = 125$ mbar.



The curve below approximately shows the relation between the actual pressure loss and the flow percentage.

The permanent pressure drop will then be $0,864 \times 125 = 108$ mbar

If this drop is compared to the system media pressure of 5 bar, it is found that the efficiency η is almost 98%.

$$\eta = (5 - 0,108) / 5 = 97,8\%$$

This means that mounting a Flow Meter with a bore, that temporarily decreases the flow area with as much as 86%, only decreases the static pressure with approximately 2 % at 50% flow.

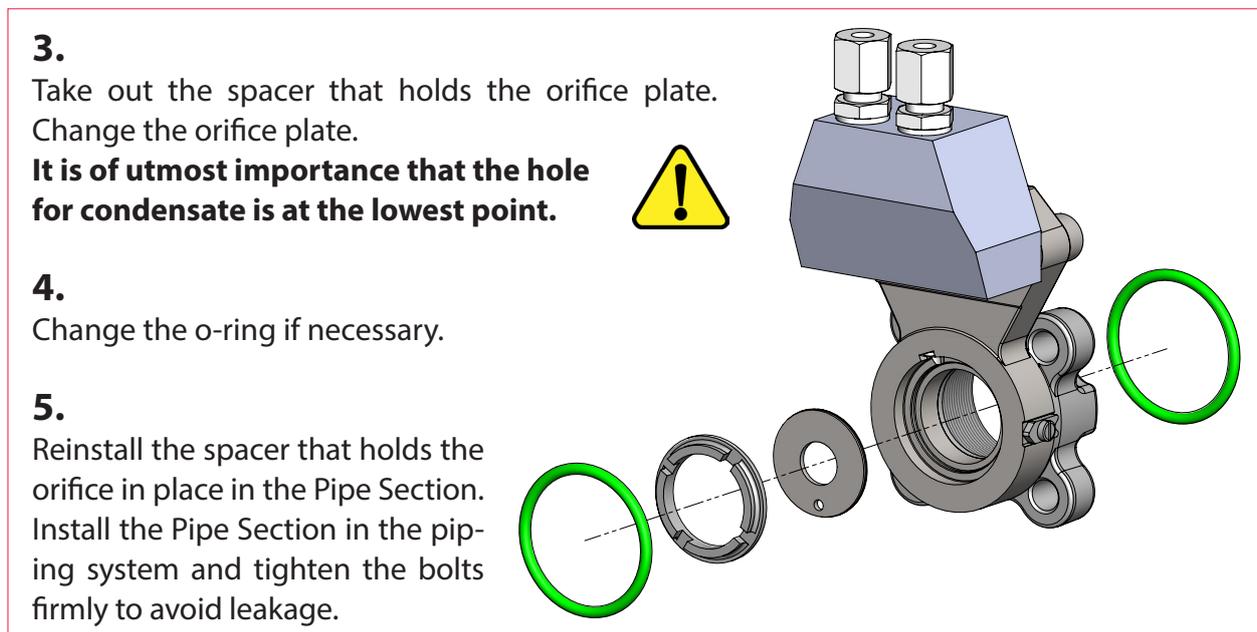
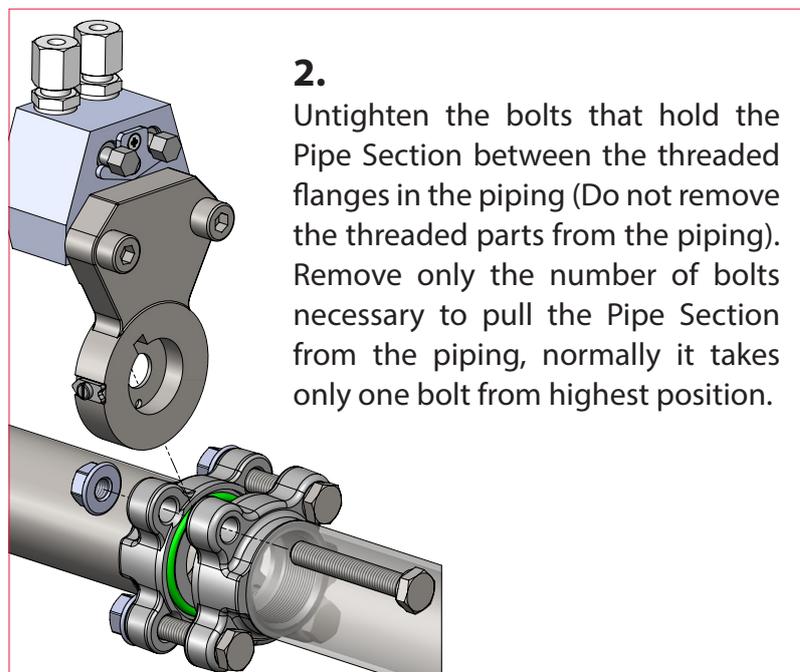
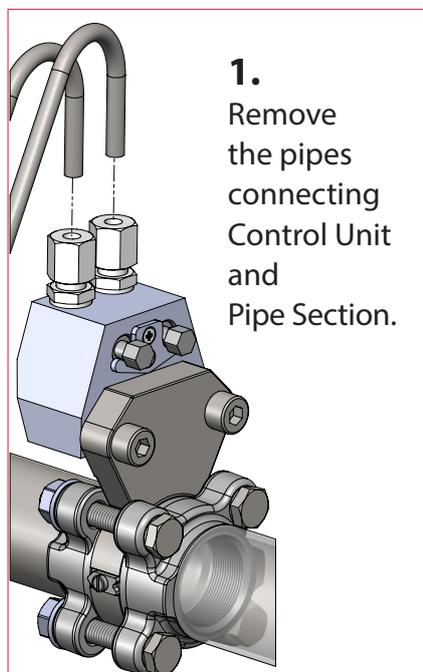
The Eletta Flow Monitor features an orifice construction that does not require recalibration after replacement and can easily be rebuilt in-field to change the flow range to another from the flow rate ordered. This is valid for all Pipe Sections.

If another flow range than ordered originally is needed; the orifice plate inside the Pipe Section is the only part that has to be changed. Any flow range that suits the specific application can be ordered, as long as the new flow rate is within the possible span for the Control Unit's dimension (see table in section **16.2 "Flow ranges"**)

In each case of rebuilding the flow Monitor on-site, consult Eletta or a local Distributor for advice of the correct orifice plate before ordering.

