

# ROBUST HIGH QUALITY FLOW MONITORS

## MANUAL R - SERIES



R-SS-GSS



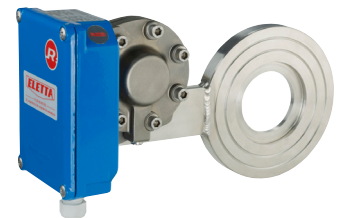
R-GL



R-FA



R-GSS



R-FSS

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## About this Manual

- This manual relates to the R-series Flow Monitor.
- Note that the latest version of this manual is always available as a PDF file on web site [www.eletta.com](http://www.eletta.com)
- On the web site there is additional useful information such as product configurator where suitable Monitors can be specified. There are leaflets, certificates, newsletters and reality reports.

## Proprietary Rights

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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](http://www.eletta.com) or by contacting Eletta Customer Service Center.

## Customer Service



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## 1.1 Description

Eletta Flow Monitors are used to control and measure flow of liquid and gases in pipes from size 15 mm to 500 mm (larger pipes as an option). They have been manufactured since 1947 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. The Flow Monitors are working with different differential pressure ranges, 50–200 mbar for the R2H/R2S. 22–550 mbar for the R5C R5H/R5S. The same ranges as for V-series, D-series, and S-series. Due to the working principle of the instrument, it is of utmost importance that the installation instructions (chapter 2.3 "Installation") are followed carefully in order to get the proper function of the instrument.

The Eletta Flow Monitor models R5C, R2H/R5H and R2S/R5S will give a 4-20 mA signal with the accuracy of < 2% if installed in the right way. (See chapter 1.3 "Specifications")

R5C is a model with ceramic potentiometer, suitable for environments with radiation. Under these circumstances, NBR-rubber should not be used in diaphragm and sealing parts.

The Flow Monitor consists of two parts mainly: the Pipe Section and the Control Unit. The Pipe Section is the part that is to be mounted in the process pipe and the Control Unit is mounted directly (standard) or remote on the Pipe Section. The Control Unit contains the potentiometer and the electrical connection terminal block.

The Pipe Sections are available in different process connections with the following standards:

**Threaded connections** in BSP or NPT from 15 mm (1/2") to 40 mm (1 1/2") depending on the chosen material of construction.

**Flanged (wafer) connection** depending on the chosen material.  
DN15-DN500 for PN16  
1/2"-20" for ANSI 150 lbs

## 1.2 Product label

Each Eletta Flow Monitors has a product label, see Fig. 1 with description.


 <b>Phone +46 (0)8 6030770</b> <b>www.eletta.com</b>	
<b>ELETTA FLOW AB, SE-14105 KUNGENS KURVA, SWEDEN</b>	
<b>Type:</b>	<b>Temp:</b>
<b>Range:</b>	<b>Max Pressure:</b>
<b>Liquid:</b>	<b>Protection Class:</b>
<b>Model:</b>	<b>Std:</b>
<b>No:</b>	<b>CE UK CA</b>

Fig. 1

### Description

- **Type:** Model type of the flow monitor. For example, R5C-GL15.  
(See section 1.3 "Specifications" for a thorough description of available types.)
- **Temp:** The maximum operation temperature allowed for the control unit.  
Reference to section 1.3 "Specifications" for a thorough description of available types.
- **Range:** The flow range for which the flow monitor has been manufactured.
- **Max Pressure:** The maximum operation pressure allowed for the flow monitor.
- **Liquid:** The media which the flow monitor has been designated for. E.g. water, oil etc.
- **Protection class:** IP-classification (International protection rating) of the control unit.
- **Model:** The article number of the flow monitor.
- **Std:** Pipe standard for which the flow monitor is designated.  
For example: DIN PN16; Dimensions according to DIN and pressure classification according to PN16.
- **No:** Serial number of the flow monitor. Each Eletta flow monitor has their own unique ID-number, which is used for traceability. CE-marking and Year of manufacturing.

### 1.3 Specifications

<b>Flow range</b>	Liquids: 0,4-25 000 l/min, depending on pipe size See chapter 5.1 "Flow ranges" for a table of standard flow ranges for water and oil. Gases: will be calculated according to application
<b>Flow measuring range (Turn Down)</b>	R2H and R2S-model: TD of 1:2 (50-100% Flow Range) R5H, R5S and R5C TD 1:5 (20-100% Flow Range)
<b>Accuracy</b>	±2% F.S. (Full scale). Accuracy is stated as per reference and under ideal conditions i.e. straight runs, temperature, pressure, viscosity and density. It is recommended that the flow range of the Flow Monitor is chosen so that the normal process flow is in the middle of the Monitor's Flow Range. This will give the highest accuracy and a lower pressure loss. For example: If the max flow is 110 l/min and the normal flow is 90 l/min, choose the Eletta Flow Monitor with a flow range of 60 - 120 l/min.
<b>Pressure</b>	Pressure class: PN16 / ANSI 150 lbs Max static pressure: 16 bar (232 PSI) Higher test pressure optional Min static pressure: Line pressure of approximately 0,7-1 bar is required for proper operation.
<b>Protection class</b>	IP65 (NEMA4)
<b>Temperature ranges</b>	Operating temp: -10 to 85°C (14 to 185°F) Higher process temperatures are achievable by remote installation of the Control unit, see chapter 2.4 "Separate Mounting"
<b>Power supply</b>	8-35 VDC
<b>Output</b>	4-20 mA and HART protocol. See chapter 2.6 "Electrical Installation"
<b>Connection cable</b>	Shielded twisted pair, min. 0,2 mm <sup>2</sup> (0,0031 inch <sup>2</sup> )
<b>Power dissipation</b>	1.6 W

## 1.4 Materials

<b>Diaphragm, O-rings and sealings</b>	<b>NBR</b> (Nitrile), standard for GL/FA, optional on GSS/FSS. Not to be used in nuclear applications. <b>FPM</b> (Fluorinated rubber), standard on GSS/FSS, optional on GL/FA <b>EPDM</b> (Ethylene Propylene Diene), optional on all models
<b>Spacers</b>	<b>GL pipes:</b> Polyamide plastic 40%glass fibre reinforced <b>FA pipes:</b> DN15-100 Polyamide plastic glass fibre reinforced. DN125-400 Stainless steel ASTM 316L
<b>Control unit</b>	Aluminium alloy, Alodine and polyester powder coating. Stainless steel 316L available. Cable gland included (Nickel plated brass for R5C, Polyamide for R2H, R2S, R5H and R5S)
<b>Pipe section, diaphragm housing</b>	<b>Type GL:</b> Dezincificated brass, CW602N, EN12420 <b>Type GSS:</b> Stainless steel 316L <b>Type FSS:</b> Stainless steel 316L <b>Type FA:</b> Housing: Dezincificated brass, CW602N, EN12420 Pipe section: Powder coated (20220096997096) steel, 1.0060/E335/SS1650.

### Process connections:

DN15 – 40 (1/2" – 1 1/2") for GL-models

DN15 – 25 (1/2" – 1") for GSS –models

DN15 – 400 (1/2" – 16") for FA-models

DN15 – 500 (1/2" – 20") for FSS-models

### CE and UKCA approvals:

The Eletta Flow Monitors complies with the EU directive for low voltage no: 2014/35/EU and the Electrical Safety regulation 2016. Certificates issued will be supplied upon request. They are also available on [www.eletta.com](http://www.eletta.com).

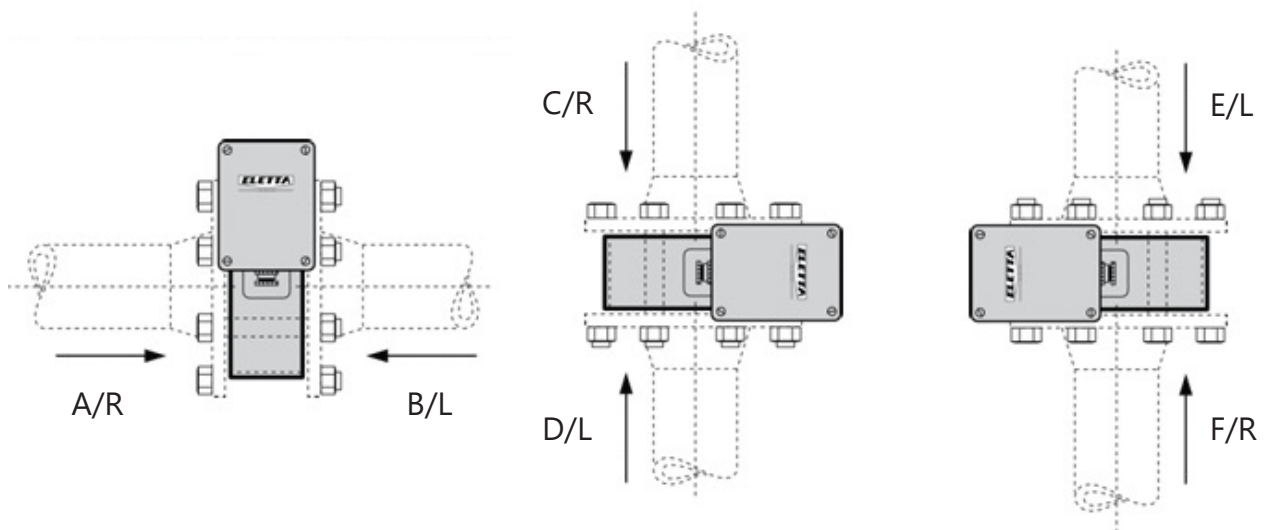
### PED-Directive:

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](http://www.eletta.com).

## 1.5 Ordering

To specify when ordering R-series

1. Type of monitor
2. Dimension
3. Measuring range
4. Media
  - a. For water: No further info required
  - b. For oil: Specify type of oil, working temperature or viscosity, density and working temperature.  
**NOTE:** If no data are given calculation will be done according to: ISO VG 220@40°C
  - c. For gas specify type of gas, working temp and static pressure.
5. Flow direction alternatives



Example: D2-GL, dimension: DN15, range. 4 – 8 l/min, media. water, installation. A/R.

