Instructions manual

Series 2000
Variable area flowmeter

The art of measuring

R-MI-2000 Rev.: 3 english version

PREFACE

Thank you for choosing a product from Tecfluid S.A.

This instruction manual allows the installation, configuration, programming and maintenance. It is recommended to read it before using the equipment.

WARNINGS

- This document shall not be copied or disclosed in whole or in any part by any means, without the written permission of Tecfluid S.A.
- Tecfluid S.A. reserve the right to make changes as deemed necessary at any time and without notice, in order to improve the quality and safety, with no obligation to update this manual.
- Make sure this manual goes to the end user.
- Keep this manual in a place where you can find it when you need it.
- In case of loss, ask for a new manual or download it directly from our website www.tecfluid.com Downloads section.
- Any deviation from the procedures described in this instruction manual, may cause user safety risks, damage of the unit or cause errors in the equipment performance.
- Do not modify the equipment without permission. Tecfluid S.A. are not responsible for any problems caused by a change not allowed. If you need to modify the equipment for any reason, please contact us in advance.

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SERIES 2000

1 INTRODUCTION

The series 2000 are flowmeters for low flows of liquids and gases.

They are very compact instruments especially indicated for control panels.

They have local flow rate indication with scales calibrated in l/h, l/min, %, etc.

They can fit switches that allow to detect a specific flow rate and provide an alarm signal to a remote device.

2 WORKING PRINCIPLE

Based on variable area principle.

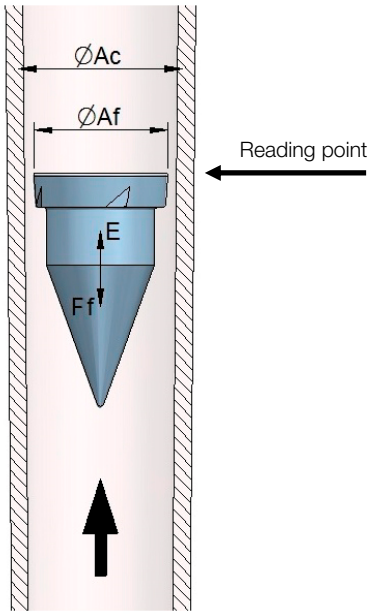
The flowmeter consists of a borosilicate glass tapered tube and a float inside it. The force of the flow pushes the float to an equilibrium point. The area obtained between the float and the tube is proportional to the flow rate.

The equilibrium point depends on:

- E = Force of the fluid flow
- Ff = Weight of the float
- Al = Free area of flow

where:

(Al = Ac, tube area - Af, float area)



3 RECEPTION

The series 2000 flowmeters are supplied conveniently packaged for their protection during transportation and storage, together with their instructions manual for installation and operation.

The instruments are supplied tested in our calibration rigs, ready for installation and service.

Turning the instrument carefully upside down, check that the float moves freely.

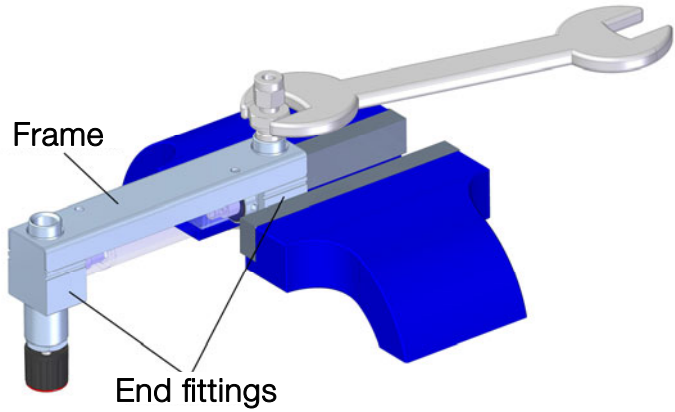
4 INSTALLATION

Flowmeters must be installed in a completely vertical position and with upwards flow direction.

It is important that the position is completely vertical given that deviations of about 5º can produce errors of about 8-10% of the readings.

To connect the flowmeter to the installation, it is very important to follow the steps below. This will ensure that the circuit is leak-free.

- Remove if it has the front plastic protection
- Hold the flowmeter by one of its end fittings (not by the frame)
- Screw the connection to the flowmeter



- Repeat the process with the other end fitting
- If it is available, reassemble the front protection
- Place the instrument in the installation

In case the instrument is intended to be mounted on a panel, in some cases it will be necessary to remove the glass tube to be able to screw the frame on the panel.