▶ **Empty the piping system so it is not pressurized and has no flow. Let it cool.** ◀

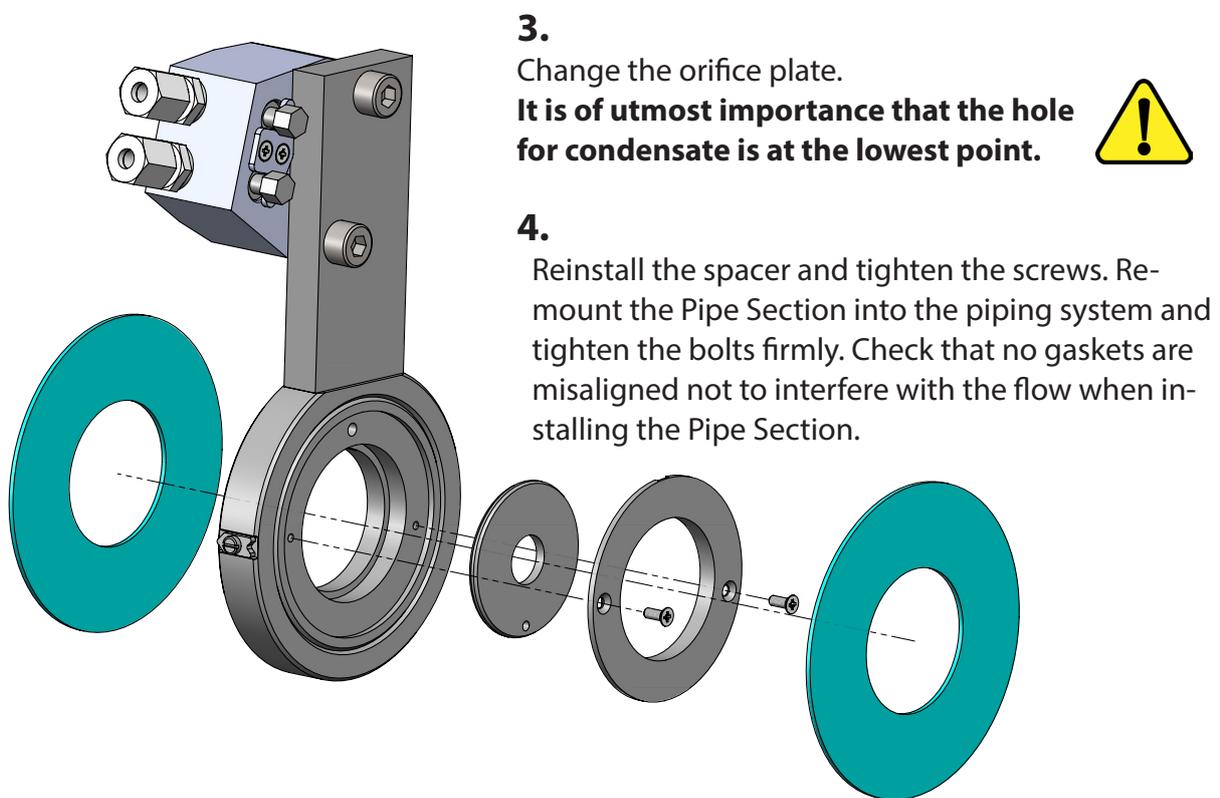
Threaded model: GSS



Flanged model -FSS

1.
Follow step 1. and 2. as GSS read on the previous page

2.
Untighten the two screws holding the orifice. Remove the spacer.



Type plate

When changing the orifice label, to get a new flow range, it is recommended to change the identification plate to the one with the new range marked. This identification plate is delivered with the orifice plate when ordering an orifice plate separately. Make sure that output signals in the receiving end PLC, display, User Interface computer etc., are matched for the new flow range.

13 Change of Flow Direction

At the time of ordering, the flow direction is specified and decides how Eletta Steam shall be mounted, i.e. from which side the media enters the Pipe Section. (See **Fig. 10** for alternatives.) If, for some reason, Eletta Steam is ordered with the wrong flow direction or the production process is altered, it is possible to change this on-site.

1. Close the shut-off valves, disconnect the cables and let the system cool down.
2. Remove the four (4) Allen screws, which attach the Control Unit to the Base Unit Steam. (See **fig. 10** below)
3. Replace the sealing if necessary
4. Turn the Control Unit 180°.
5. Change the direction of the arrows on the Pipe Section and on the Control Unit. (See **fig. 11** below)
6. Fasten the four (4) Allen screws.