### Options:

- Customized alarm set point
- Mark on tag plate (max. 21 characters)
- ANSI connection
- Rubber parts in other material
- Separate mounting
- Manifold with shut-off valves
- Forced production time



### 2.1 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 Flow Monitor inside; contact the delivery company to claim replacement or economical compensation. Compare the Monitors' product label 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.

### 2.2 Procedures before installation

► **Note: Before any installation or maintenance work, disconnect all electrical power** ◀

Check that the Monitor is mounted at the lowest point in the piping system when measuring liquids and at the highest point for gases. Check if the planned flow direction in the system matches the one indicated on the Monitor. There is a red flow direction arrow on the outside of the pipe section. If there is a mismatch; see section 3.4 "Change of Flow Direction"

Check that the pipe section has correct threading or correct flange dimension to match piping or counter flange. For separate/remote execution i.e. Pipe Section and Control Unit installed in separate locations; check the plastic hoses for any damage. The plastic hoses should not be used in temperatures over 130°C/16 bar (266°F/232 PSI). If the application temperature exceeds this temperature/pressure, it is recommended to use copper or stainless steel tubing, depending on the media (See 2.4 "Separate mounting")

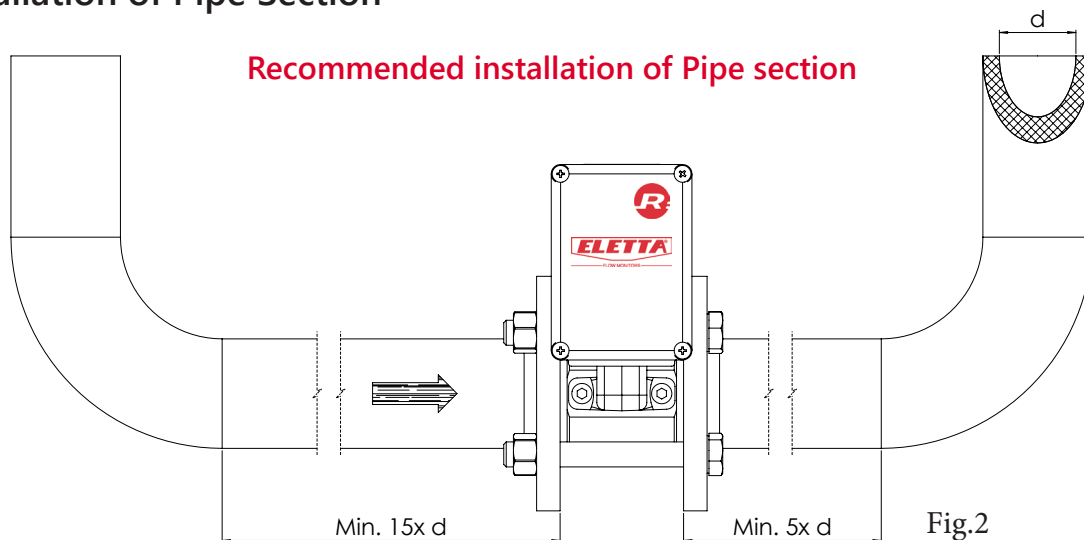
### 2.3 Installation of Pipe Section

**Note:**

► **Before installing the Pipe Section, make sure the piping is not pressurized by flow of liquid/gas** ◀

The pipe section can be installed in any desired direction, vertically or horizontally. The direction-arrow on the pipe section indicates the direction of the flow. It is particularly important that the pipe section is mounted in the correct direction, as the function of the Flow Monitor otherwise will be prevented. The piping shall be rigid and free from vibrations. Avoid connecting hoses directly into the Monitors. If the piping is unstable, it is advised to use the M6 mounting hole (only on GL-series) on the backside of the pipe section, to fasten the pipe section to a wall or a rigid bracket. The straight pipe-runs before and after the Monitor should not be too short, to avoid disturbances, which can cause the Monitor to show incorrect values. It is recommended to allow at least 10-15 pipe diameters upstream and 5 pipe diameters downstream. The straight runs must be free from valves, bends or changes in pipe diameters.

## 2.3 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.

If "tube fittings" are used when connecting the system pipes to the Pipe Section, make sure they do not have inside diameters that are too small. This can create a jet stream of the fluid or gas, which will cause the differential pressure to be too low and cause inaccurate readings.

The following inside diameters apply for the threaded Pipe Sections:

GL - and GSS 15 = **16 mm**

GL - and GSS 20 = **21 mm**

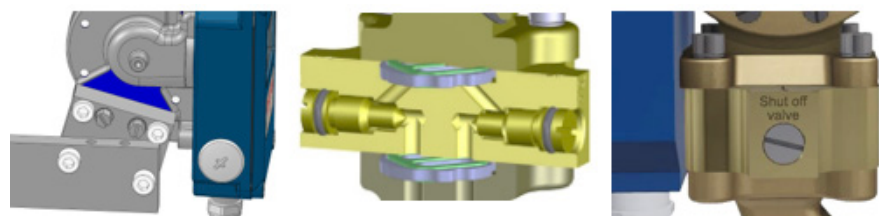
GL - and GSS 25 = **26 mm**

GL - 40 = **40 mm**

Make sure the Control unit (if mounted directly on the pipe section) is placed on top of the pipe section to prevent particles in the fluid to collect in the diaphragm housing. Consider using a filter in the pipeline if the fluid may contain particles.

The flanged models, FA and 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 and don't 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. If needed, support the Flow Monitor with rigid brackets. but it is recommended mounting the Flow Monitor directly in the pipeline to avoid unnecessary stress in the installation area.

As an option there is a manifold with shut-off valves. The manifold is installed between the Control Unit and the Pipe Section. It enables dismantling the Control Unit from the Pipe Section during full operation. Without a manifold installed, it is necessary to shut off the system and make sure that the piping is not pressurized before changing the Control Unit.



## 2.4 Separate mounting of Pipe Section and Control Unit

Sometimes separate mounting of the Pipe Section and the Control Unit is necessary due to vibrations, high temperature or lack of space. As the Eletta Flow Monitors use differential pressure caused by the orifice plate mounted in the pipeline and directs these two pressures via two individual ports up to the Control Unit, it is possible to separate the Monitor into two parts. The pressure is then contributed through either plastic hoses or metallic tubing depending on the liquid, pressure and temperature. As standard, 2x1,75-meter (5.74 feet) of PA plastic, Ø6 mm (0,23 inch) hoses capable of handling 130°C (266°F) and 16 bar (232 PSI), are supplied together with two custom made adapters to be mounted on the Pipe Section and Control Unit respectively. If the application requires metal tubing, it has to be provided locally. Check which material is suitable for the media. Ø6 mm will fit the adapters included in the delivery.

There is no actual limitation in the length of the hoses or tubing, but it is recommended to place the units as close to each other as possible to make troubleshooting and on-site calibration easier.

► **Note: The hoses/tubing must have the same length to avoid uneven pressure.** ◀

If valves (not included in delivery) are mounted along the pressure hoses/tubing, the Control Unit can be removed/exchanged at full process pressure. Mounting of three-way/five-way standard valve (not included in delivery) 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. As hoses/tubing will lead the pressure up to the Control Unit, it is possible to mount the Pipe Section in any direction, vertically or horizontally and with the pressure ports pointing up, down or to the side. After the adapter is mounted on to the Pipe Section, follow the instructions in chapter 2.3 "Installation of the Pipe Section".

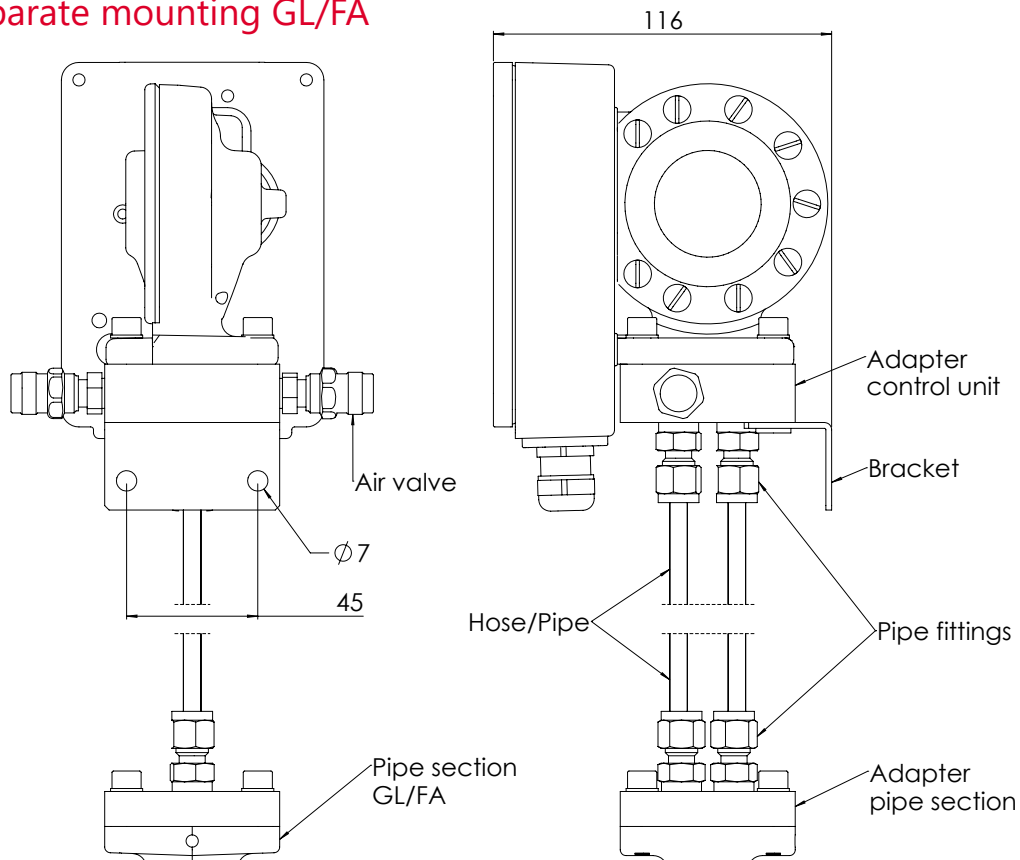
Find a suitable place for the Control Unit to be mounted. Attach the supplied bracket to a wall, pipe or another rigid support. Place it with respect to surrounding piping and obstacles.