4.1 Valves

The series 2000 flowmeters are supplied by default with needle valve for flow regulation.

In cases where the operating fluid is a liquid, the valve should be mounted at the inlet (bottom) of the meter, unless otherwise indicated by the customer. The same installation position applies to gas flow measurement at atmospheric pressure.

In those cases where the operating fluid is a pressurized gas, the equipment is supplied with the regulating valve mounted at the outlet (top), unless otherwise indicated by the customer.

The flowmeters in this series are also available without valve. For these cases, if the fluid to be measured is a liquid, it is advisable to install a regulating valve before the meter.

If the fluid to be measured is a gas, and the calibrating pressure of the instrument corresponds to the inlet pressure, being higher than atmospheric pressure, the regulating valve shall be installed downstream of the flowmeter. Thus, it is ensured that the instrument works at calibrating pressure and with a counter pressure that keeps the float in equilibrium.

In applications where the gas outlet is at atmospheric pressure, the regulating valve must be installed at the meter inlet as long as the calibrating pressure of the meter is atmospheric pressure.

Valves should always be opened slowly to avoid water hammers.

4.2 Filters

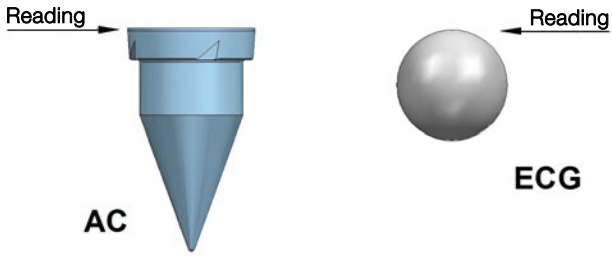
The installation of a filter before the instrument is recommendable, this will avoid possible obstructions and breakdowns in the measuring system.

The mesh of the filter should be maximum 200 microns.

5 FLOW READING

The float determines the flow rate on the scale.

Depending on the type of float, the reading should be taken at the height given in the following figure.



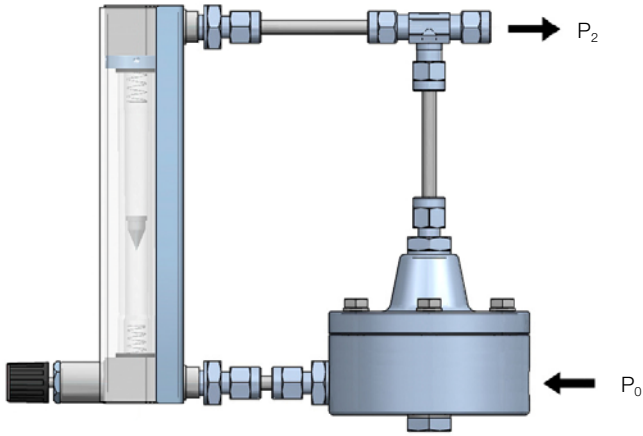
6 RCA / RCD FLOW REGULATORS

The series 2000 flowmeters are built to incorporate the RCA and RCD regulators, that keep a constant flow rate when the operating pressure at the inlet or outlet are not constant.

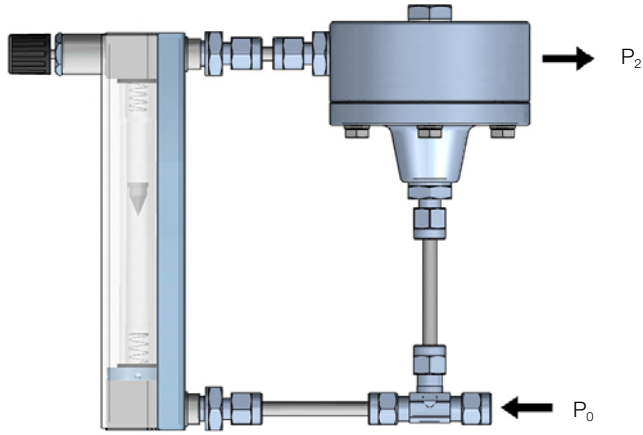
In applications for gases, the RCA model is used in installations where inlet pressure is variable and outlet pressure or counter pressure is constant, while model RCD is used in installations where the inlet pressure is constant and outlet pressure or counter pressure is variable.

In liquids, model RCA is the most commonly used.