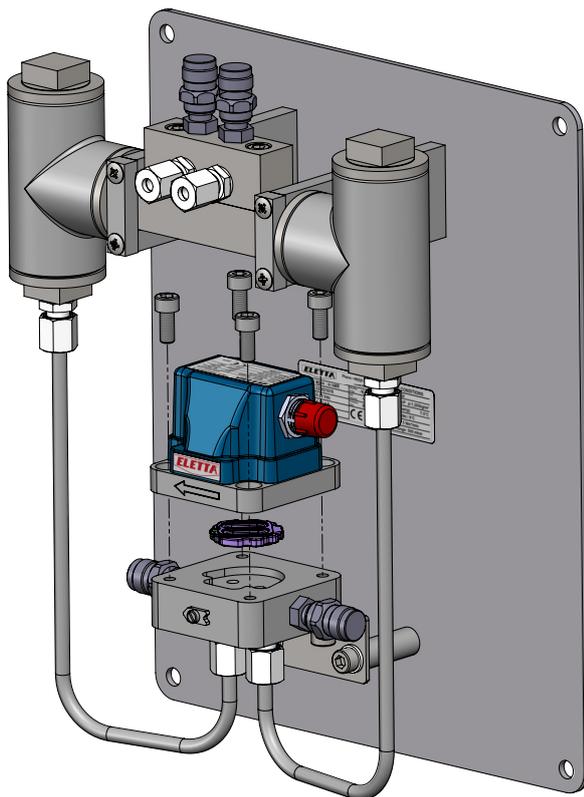


Fig. 10

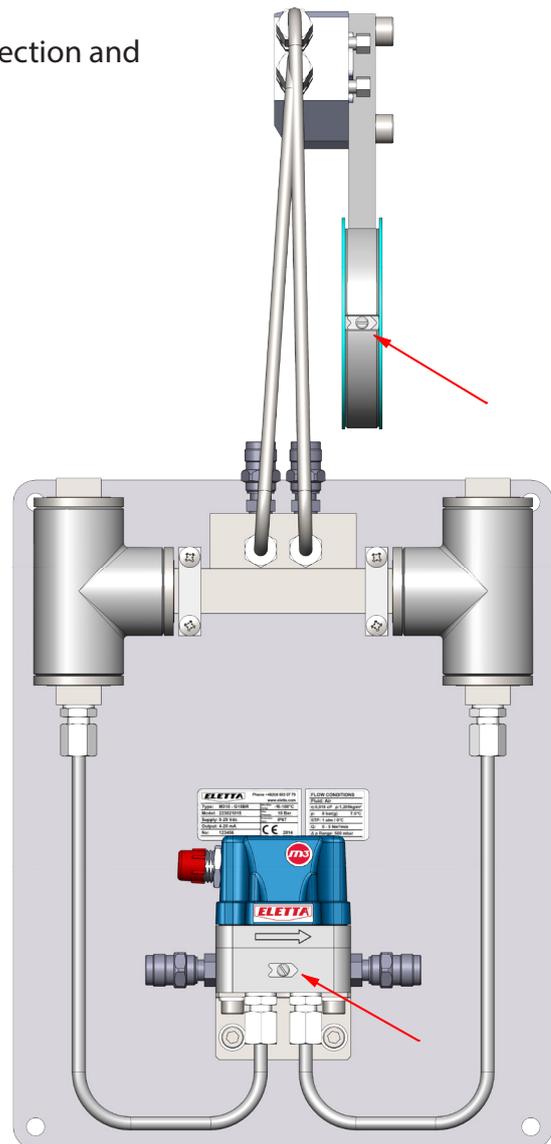
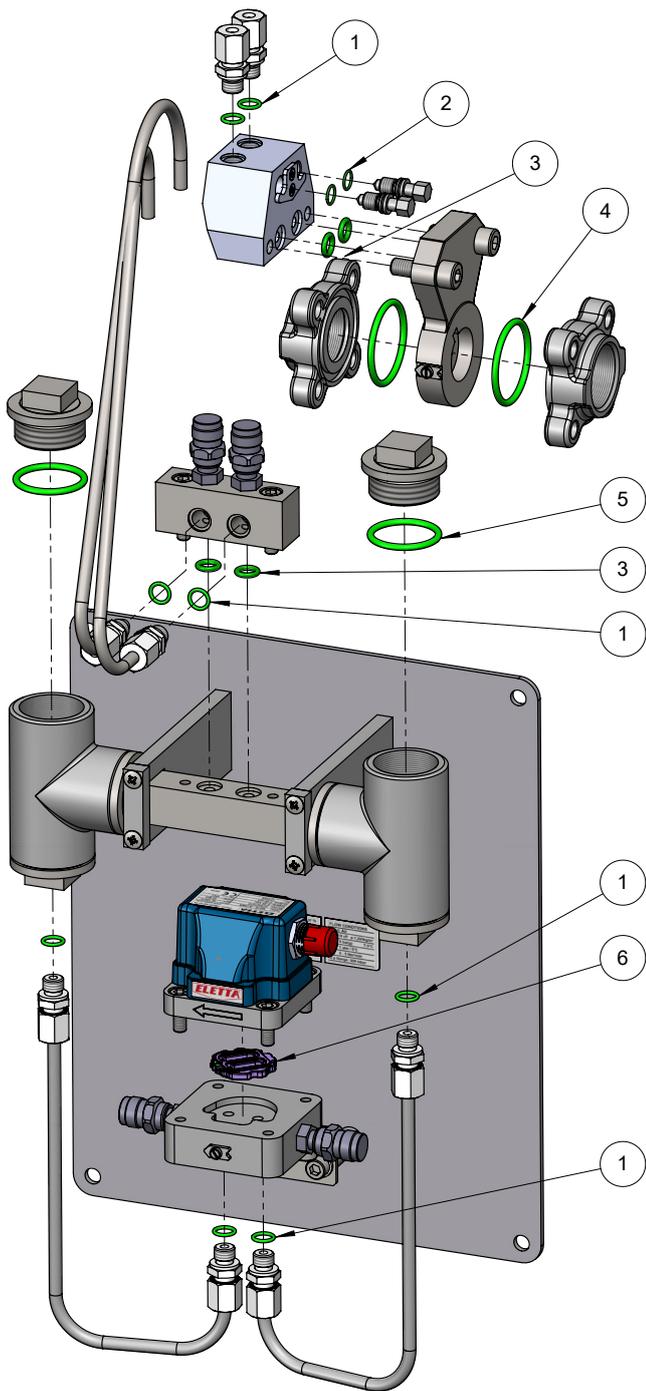


Fig. 11



- Inspect the orifice plate on a regular basis. Check for damage, dirt build-up and that the edge of the orifice plate is still sharp. The sharp edge of the bore is crucial to provide proper and accurate flow reading. If the bore wear is excessive, please contact a local distributor or Elettta Flow for purchase of a replacement orifice.
- Inspect the condensate pots and clean them. Fill them before starting up the system again.
- Inspect the power and output wirings for signs of corrosion, cracks or deterioration. Check that the electrical connector to the instrument is tightly attached and shows no signs of corrosion.
- Inspect the process pipe body and connections for signs of corrosion and fatigue fractures.
- Make sure the Flow Meter isn't exposed to vibrations.
- Check that the temperature at the Control Unit doesn't exceed the max temp of 100° C.
- Inspect o-rings and sealings. Replace them if necessary, new ones can be ordered from Elettta distributors or directly from Elettta. See section **17.1 Drawings Elettta Steam**

ITEM NO.	DESCRIPTION	MATERIAL	QTY.
6	Flow direction selector	FPM/316L	1
5	O-ring 29.2x3	FPM	2
4	O-ring 39.2x3	FPM	2
3	O-ring 7.3x2.4	FPM	4
2	O-ring 8x1	FPM	2
1	O-ring 8.1x1.6	FPM	8

15.1

Verification of flow

All Eletta Control Units are calibrated and adjusted individually with water in a dedicated calibrated flow rig under reference conditions with enough straight runs before and after.

If the Control Unit shows another value compared to a reference meter on site, it can be due to that the reference meter has been calibrated under other reference conditions and that the Control Unit have other conditions on site in the actual application, than used during the calibration prior to shipping. The accuracy stated is achievable only if the instrument is correctly installed according to this manual.

The meter is not showing correct values or nothing at all:

- Check if the power supply is connected.
- Check that the power supply uses the correct voltage.
- Check that there is an output signal, at least 4 mA.
- Check the flow in the piping system and that it is enough to create the needed Δp
See section **7 Specifications**.
- Check that the Control Unit is mounted correctly with respect to the flow direction. Check that the arrow outside of the Pipe Section correspond with the actual flow direction. Check the flow direction selector under the Control Unit. Make sure that it corresponds to the actual flow.
- Check that the orifice calculation conditions correspond with the pressure and temperature of the system.
- Check that the orifice plate is correct for the application. Check the stamped values on the orifice plate and that it corresponds with Pipe Section, model number and flow.
- If compression couplings into the Control Unit inlet are used, check that the inside diameter is enough to avoid the bottle neck effect Check the table for the minimum correct inner diameter. (See section 2.3 Specifications)
- Verify that the inner diameter is correct and there are enough straight runs up-stream and downstream of the Pipe Section.

Media is coming out of the Control Unit:

Close the shut-off valves, disconnect the cables and let the system cool down. Remove the Control Unit and check that the Pipe Section and Control Unit have no cracks, and that all seals are undamaged.

The unit is damaged and shall be replaced.

Check the identification plate/tag on the Control Unit and note the serial number, flow range and liquid before ordering a new Control Unit from Eletta or a representative. The broken Control Unit can be changed in minutes without any on-site calibration. (See section **2.5 for details on how to replace a Control Unit**).

If the meters does not show the right value contact a local distributor or Eletta Service department for control.

15.2 Spare parts

See section **17 “Drawings”** for exploded drawings showing all replaceable components.

If Elettta Steam is installed in a very critical application, it is recommended to have a complete, identically pre-calibrated Control Unit in stock, as it only involves four bolts to replace it. The Pipe Section seldom needs replacement since it does not consist of any moving parts but can also be ordered as spare part.

The Control Unit contains no exchangeable parts.

Do not try to repair the Control Unit. It is not possible to replace certain spare parts since the Control Unit must be calibrated as a whole. Contact a local distributor or Elettta Flow for advice and information about service.

The product label specifies the serial number, the flow range and the media.