Install the hoses/tubing starting at the Pipe Section. Check that there is enough length to cover the distance between the Pipe Section and Control Unit. The Pipe Section adapter has a (+) and (-) marking engraved and the adapter on the Control Unit too. Please make sure to match (+) to (+) and (-) to (-) on the adapters.

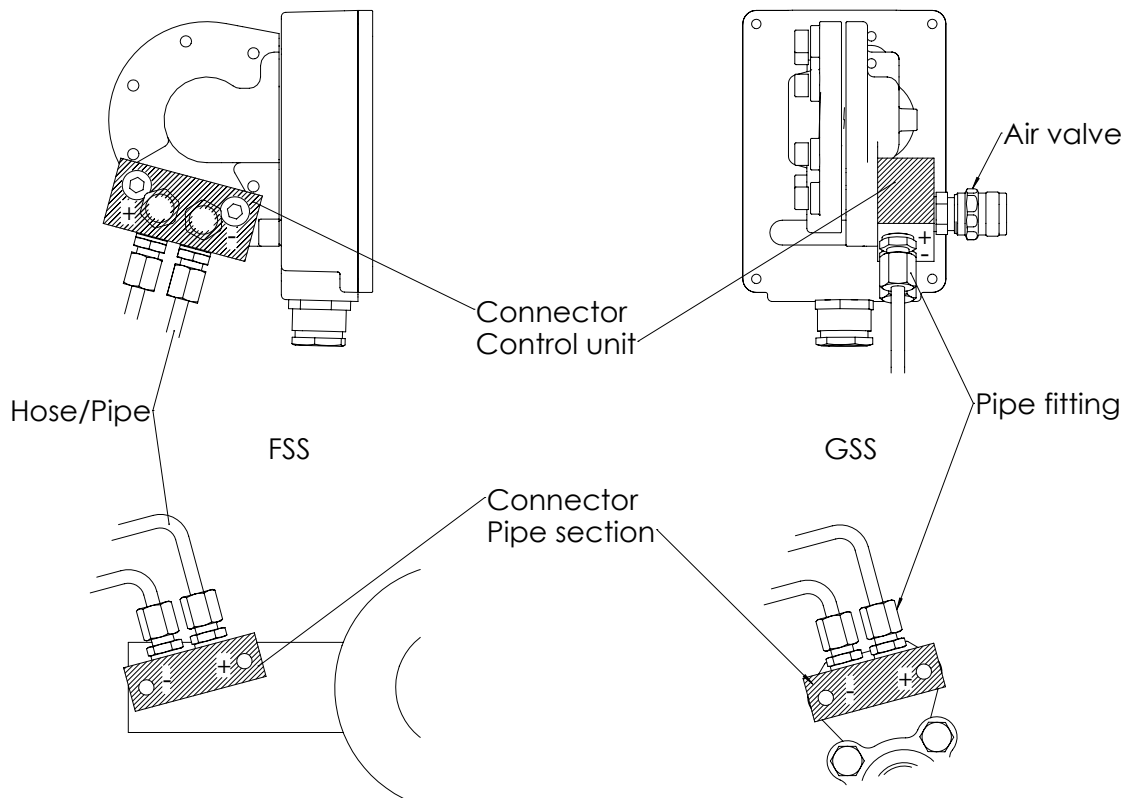
Press the hose/tube end into the coupling and tighten with care. Proceed to the Control Unit and repeat the step. When the system is filled for the first time with liquid, please make sure that all entrapped air in the piping between the Pipe Section and Control Unit is removed. The air can otherwise, as it is a compressible media, cause faulty Flow readings.

## 2.4 Separate mounting

### Separate mounting GL/FA



### Separate mounting GSS/FSS



## 2.5 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 a ready installed Monitor, by changing the Control Unit or Pipe Section.

When ordered, the Control Unit will be delivered with the diaphragm housing included. Make sure the correct material in the diaphragm housing and rubber parts (diaphragm, o-rings and diaphragm lever) is ordered. The Control Unit will be tested and calibrated at Eletta production site and ready to fit onto the Pipe Section, no on-site adjustments or calibrations are needed. All Eletta DP Flow Monitors are working with the same differential pressure within their specific range (See section 1.1 "Description").

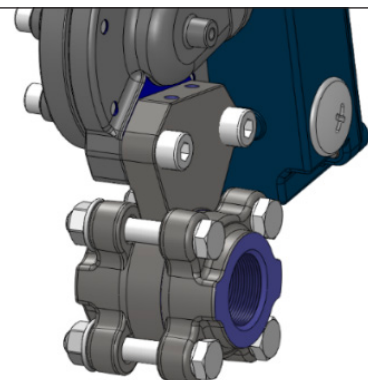
As an option there is a manifold with shut-off valve, this enables dismantling the control unit from the pipe-section during full operation.

Start with making sure that there is no pressure in the system. Turn the electric power supply off and then disconnect the cables from the microswitch electric terminal.

**On the -GL Pipe Section;** loosen the four (4) Allen screws that hold the diaphragm housing (do not remove the blue housing at any time) to the Pipe Section. Replace the flow direction selector if damaged, or if other material is required. Install the new Control Unit and tighten the four(4) hexagon screws firmly again.

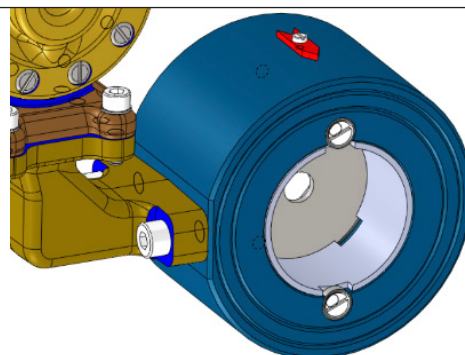


**On the -GSS Pipe Section;** loosen the two (2) Allen screws that hold the diaphragm housing and replace the O-rings to the right material, if necessary. Install the new Control Unit and tighten the two (2) screws firmly again.

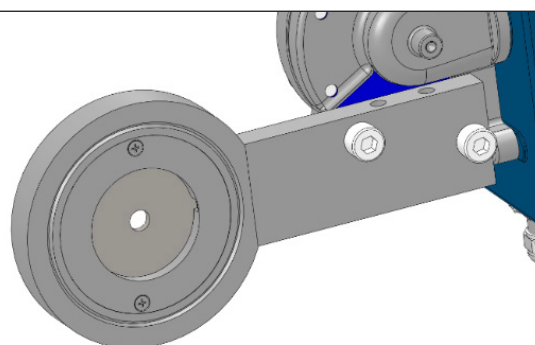


## 2.5 Installation and changing of Control Unit

**On the -FA Pipe Section;** loosen the four (4) Allen screws that hold the diaphragm housing to the pipe section (do not remove the blue housing at any time) Replace the flow direction selector if damaged, or if other material is required. Install the new Control Unit and tighten the four (4) hexagon screws firmly again.



**On the -FSS Pipe Section;** loosen the two (2) Allen screws that hold the diaphragm housing and replace the O-rings to the right material, if necessary. Install the new Control Unit and tighten the two (2) screws firmly again.



Connect the electrical cables according to the new Control Unit's specification. For detailed information regarding wiring, see section 2.6 "Electrical installation".

### Differential Pressure Range

Turn down 1:2 R2- ( <b>+2% F.S. Reading</b> ) Dp-range: 500-2000 mm H <sub>2</sub> O															
Flow	50%			62,5%			75%			87,5%			100%		
	-2%		+2%	-2%		+2%	-2%		+2%	-2%		+2%	-2%		+2%
%	49,0	<b>50,0</b>	51,0	61,3	<b>62,5</b>	63,8	73,5	<b>75,0</b>	76,5	85,8	<b>87,5</b>	89,3	98,0	<b>100,0</b>	102,0
<b>mA(Z)</b>	<b>11,8</b>	<b>12,0</b>	12,2	13,8	<b>14,0</b>	14,2	15,8	<b>16,0</b>	16,2	17,7	<b>18,0</b>	18,3	19,7	<b>20,0</b>	<b>20,3</b>
<b>mA(NZ)</b>	<b>3,7</b>	<b>4,0</b>	4,3	7,6	<b>8,0</b>	8,4	11,5	<b>12,0</b>	12,5	15,4	<b>16,0</b>	16,6	19,4	<b>20,0</b>	<b>20,6</b>
mbar	47	<b>49</b>	51	74	<b>77</b>	80	106	<b>110</b>	115	144	<b>150</b>	156	188	<b>196</b>	204

Turn down 1:5 R5- ( <b>+2% F.S. Reading</b> ) Dp-range: 220-5500 mm H <sub>2</sub> O															
Flow	20%			40%			60%			80%			100%		
	-2%		+2%	-2%		+2%	-2%		+2%	-2%		+2%	-2%		+2%
%	19,6	<b>20,0</b>	20,4	39,2	<b>40,0</b>	40,8	58,8	<b>60,0</b>	61,2	78,4	<b>80,0</b>	81,6	98,0	<b>100,0</b>	102,0
<b>mA(Z)</b>	<b>7,1</b>	<b>7,2</b>	7,3	10,3	<b>10,4</b>	10,5	13,4	<b>13,6</b>	13,8	16,5	<b>16,8</b>	17,1	19,7	<b>20,0</b>	<b>20,3</b>
<b>mA(NZ)</b>	<b>3,9</b>	<b>4,0</b>	4,1	7,8	<b>8,0</b>	8,2	11,8	<b>12,0</b>	12,5	15,7	<b>16,0</b>	16,3	19,6	<b>20,0</b>	<b>20,4</b>
mbar	21	<b>22</b>	22	83	<b>86</b>	90	186	<b>194</b>	202	332	<b>345</b>	359	518	<b>539</b>	861

## 2.6 Electrical Installation

- ▶ **Note:** An authorized professional person should make all electrical installations and ◀ 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 1.3" Specifications"). All terminal block connections are to be made through the included cable gland (PG16 Nickel plated brass for R5C. PG9 Polyamide for R2S/R2H and R5S/R5H) There are two alternative positions of the cable gland depending on if the cables are preferred on the side or bottom of the Control Unit. If the cable gland is moved, make sure the other opening is covered by the plug.

### Wiring diagram

#### R2S, R5S

In R2S and R5S the variable resistor is connected by 4-wire resistance method to a 2-wire transmitter with HART protocol from PR-electronics (6335A)

For further information how to use the HART protocol; visit [www.prelectronics.com](http://www.prelectronics.com) for latest user manual.

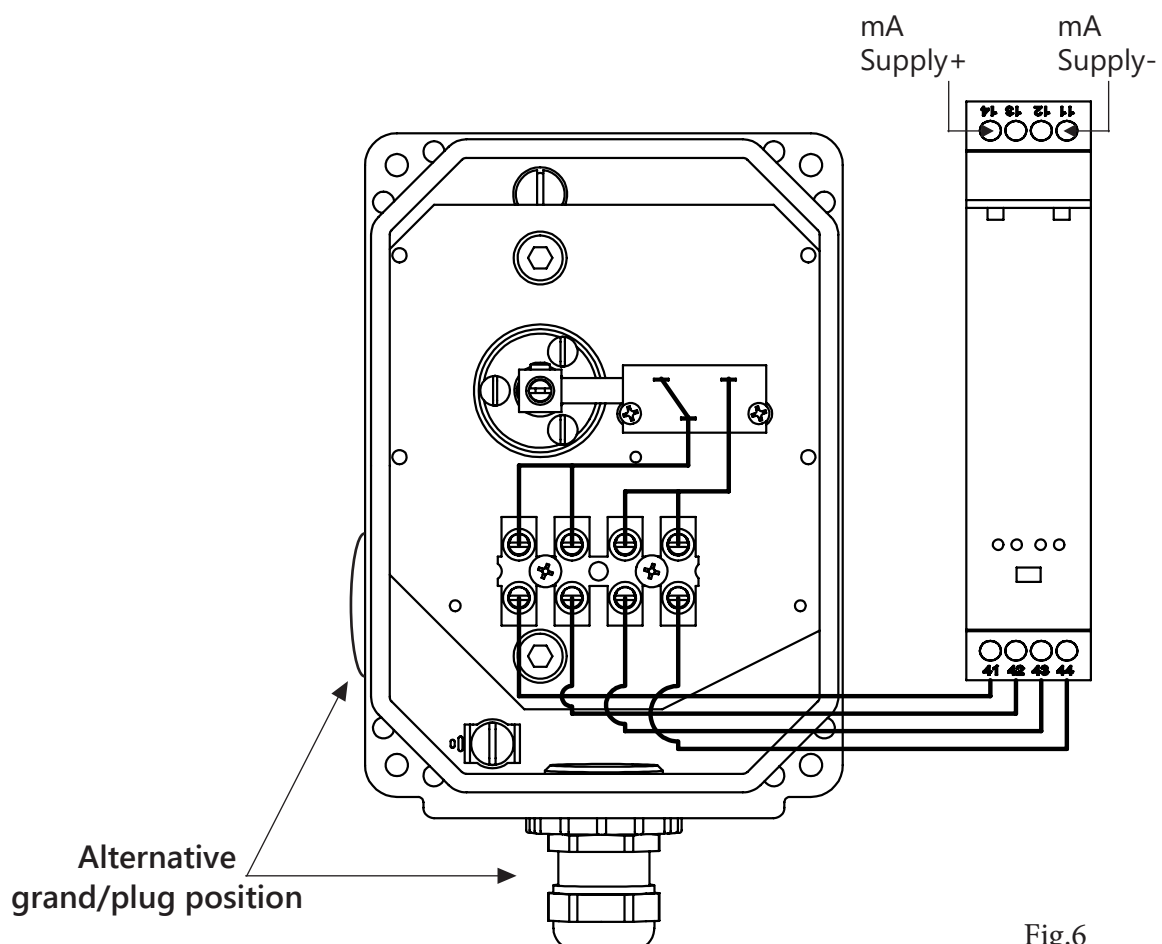
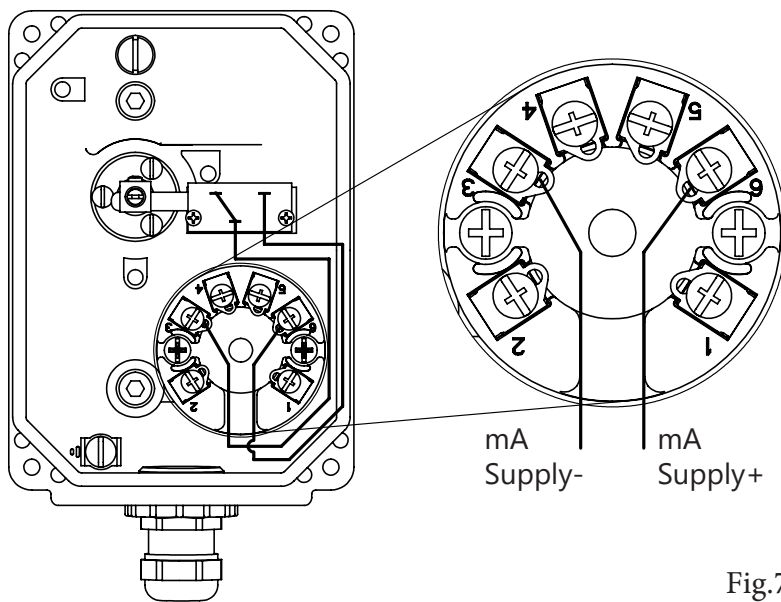


Fig.6

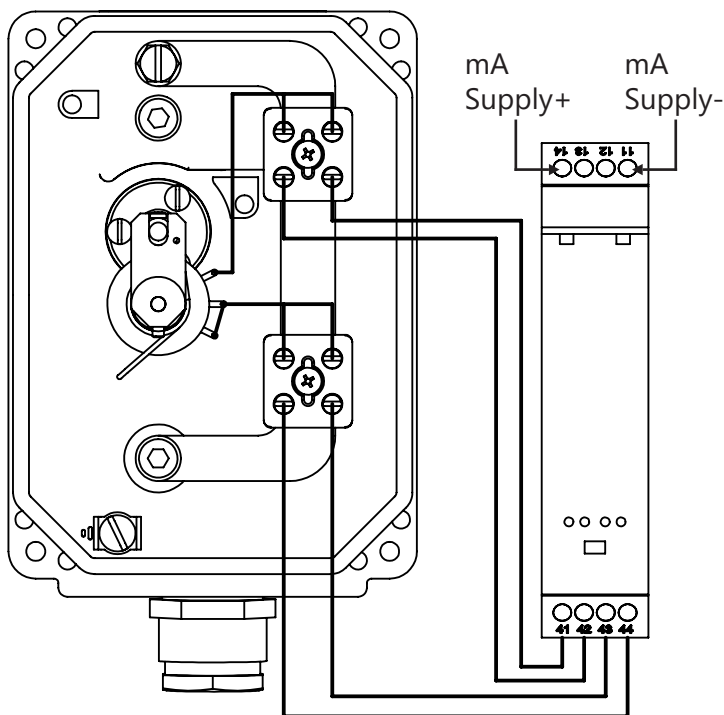


### R2H, R5H

In R2H and R5H the variable resistor is connected by 2-wire resistance method to a 2-wire transmitter with HART protocol from PR-electronics (5335A).

For further information on how to use the HART protocol; visit [www.prelectronics.com](http://www.prelectronics.com) for latest user manual.

Fig.7



### R5C

In R5C the variable resistor is connected by 4-wire resistance method to a 2-wire transmitter with HART protocol from PR-electronics (6335A)

For further information on how to use the HART protocol; visit [www.prelectronics.com](http://www.prelectronics.com) for latest user manual.

Fig.8



### 3.1 Principle of operation

The function of the Eletta Flow 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 behavior of a certain orifice plate.

Inserted into the Pipe Section of the Flow Monitor, 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 into the Control Unit. In most Eletta Flow Monitors, the differential pressure is sensed and measured by a mechanical mechanism inside the Control Units diaphragm housing. This mechanism transforms the movement into a Flow rate value given through the output signal.

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

### 3.2 Change of Flow Range

The Eletta Flow Monitor features an orifice construction that does not require recalibration after replacement and can easily be rebuilt in the 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 Flow Monitor's dimension (see table in section 5.1 "Flow range")

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.

**First empty the piping system so it is not pressurized and has no flow**

### 3.2 For threaded models -GL and -GSS

Untighten the bolts that hold the Pipe Section between the flanges in the piping (Do not remove the threaded parts from the piping). Remove only the number of bolts necessary to pull the Monitor from the piping, normally it takes only one bolt from the highest position to get the Monitor out. Take out one of the spacers that holds the orifice plate. Change the orifice plate, it can be installed in any direction. Reinstall the spacer that holds the orifice in place in the Pipe Section. Install the Monitor in the piping system and tighten the bolts firmly to avoid leakage.

#### **For flanged model -FA:**

Follow the procedure above to loosen the pipe section from the counter flanges in the piping system. Note that the spacers ring is held in place with two screws, which have to be untightened before removal and reinstalled after.

#### **For flanged stainless steel model -FSS:**

Untighten the two screws holding the orifice. Remove the spacer and o-ring. Replace the orifice, reattach the o-ring and put them back. Reinstall the spacer and tighten the screws. Remount the Flow Monitor into the piping system and tighten the bolts firmly. Check that no gaskets are misaligned not to interfere with the flow when installing the pipe section.

#### **Type plate**

When changing the orifice plate in order to get a new flow range, it is commended to change the identification plate to a with the new range marked. This identification plate comes together with the orifice plate when ordering an orifice plate separately. Make sure that output signals in the receiving end PLC, display, computer etc., are matched for the new flow range.

### 3.3 Pressure Drop

The Eletta Flow Monitor is a differential pressure measuring device, it detects a certain pressure drop when the system is active. There are two different types of Pressure Drop's involved, **actual pressure drop** and **permanent pressure drop**. When the orifice plate, mounted in the Eletta Flow Monitor, reduces the flow area inside the pipe system, a pressure drop over the orifice is created. This is the **actual pressure drop**. Refer to chapter 1.1 "Description" for actual pressure drop (differential pressure span).