16.1 Differential Pressure Range 1-10

M325- Dp-range: 12,5-1250 mbar, Max. pressure: 25 bar

	-2%	10	+2%	-2%	20	+2%	-2%	30	+2%	-2%	40	+2%	-2%	50	+2%	-2%
%	8	10	12	18	20	22	28	30	32	38	40	42	48	50	52	-2
mbar	8	13	18	41	50	61	98	113	128	181	200	221	288	313	338	1
mA	5,3	5,6	5,9	6,9	7,2	7,5	8,5	8,8	9,1	10,1	10,4	10,7	11,7	12,0	12,3	3,7

	60	+2%	-2%	70	+2%	-2%	80	+2%	-2%	90	+2%	-2%	100	+2%
%	60	62	68	70	72	78	80	82	88	90	92	98	100	102
mbar	450	481	578	613	648	761	800	841	968	1013	1058	1201	1250	1301
mA	13,6	13,9	14,9	15,2	15,5	16,5	16,8	17,1	18,1	18,4	18,7	19,7	20,0	20,3

M325- Dp-range: 12,5-1250 mbar, Max. pressure: 25 bar

	-2%	10	+2%	-2%	20	+2%	-2%	30	+2%	-2%	40	+2%	-2%	50	+2%	-2%
%	8	10	12	18	20	22	28	30	32	38	40	42	48	50	52	-2
mbar	8	13	18	41	50	61	98	113	128	181	200	221	288	313	338	1
mA	5,3	5,6	5,9	6,9	7,2	7,5	8,5	8,8	9,1	10,1	10,4	10,7	11,7	12,0	12,3	3,7

	60	+2%	-2%	70	+2%	-2%	80	+2%	-2%	90	+2%	-2%	100	+2%
%	60	62	68	70	72	78	80	82	88	90	92	98	100	102
mbar	450	481	578	613	648	761	800	841	968	1013	1058	1201	1250	1301
mA	13,6	13,9	14,9	15,2	15,5	16,5	16,8	17,1	18,1	18,4	18,7	19,7	20,0	20,3