The calculation of the flow is using this pressure drop to calculate the actual flow value (see calculation below). **The actual pressure drop** is a temporary pressure state and the Eletta Flow Monitors are working within this differential pressure created within the Flow range of the Monitor. When the flow has passed the Monitor, the pressure strives back to its original pressure and approximately after 10 - 15 times the inner diameter of the pipe, the flow becomes linear and fully developed. This is a normalized flow but due to friction losses over the Flow Monitor, the pressure will not be able to reclaim all the energy (pressure). This is called **permanent pressure drop**.

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

$$\Delta p(\text{ppd}) = \Delta p(\text{apd})(1 - \beta^2), \text{ where:}$$

$\Delta p(\text{ppd})$  = Permanent pressure drop

$\Delta p(\text{apd})$  = Actual pressure drop for a certain flow

$\Delta p$  = Differential pressure flow measurement

$\beta = d/D$  ratio (ratio between bore and inner diameter of the pipe)

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

Example:

For the Eletta Flow Monitor R5-GL15 with a flow range of 10 - 20 l/min, the following calculation can be used as an example; Bore = 10.20 mm, inner diameter = 16 mm This gives  $\beta = 10.2/16.0$  which results in  $(1 - \beta^2) = 0.59$  \*  $\Delta p$  Actual pressure drop (differential pressure) at a flow of 15 l/min in the above example = 112,5 mbar Taken this into consideration, the mentioned Flow Monitor will have an approximate permanent pressure drop of:  $0,594 * 112,5 \text{ mbar} = 66,82 \text{ mbar}$

The Pressure loss curves in the graph Fig. 9 serve as a guideline.

$$\Delta p(\text{apd}) = (Q/Q_{\text{max}})^2 * 196 \text{ mbar for turn down ratio of 1:2}$$

$$\Delta p = (Q/Q_{\text{max}})^2 * 539 \text{ mbar for turn down ratio of 1:5}$$

$Q$  = Actual flow

$Q_{\text{max}}$  = Maximum flow of the Flow Monitor (installed orifice plate)

$\Delta p$  = Actual pressure drop in mbar

Example: Eletta Flow Monitor type R5-GL15, flow range 10-20 l/min. Use the formula

$$\Delta p(\text{apd}) = (Q/Q_{\text{max}})^2 * 200 \text{ which gives; } \Delta p(\text{apd}) = (15/20)^2 = 112,5 \text{ mbar}$$

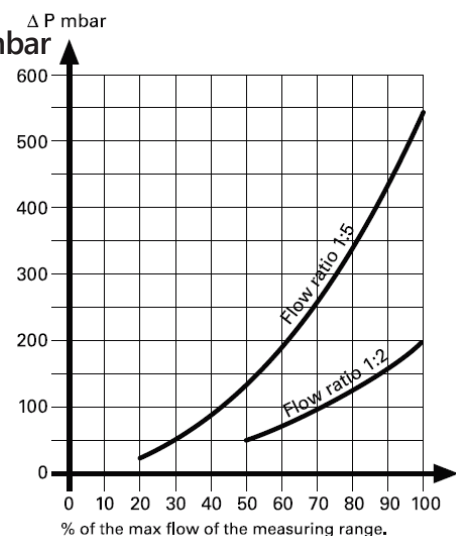


Fig.9

### 3.4 Change of Flow Direction

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

GL- and FA-models are delivered with a flow direction selector that can be used for both directions. First empty the pipe system so it is unpressurized and has no flow. To change the direction, loosen the four (4) hexagon screws, which attach the diaphragm housing to the Pipe Section. Remove the diaphragm housing. Reposition the flow direction selector to match the flow direction of the system (see Fig. 10). There is a green marking indicating the flow direction. Change the direction of the red arrow on the outside of the Flow Monitor.

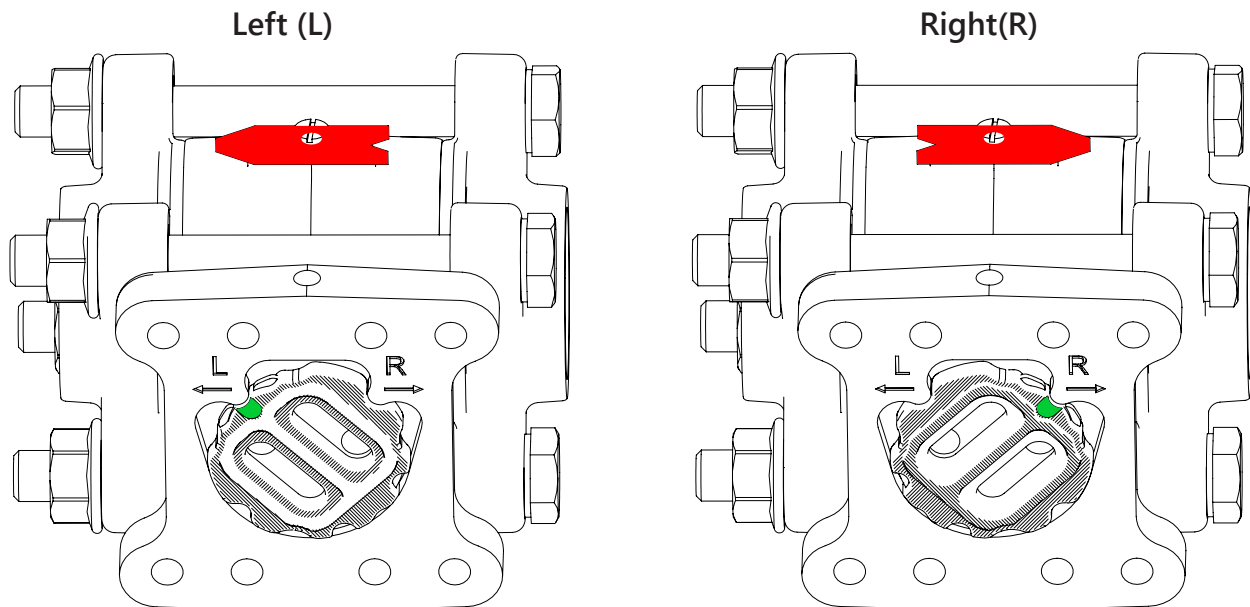


Fig.10

For FSS and GSS a flow direction change block can be ordered.

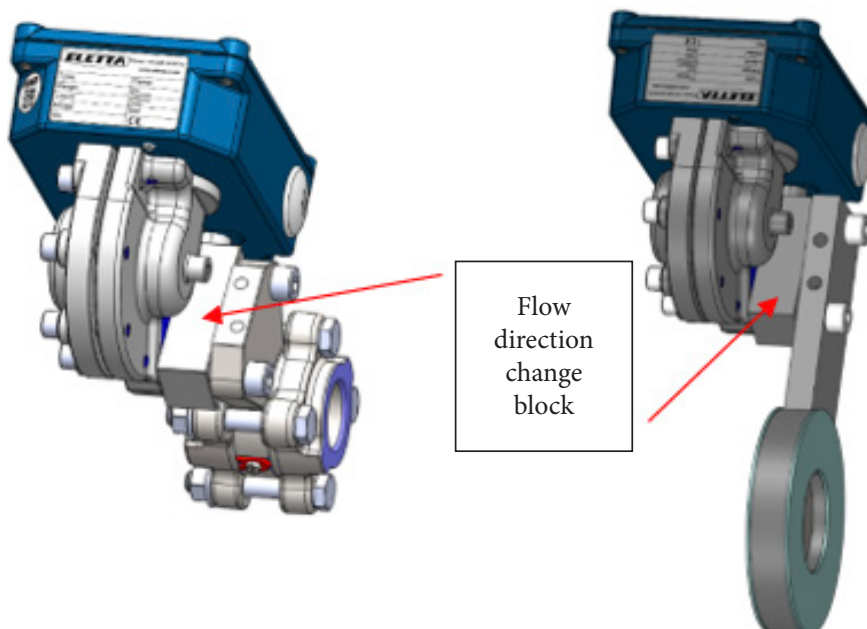


Fig.11

### 4.1 Verification of flow

All Eletta Flow Monitors 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 Monitors 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 Monitor has other conditions on site in the actual application, than used during the calibration prior to shipping. The Monitors are calibrated against flow, not pressure.

#### The meter is not giving an alarm:

- Check if the power supply is connected.
- Check that the Monitor is mounted correctly with respect to the flow direction. Check that the arrow outside of the pipe section correspond with the actual flow direction. For GL- and FA-models; check the flow direction selector inside the monitor. Make sure that it corresponds to the actual flow.
- Check the flow in the pipe and that is it enough to create the needed  $\Delta p$
- 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 Monitor 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)
- Verify that there is enough straight runs up-stream and downstream of the pipe setion.

#### Media is coming out of the Control Unit:

The most likely problem is that the diaphragm inside the diaphragm housing is broken and needs replacement. A new diaphragm is available to buy as a spare part. Contact the Eletta factory if there is any uncertainty on how to change the diaphragm.

If there is liquid inside the blue housing of the Control Unit, the problem is probably a broken lever between the diaphragm housing and the Control Unit. In this case the complete Control Unit needs to be sent to Eletta for repair, since changing the lever requires recalibrating the unit. It is also likely that the circuit boards inside the Control Unit have been damaged by the leaking liquid.

Check the identification plate/tag on the Monitor 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 Flow Monitor is specially designed i.e. if it does not follow standard execution, it must be verified which polymer parts (diaphragm and seals) are installed in the Flow Monitor. There are three different kinds of rubber (see section 1.3 for details) Provide the specification for the Monitor in question to receive the correct parts.

**4.1** Under section 3.3 it is described how the Monitor creates the differential pressure. Eletta Flow Monitors work with different  $\Delta p$  for R2-Monitors is 196 mbar. R5-units, the  $\Delta p$  is 539 mbar. It means that at maximum  $\Delta p$  the flow is always 100% in any Flow Monitor mounted on any pipe section. Hence it is easy to move one control unit to another pipe section on another pipe, to check the function. It does not matter what size/diameter the pipe section has, as the same  $\Delta p$  is applicable on every pipe size and corresponding Control Unit. The alarm point in the Eletta Flow Monitor can be verified compared to another flow meter in the system. The Monitor can be put in a flow test rig, if possible. If the problem still is not solved, send the Monitor to the Distributor or directly to The Eletta Service department for control.

## **4.2 Electrical connections**

See to that the correct voltage and current is used. (See section 1.3) and that all the leads are connected in a proper way (see section 4.2) Open the cover and check if there is any visible damage.

Check the identification plate/tag, note the serial number, flow range and liquid and order a new Control Unit. A complete Control Unit with diaphragm housing will be shipped. It can be mounted to existing Pipe Section with only four (4) screws, (See section 2.4)

## **4.3 Spare parts**

See section 6 for exploded drawings showing all replaceable components.

If the Monitor 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.

## 5.1 Flow Ranges

R5 (22-550 mbar)					
Dimension		l/min	Dimension		l/min
1/2" DN 15	GL, GSS FA, FSS	0,4 - 2	2 1/2" DN 65	FA, FSS	20 - 100
		1 - 5			50-250
		2 - 10			100 - 500
		4 - 20			160 - 800
		6 - 30	3" DN 80	FA, FSS	40 - 200
		8 - 40			80 - 400
3/4" DN 20	GL, GSS FA, FSS	4 - 20	4" DN 100	FA, FSS	160 - 800
		6 - 30			240 - 1200
		8 - 40			80 - 400
		15 - 75	160 - 800		
1" DN 25	GL, GSS FA, FSS	6 - 30	5" DN 125	FA, FSS	250 - 1250
		12 - 60			400 - 2000
		16 - 80			100 - 500
		24 - 120			200 - 1000
	FA, FSS	30 - 150	400 - 2000		
1 1/4" DN 32	FA, FSS	8 - 40	6" DN 150	FA, FSS	600 - 3000
		20 - 100			200 - 1000
		40 - 200			400 - 2000
		50 - 250			600 - 3000
1 1/2" DN 40	GL, FA, FSS	8 - 40	8" DN 200	FA, FSS	900 - 4500
		20 - 100			400 - 2000
		40 - 200			600 - 3000
		60 - 300			1000 - 5000
2" DN 50	FA, FSS	20 - 100	10" DN 250	FA, FSS	1500 - 7500
		40 - 200			600 - 3000
		70 - 350			1000 - 5000
		100 - 500			1600 - 8000
					2400 - 12000

## 5.1 Flow Ranges

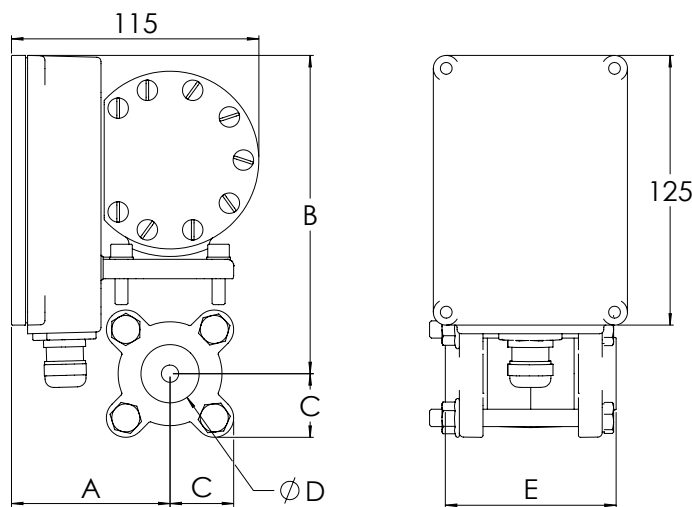
R2 (50-200 mbar)					
Dimension		l/min	Dimension		l/min
1/2" DN 15	GL, GSS FA, FSS	0,4 - 0,8	2" DN 50	FA, FSS	40 - 80
		0,6 - 1,2			60 - 120
		1 - 2			80 - 160
		1,6 - 3,2			120 - 240
		2 - 4			160 - 320
		2,4 - 4,8	2 1/2" DN 65	FA, FSS	60 - 120
		3,2 - 6,4			80 - 160
		4 - 8			120 - 240
		6 - 12			160 - 320
		8 - 16			240 - 480
		10 - 20			280 - 560
		12 - 24			120 - 240
		16 - 32			160 - 320
		3/4" DN 20	GL, GSS FA, FSS	4 - 8	3" DN 80
6 - 12	320 - 640				
8 - 16	400 - 800				
10 - 20	160 - 320				
12 - 24	4" DN 100			FA, FSS	280 - 560
16 - 32					400 - 800
20 - 40					600 - 1200
1" DN 25	GL, GSS FA, FSS	8 - 16	5" DN 125	FA, FSS	700 - 1400
		10 - 20			400 - 800
		12 - 24			600 - 1200
		16 - 32			800 - 1600
		24 - 48			1000 - 2000
		36 - 72	6" DN 150	FA, FSS	600 - 1200
		40 - 80			800 - 1600
	FA, FSS	50 - 100			1200 - 2400
1 1/4" DN 32	FA, FSS	20 - 40	8" DN 200	FA, FSS	1400 - 2800
		28 - 56			1500 - 3000
		40 - 80			800 - 1600
		60 - 120			1200 - 2400
		80 - 160			1600 - 3200
1 1/2" DN 40	GL, FA, FSS	20 - 40	10" DN 250	FA, FSS	2400 - 4800
		28 - 56			2500 - 5000
		40 - 80			1600 - 3200
		60 - 120			2000 - 4000
	80 - 160	3200 - 6400			
	FA, FSS	100 - 200			4000 - 8000



5.2 Weight and Dimensions

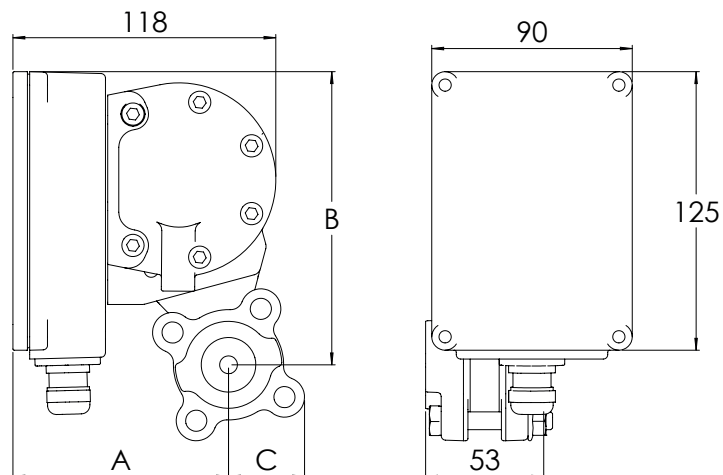
R-GL						
Type	D	A [mm]	B [mm]	C [mm]	E [mm]	Approx. Weight [kg]
R-GL15	1/2"	74	148	30	79	3
R-GL20	3/4"	74	148	30	79	3
R-GL25	1"	74	148	30	79	3
R-GL40	1 1/2"	84	159	40	90	4

GL



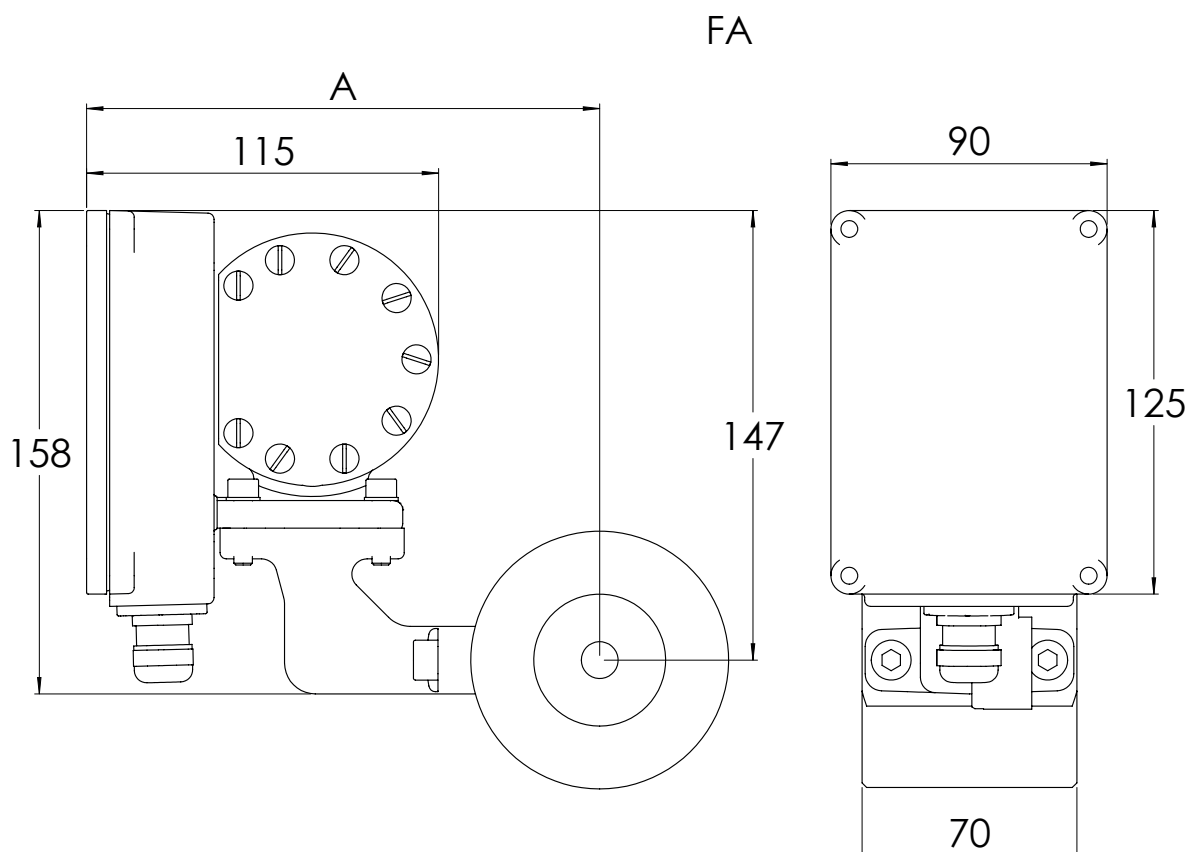
R-GSS					
Type	D	A [mm]	B [mm]	C [mm]	Approx. Weight [kg]
R-GSS15	1/2"	97	132	34	3
R-GSS20	3/4"	97	132	34	3
R-GSS25	1"	97	132	34	3