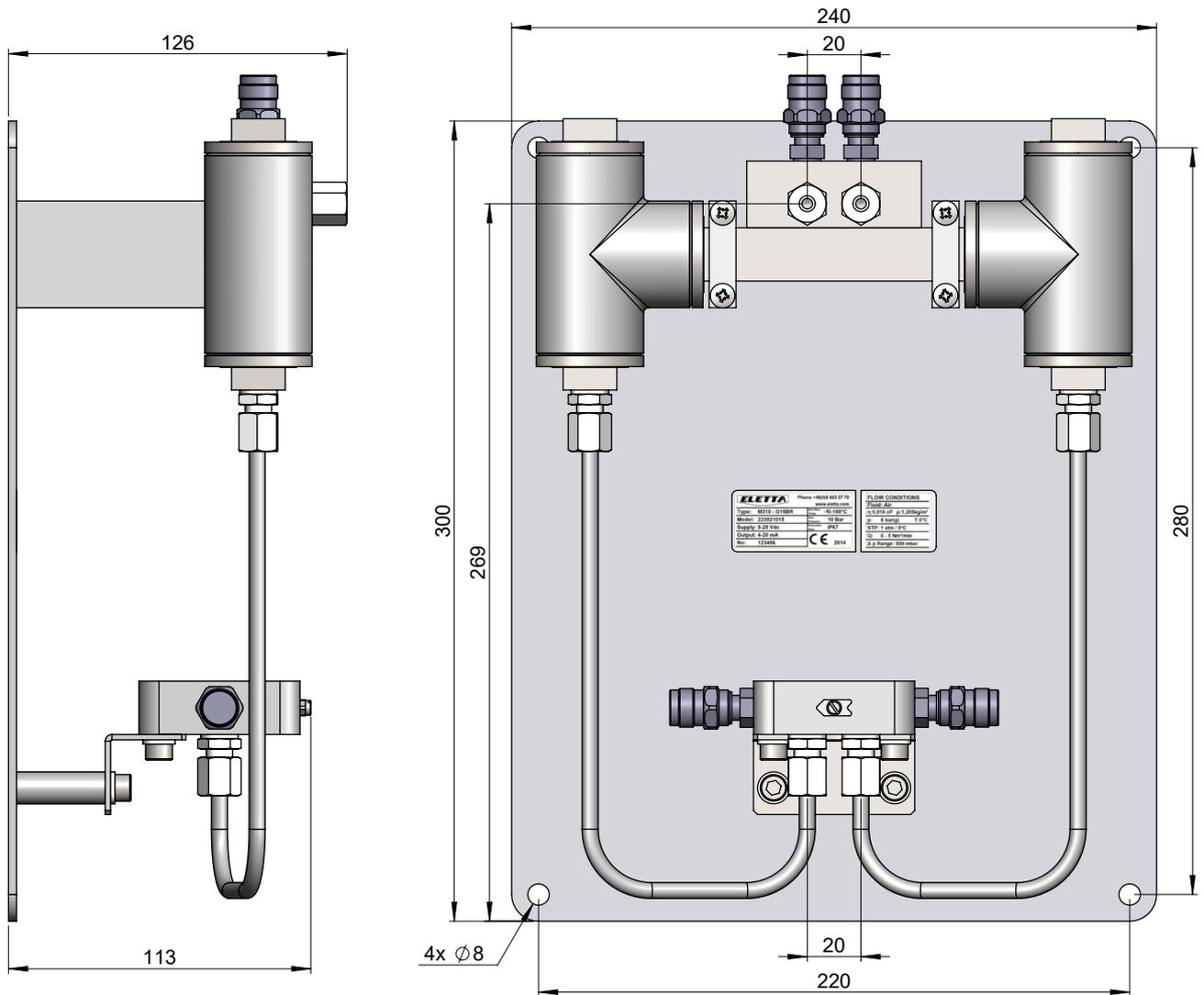
16.2 Flow Ranges

Dimensioning of steam lines (capacity in kg/h) line dimension

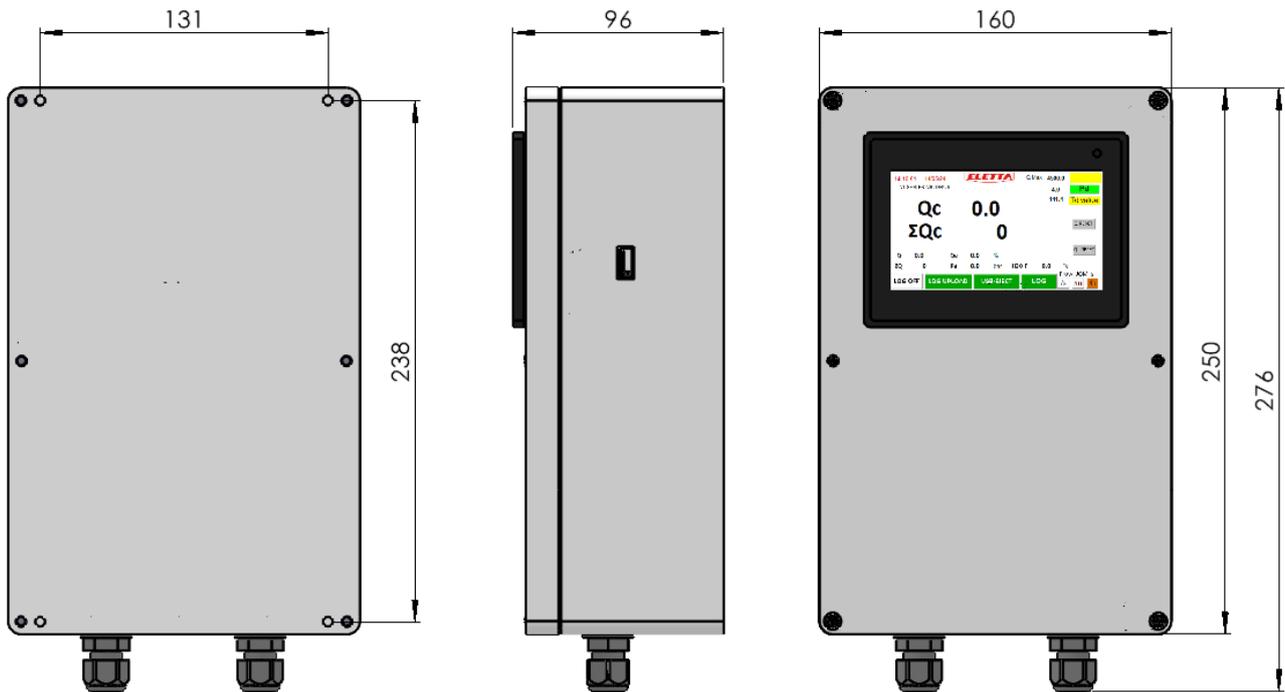
Pressure	Speed	15	20	25	32	40	50	65	80	100	125	150	200	250	300
bar	m/s	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
0.4	15	7	14	24	37	52	99	145	213	394	648	917	1606	2590	3678
	40	17	35	64	102	142	265	403	576	1037	1670	2303	4318	6909	9500
0.7	15	7	16	25	40	59	109	166	250	431	680	1006	1708	2791	3852
	40	18	37	68	106	167	298	428	630	1108	1712	2417	4532	7251	10323
1.0	15	8	17	29	43	65	112	182	260	470	694	1020	1864	2814	4045
	40	19	39	71	112	172	311	465	640	1150	1800	2500	4815	7333	10370
2.0	15	12	25	45	70	100	182	280	410	715	1125	1580	2814	4545	6277
	40	19	43	70	112	162	295	428	656	1215	1755	2520	4815	7425	10575
3.0	15	16	37	60	93	127	245	385	535	925	1505	2040	3983	6217	8743
	40	26	56	100	152	225	425	632	910	1580	2480	3440	6779	10269	14316
4.0	15	19	42	70	108	156	281	432	635	1166	1685	2460	4618	7121	10358
	40	30	63	115	180	270	450	742	1080	1980	2925	4225	7866	12225	17304
5.0	15	22	49	87	128	187	352	526	770	1295	2105	2835	5548	8586	11947
	40	36	81	135	211	308	548	885	1265	2110	3540	5150	8865	14268	20051
6.0	15	26	59	105	153	225	425	632	925	1555	2525	3400	6654	10297	14328
	40	43	97	162	253	370	658	1065	1520	2530	4250	6175	10629	17108	24042
7.0	15	29	63	110	165	260	445	705	952	1815	2765	3990	7390	12015	16096
	40	49	116	197	295	456	796	1247	1825	3120	4940	7050	12661	19663	27816
8.0	15	32	70	126	190	285	475	800	1125	1990	3025	4540	8042	12625	17728
	40	54	122	205	320	465	810	1260	1870	3240	5220	7120	13140	21600	33210
10.0	15	41	95	155	250	372	626	1012	1465	2495	3995	5860	9994	16172	22713
	40	84	192	327	510	730	1370	2065	3120	5135	8395	12470	21247	33669	46858
14.0	15	50	121	205	310	465	810	1270	1870	3220	5215	7390	12921	20538	29016
	40	85	195	331	520	740	1375	2080	3120	5200	8500	12560	21720	34139	47128
	15	126	305	555	825	1210	2195	3425	4735	8510	13050	18630	35548	54883	76534

16.3 Weight and Dimensions

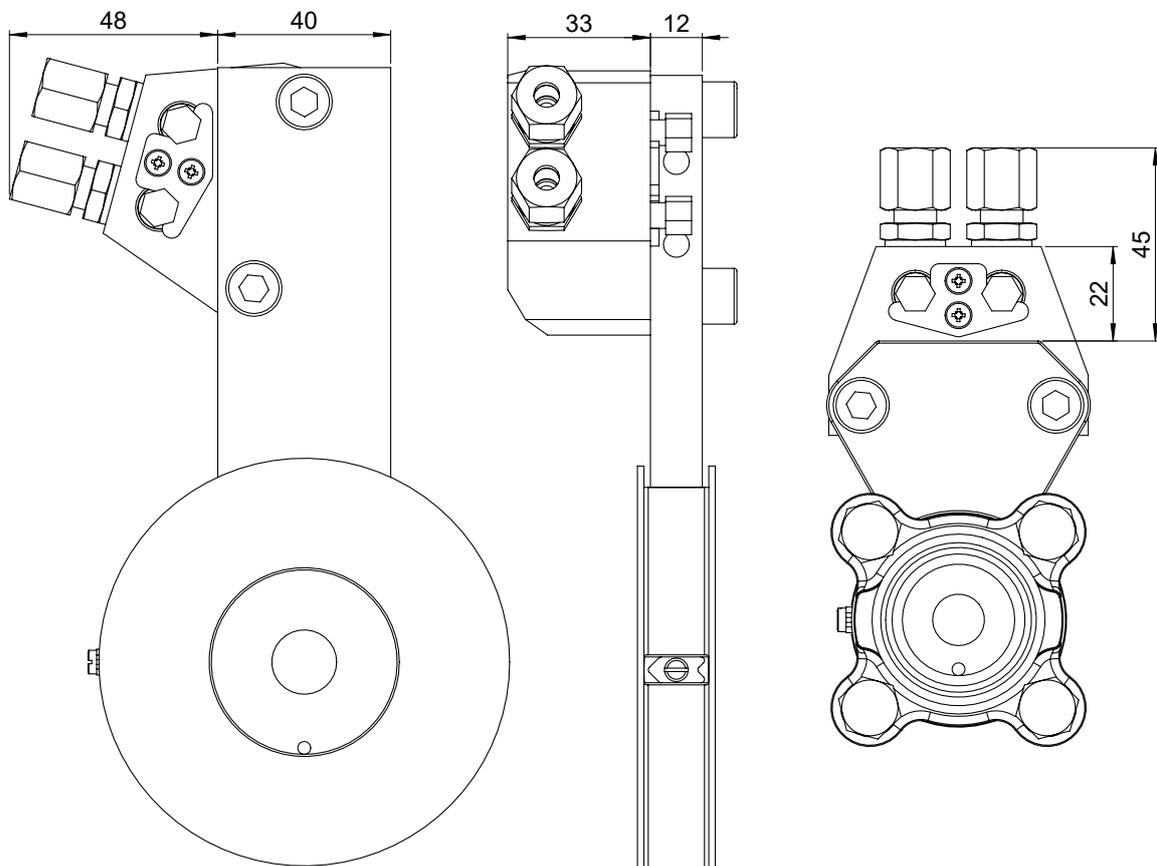
Eletta Steam Unit	5,3kg
Control Unit M310 Plastic cover	0,4kg
Control Unit M310 Stainless steel cover	0,5kg
User Interface	1,4kg
Pipe Section	See table