GSS



## 5.2 Weight and Dimensions

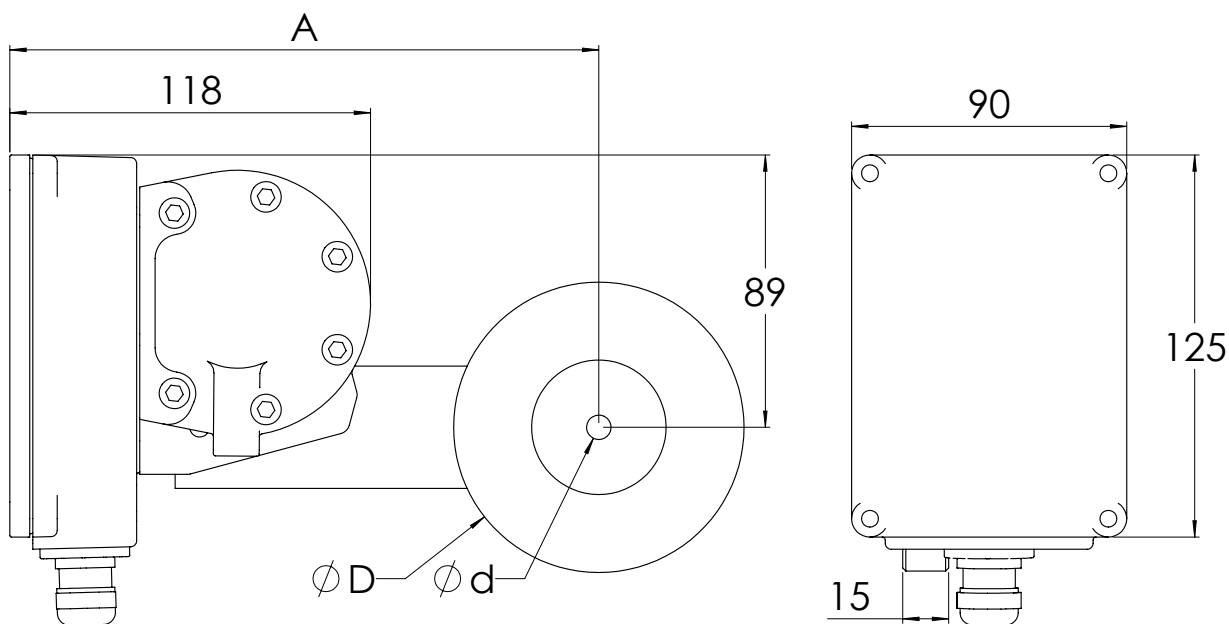
R-FA				
Type	d [mm]	D [mm]	A [mm]	Approx. Weight [kg]
R-FA15	16	53	152	4
R-FA20	21,6	63	157	4,5
R-FA25	28,5	73	162	4,5
R-FA32	37,5	84	168	5
R-FA40	43	94	173	6
R-FA50	55	109	181	6
R-FA65	70	129	191	7
R-FA80	82	144	199	8
R-FA100	107	164	209	8
R-FA125	132	194	224	10
R-FA150	158	219	237	11
R-FA200	207	274	265	15
R-FA250	260	330	293	19
R-FA300	310	385	320	21
R-FA350	340	445	350	35
R-FA400	390	498	377	40,5



5.2 Weight and Dimensions

R-FSS				
Type	d [mm]	D [mm]	A [mm]	Approx. Weight [kg]
R-FSS15	17	53	168	3
R-FSS20	22	63	174	3
R-FSS25	29	73	181	3
R-FSS32	39	84	187	3
R-FSS40	43	94	193	3
R-FSS50	55	109	201	3
R-FSS65	70	129	211	3,5
R-FSS80	82	144	219	3,5
R-FSS100	107	164	230	4
R-FSS125	132	194	245	4,5
R-FSS150	160	219	267	5
R-FSS200	207	274	295	6,5
R-FSS250	260	330	323	8
R-FSS300	310	385	350	9,5
R-FSS350	340	445	381	14,5
R-FSS400	390	498	427	16,5

FSS



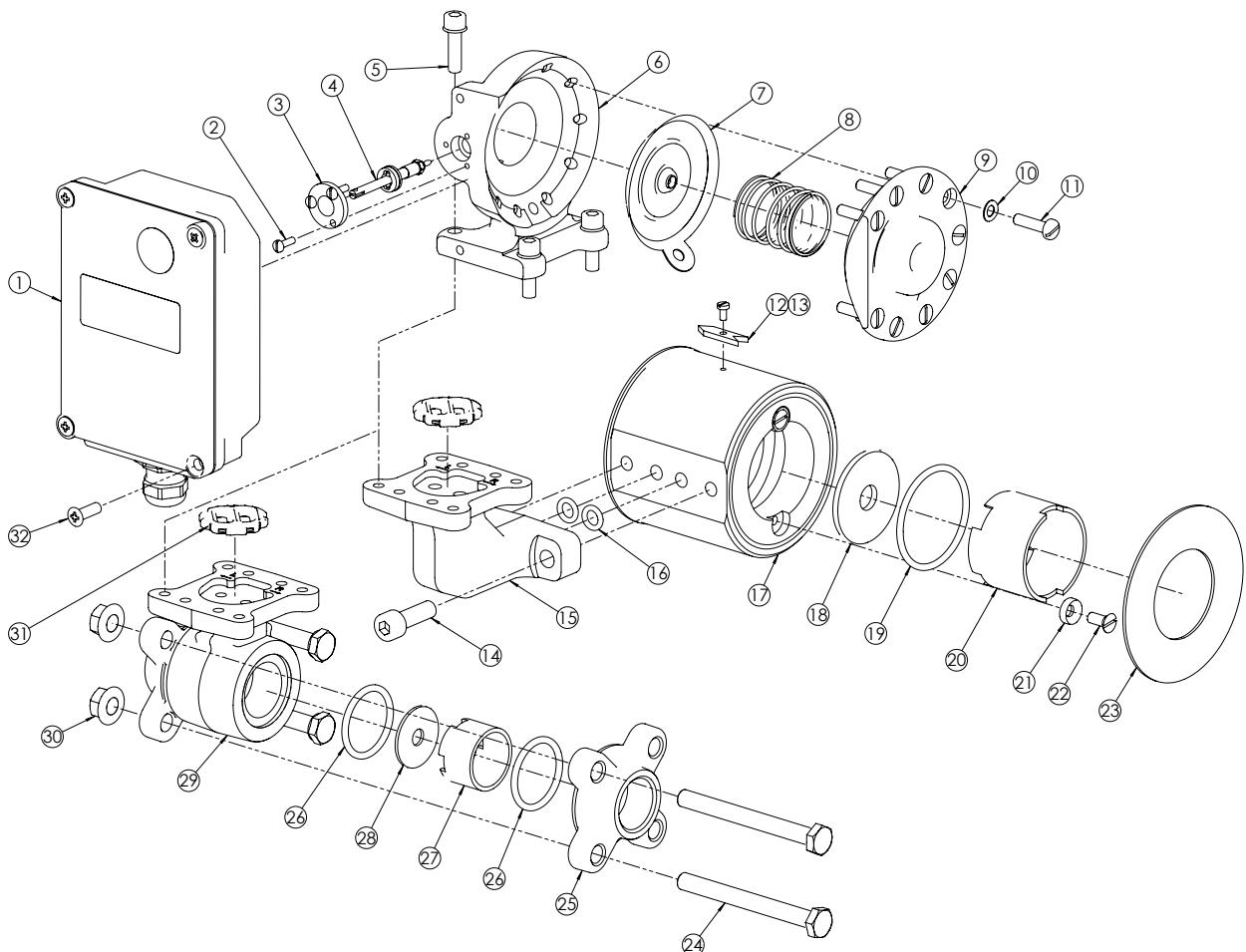
6.1 R-GL/FA

R-GL/FA		
Pos.	Description	Qty.
1	Control unit	1
2	Screw	3
3	Pressure flange	1
4	Lever	1
5	Screw	4
6	Diaphragm housing	1
7	Diaphragm	1
8	Diaphragm spring	1
9	Diaphragm cover	1
10	Disc spring	6
11	Screw	6
12	Flow direction arrow	1
13	Screw	1
14	Screw	2
15	Connecting body FA	1
16	O-ring	2
17	Pipe FA	1
18	Orifice plate	1
19	O-ring	1

3-D models in STEP format are available at

[www.eletta.com](http://www.eletta.com)

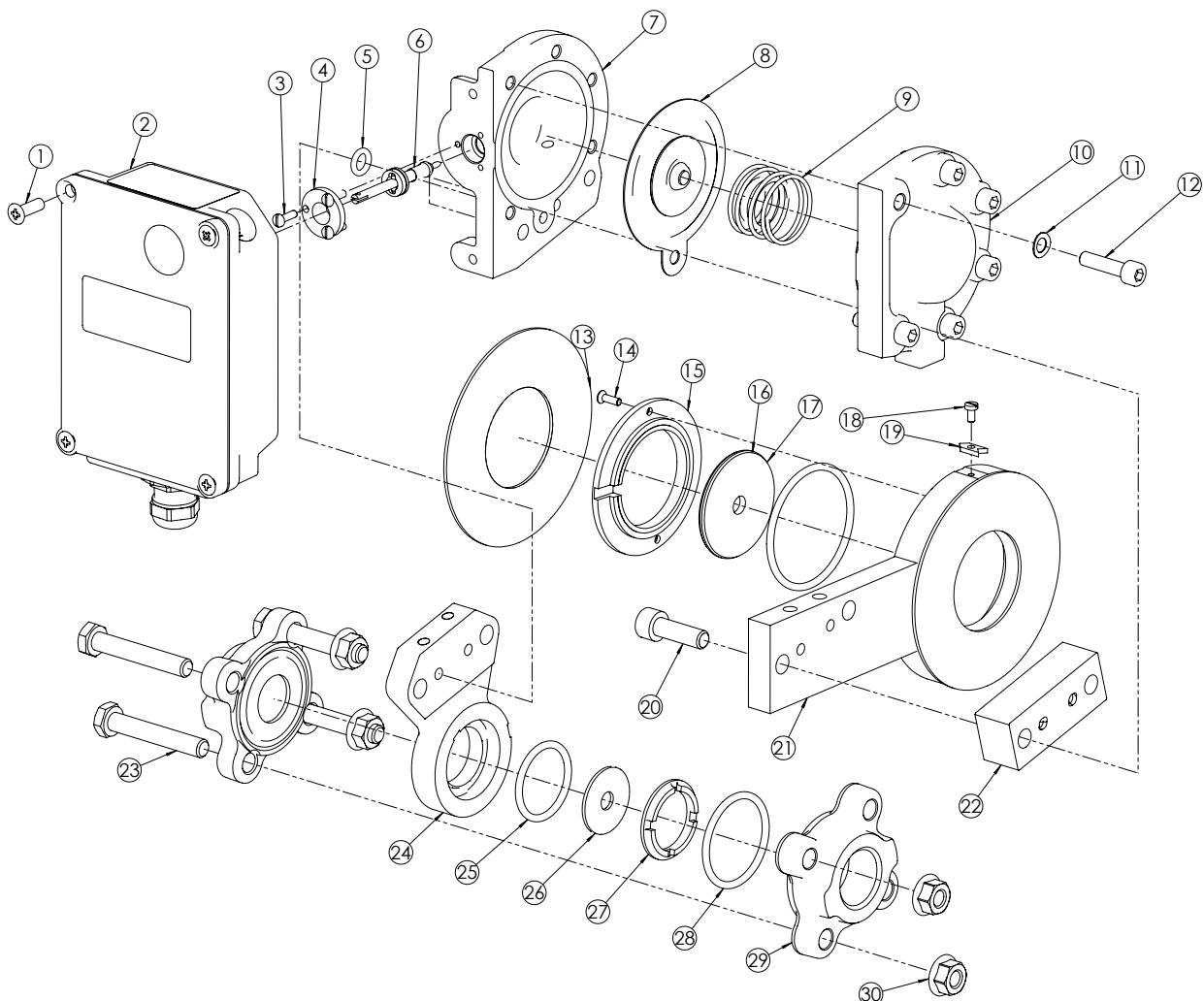
20	FA Spacer	2
21	Washer FA-pipe	4
22	Screw	4
23	Flange gasket	2
24	Screw	4
25	Thread connection flange	2
26	O-ring	3
27	GL Spacer	1
28	Orifice plate	1
29	Pipe housing GL	1
30	Nut	4
31	Flow direction selector	1
32	Screw	4



## 6.2 R-GSS/FSS

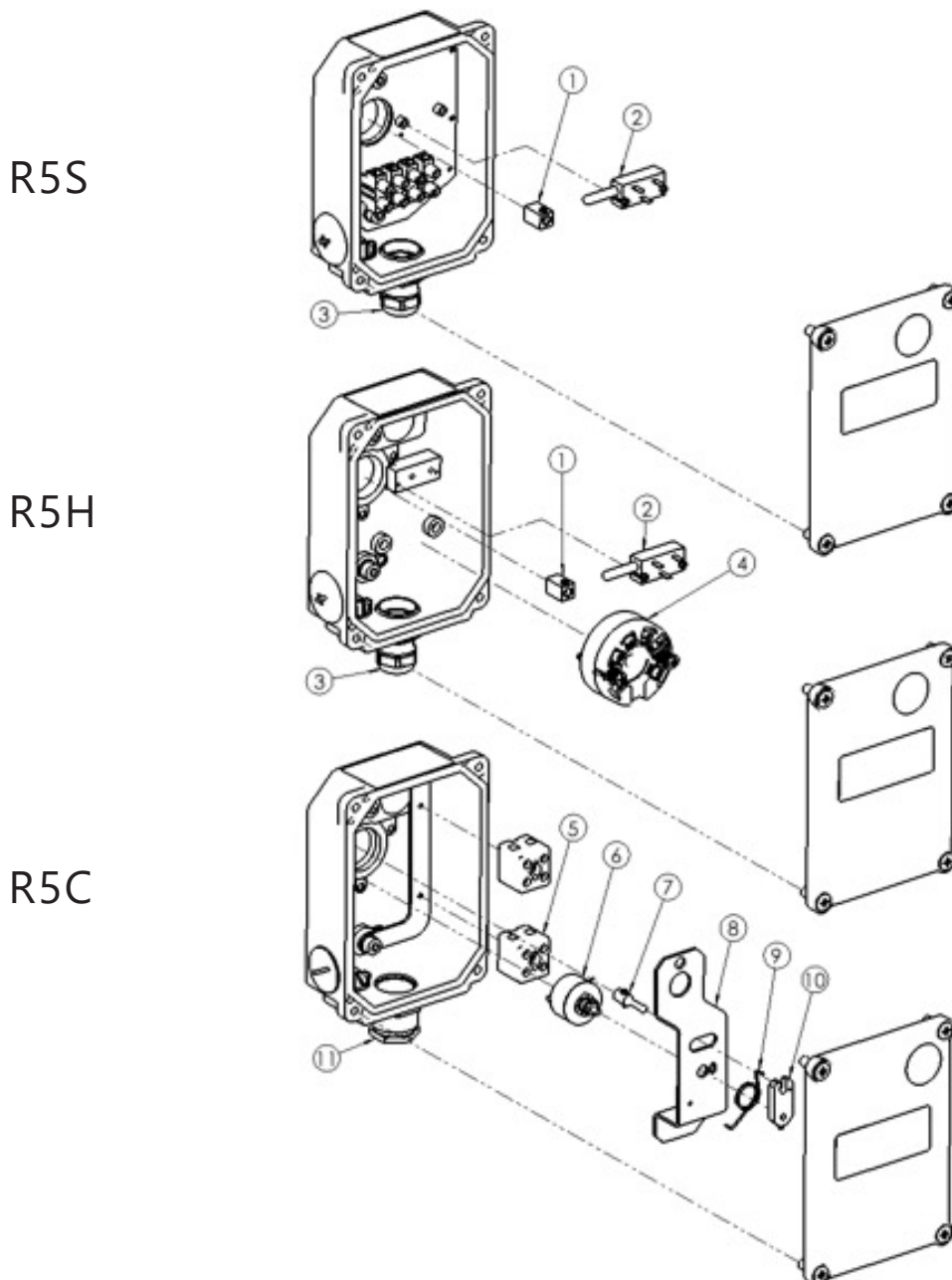
R-GSS/FSS		
Pos.	Description	Qty.
1	Screw	4
2	Control unit	1
3	Screw	3
4	Pressure flange	1
5	O-ring	2
6	Lever	1
7	Diaphragm housing	1
8	Diaphragm	1
9	Diaphragm spring	1
10	Diaphragm cover	1
11	Disc spring	9
12	Screw	9
13	Flange gasket	2
14	Screw	2
15	FSS Spacer	1
16	Orifice plate	1
17	O-ring	1
18	Screw	1
19	Flow direction arrow	1

20	Screw	2
21	FSS orifice flange	1
22	Flow direction switch (Optional)	-
23	Screw	4
24	GSS orifice flange	1
25	O-ring	1
26	GSS orifice plate	1
27	GSS Spacer	1
28	O-ring	2
29	Thread connection flange	2
30	Nut	4



6.3 R5S, R5H, R5C Control unit

R5S, R5H, R5C Control unit		
Pos.	Description	Qty.
1	Lever end piece	1
2	Linear sensor	1
3	Cable gland PG9	1
4	HART Transmitter	1
5	Terminal block	2
6	Rheostat	1
7	Shaft	1
8	Bracket	1
9	Spring	1
10	Torque bracket R5C	1
11	Cable gland PG16	1



### Recycle the product and reuse/recycle the packaging.

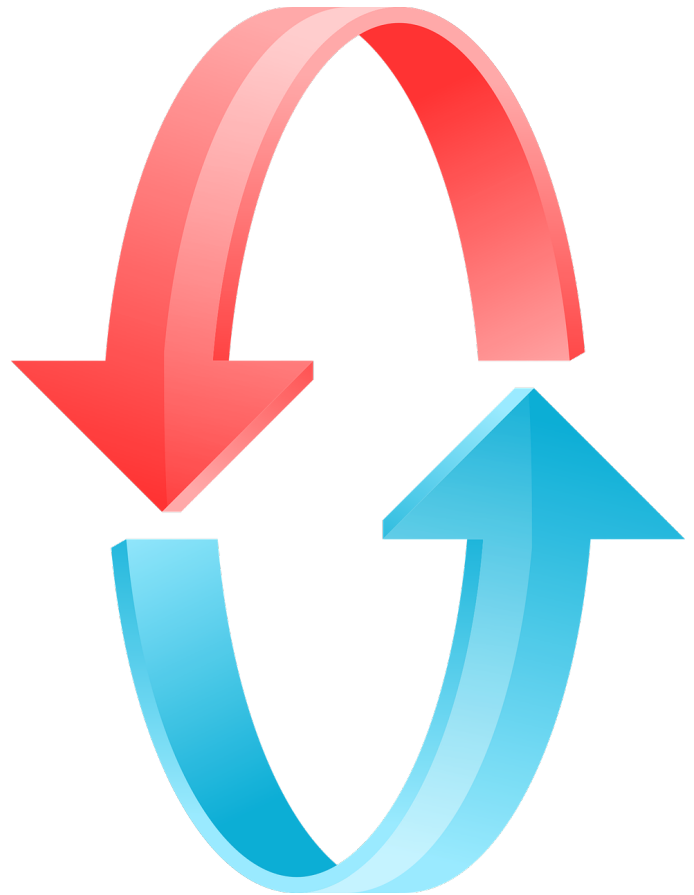
These products and packaging should not be mixed with general household waste. For proper recycling, take these products to a designated collection point.

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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