Base Unit Steam

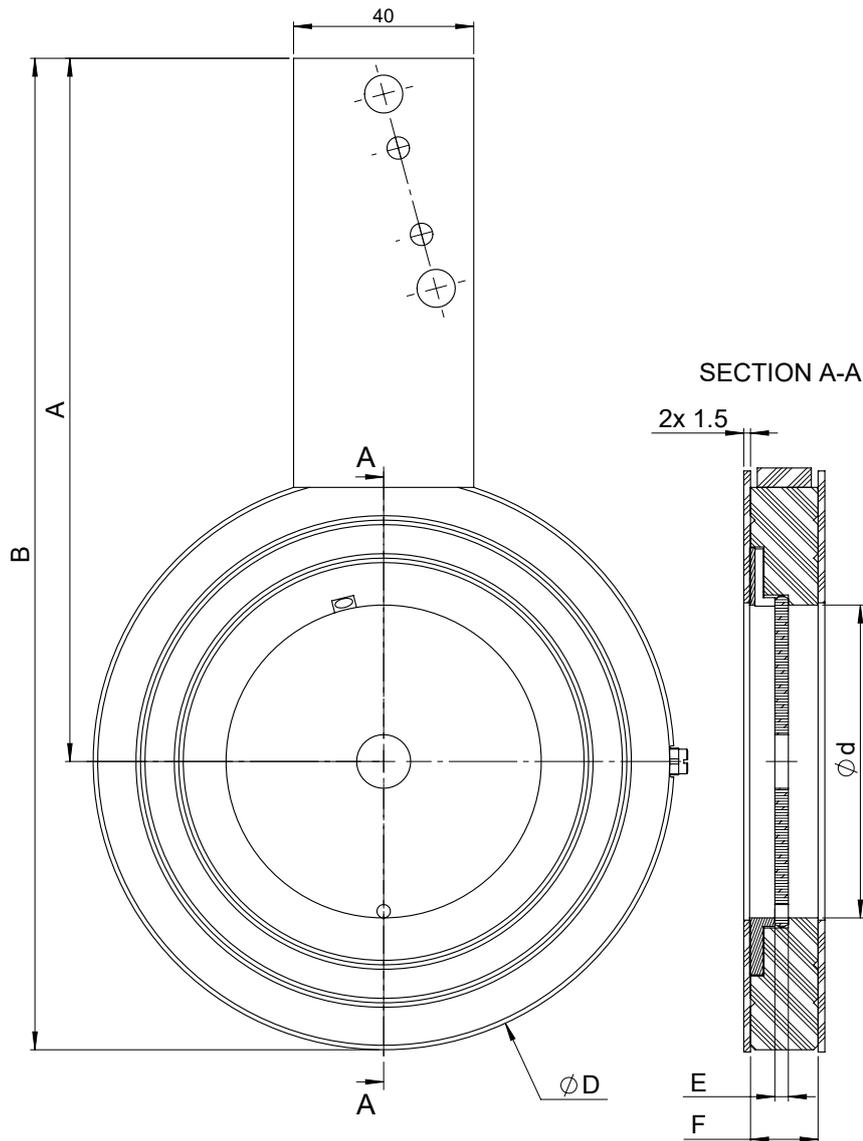


User Interface



Additional dimensions for shut off block

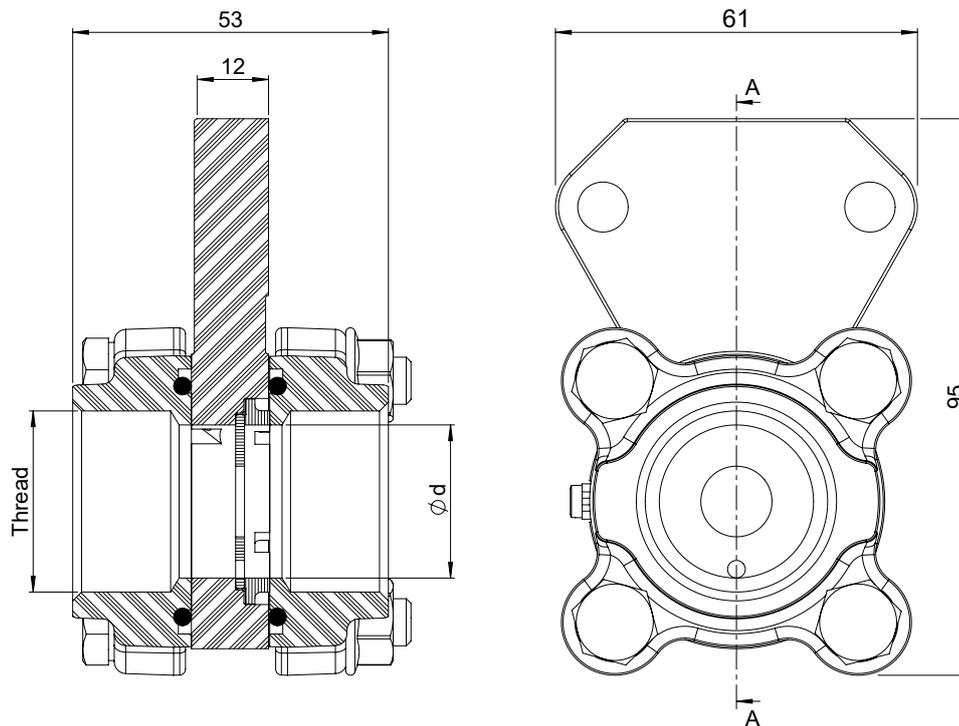
FSS



FSS DIN							
FSS DIN	A	B	Ød	ØD	E	F	Approx weight [kg]
FSS15 (1/2")	114	140	17	53	1,5	15	0.5
FSS20 (3/4")	120	152	22	63	1,5	15	0.6
FSS25 (1")	127	163	29	73	3	15	0.7
FSS32 (1 1/4")	133	175	37	84	3	15	0.9
FSS40 (1 1/2")	139	186	43	94	3	15	1.0
FSS50 (2")	147	201	55	109	3	15	1.2
FSS65 (2 1/2")	157	222	70	129	3	15	1.5
FSS80 (3")	165	237	83	144	3	15	1.8
FSS100 (4")	176	258	107	164	3	15	2.0
FSS125 (5")	191	288	132	194	3	15	2.6
FSS150 (6")	213	323	159	220	3	15	3.0
FSS200 (8")	241	379	207	275	3	15	4.3
FSS250 (10")	269	435	260	331	3	15	5.6
FSS300 (12")	297	490	310	386	3	15	7.2
FSS350 (14")	327	550	340	446	3	15	10.5
FSS400 (16")	373	621	390	497	3	18	14.2
FSS450 (18")	403	681	441	557	3	18	17.4
FSS500 (20")	434	743	492	619	3	18	21.2

FSS ANSI							
FSS DN	A	B	Ød	ØD	E	F	Approx. Weight [kg]
FSS15 (1/2")	115	138	16	46	1,5	15	0,5
FSS20 (3/4")	118	146	21	56	1,5	15	0,5
FSS25 (1")	120	153	27	66	3	15	0,6
FSS32 (1 1/4")	128	165	35	75	3	15	0,7
FSS40 (1 1/2")	134	176	41	85	3	15	0,8
FSS50 (2")	144	196	53	104	3	15	1,1
FSS65 (2 1/2")	154	216	63	123	3	15	1,4
FSS80 (3")	160	228	78	135	3	15	1,6
FSS100 (4")	180	267	102	173	3	15	2,4
FSS125 (5")	201	299	128	196	3	15	2,7
FSS150 (6")	214	324	154	221	3	15	3,2
FSS200 (8")	243	382	203	278	3	15	4,5
FSS250 (10")	273	443	255	339	3	15	6,3
FSS300 (12")	308	512	303	408	3	15	9,2
FSS350 (14")	349	574	333	450	3	15	11,2
FSS400 (16")	381	637	381	513	3	18	16,6
FSS450 (18")	398	672	429	548	3	18	17,1
FSS500 (20")	427	729	478	605	3	18	20,4

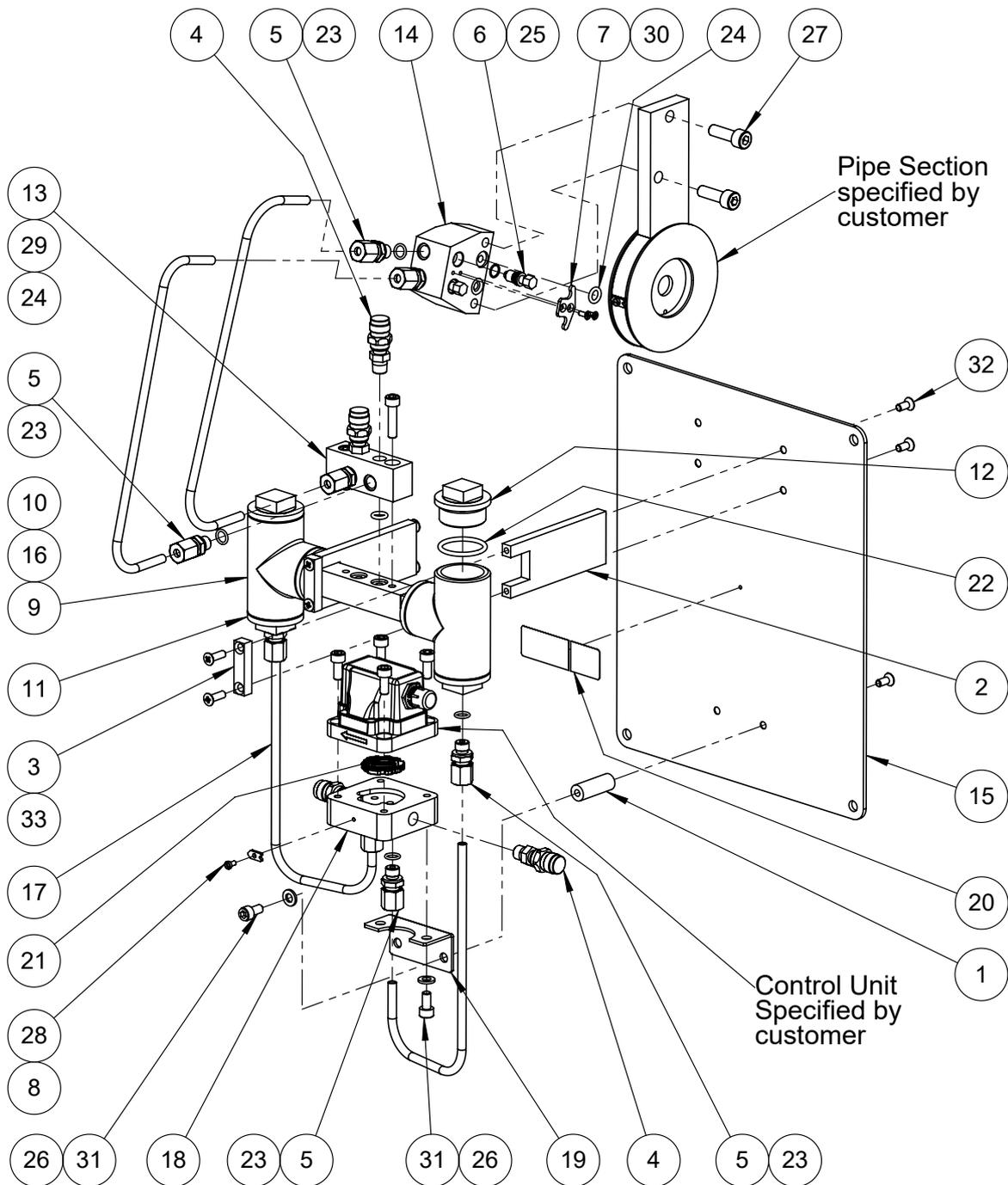
GSS DIN and ANSI



GSS DIN and ANSI			
Description	C	Ød	Approx. Weight [kg]
Pipe section GSS15 DIN	G 1/2	16	1.0
Pipe section GSS20 DIN	G 3/4	21	0.5
Pipe section GSS25 DIN	G 1	26	0.5
Pipe section GSS15 ANSI	NPT 1/2	21	1.0
Pipe section GSS20 ANSI	NPT 3/4	27	0.9
Pipe section GSS25 ANSI	NPT 1	26	0.8

17.1 Eletta Steam

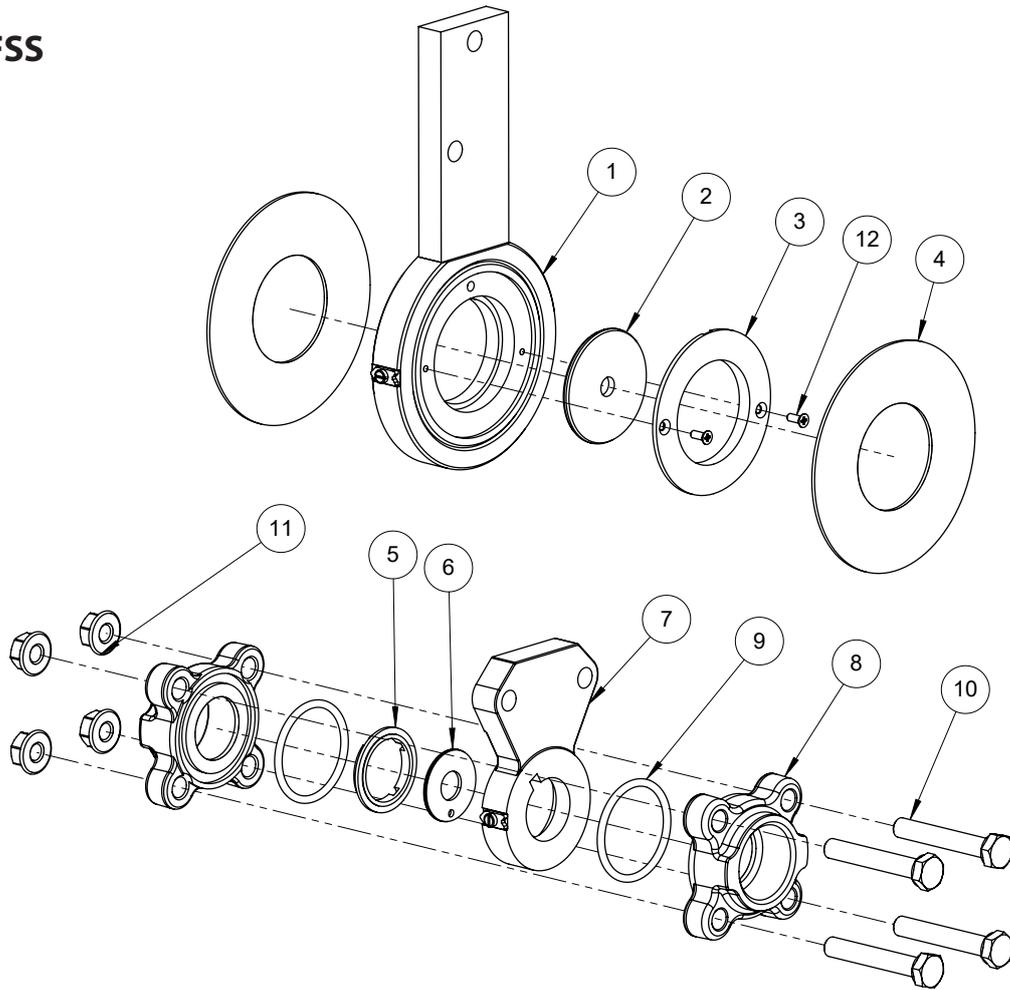
3-D models in STEP format are available at www.eletta.com



Eletta Steam			
ITEM NO.	DESCRIPTION	Material	QTY.
33	Screw MKFX M5x16	A2 304 (1.4301)	4
32	Screw MFT M5x12	A2 304 (1.4301)	6
31	Screw MC6S M6x12	A2 304 (1.4301)	4
30	Screw MFX M3x8	A2 304 (1.4301)	2
29	Screw MC6S M6x25	A2 304 (1.4301)	2
28	Screw MCS M3x6	A2 304 (1.4301)	1
27	Screw MC6S M8x25	A2 304 (1.4301)	2
26	Washer 6,4x12x1,6	A2 304 (1.4301)	4
25	O-ring 8x1	FPM	2
24	O-ring 7.3x2.4	FPM	4
23	O-ring 8.1x1.6	FPM	8
22	O-ring 29.2x3	FPM	2
21	Flow direction selector	FPM/316L	1
20	Label M Standard	Polyester	1
19	Angle bracket	304 (1.4301)	1
18	Block control unit Steam	316 (1.4401)	1
17	Pipe 6/4 Steam	316 (1.4401)	2
16	Attachment bracket	316 (1.4401)	1
15	Assembly plate S15C	316 (1.4401)	1
14	Block shut off	316 (1.4401)	1
13	Block condensate	316 (1.4401)	1
12	R-237 DN25 G1"	316 (1.4401)	2
11	R-237 DN25 G1" Machined G1/8"	316 (1.4401)	2
10	R-237 DN25 G1" Machined 5 mm	316 (1.4401)	2
9	R-221 T-pipe DN25	316 (1.4401)	2
8	Flow direction arrow	316L (1.4404)	1
7	Stop plate Shut off valve	316L (1.4404)	1
6	Shut off valve	316L (1.4404)	2
5	Fitting 6/4 SS	316L (1.4404)	8
4	Air valve SS	316L (1.4404)	4
3	Yoke condensate pot	316L (1.4404)	2
2	Bracket condensate pot	316L (1.4404)	2
1	Distance steam plate	316L (1.4404)	2

17.2

GSS/FSS



Eletta Steam Pipe Sections			
ITEM NO.	DESCRIPTION	Material	QTY.
12	Screw MFX M3x8	A2 304 (1.4301)	1
11	Nut M6M M8	A2 304 (1.4301)	4
10	Screw M6S M8x50	A2 304 (1.4301)	4
9	O-ring 39.2x3	FPM	2
8	GSS 15-25 Threaded Connecting Flange	1.4470	2
7	GSS 15-25 Connecting pipe	1.4470	1
6	GSS 15-25 Orifice plate	316 (1.4401)	1
5	GSS 15-25 Spacer	316L (1.4404)	1
4	FSS 15-500 Flange gasket	Tensnit BA-U	2
3	FSS 15-500 Spacer	316L (1.4404)	1
2	FSS 15-500 Orifice plate	316L (1.4404)	1
1	FSS 15-500 Orifice flange DIN	316L (1.4404)	1

Recycle the product and reuse/recycle the packaging.

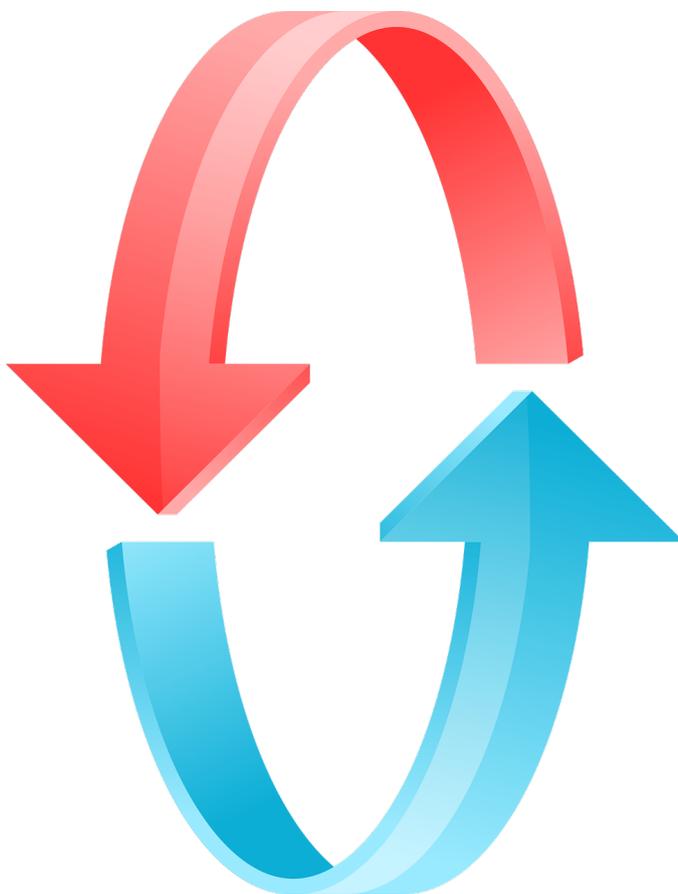
These products and packaging should not be mixed with general household waste. For proper recycling, take these products to a designated collection point.

Contact local authority for further details of the nearest designated collection station.

Correct product disposal and reusing of the packaging material saves resources and prevents negative effects on human health and the environment.



If you have questions, considerations or suggestions for improvements that would enhance your business, we will be happy to hear from you.



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