RCA



RCD

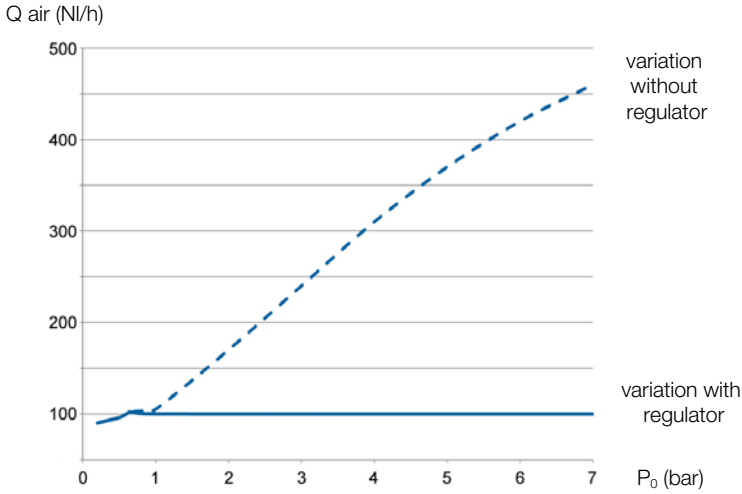


The differential pressure between P_0 and P_2 should always be higher than 350-450 mbar depending on the model. This differential pressure is calculated for the proper operation of the flow rate regulator.

6.1 Regulation curves

The flow curves show the relationship between the inlet pressure P_0 and the counter pressure P_2 in the RCA regulator.

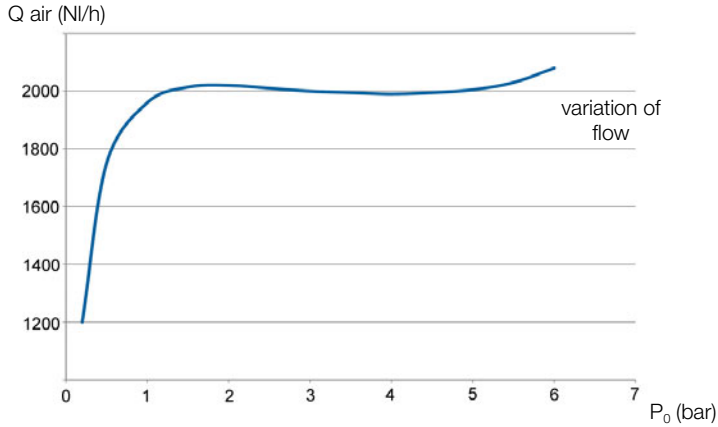
The different flow rates are adjusted by means of the regulating valve of the flowmeter. The counter pressure P_2, in these cases, corresponds to the atmospheric pressure.



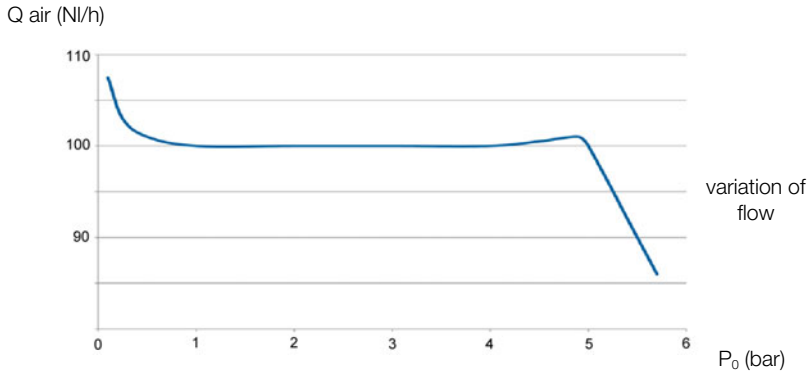
P_0 = inlet pressure RCA regulator (low flow)

The dotted line shows the variation of flow without the action of the constant flow regulator.

With constant flow regulator, variations of 100% in the inlet pressure P_0 involve variations of flow of less than 1%.



P_0 = inlet pressure RCA regulator (high flow)



P_0 = outlet pressure RCD regulator (low flow)

7 AMD LIMIT SWITCH

7.1 Introduction

The AMD limit switch can be used to generate an alarm or an operation when the flow rate that the instrument is measuring reaches a preset value.

This switch consists of a NAMUR ring type inductive sensor, that is actuated by the float.

For the correct activation of the limit switch, it is necessary that the material of the float is AISI 316L stainless steel.

7.2 Operation

When the float passes through the point where the limit switch is positioned, it changes the state of the inductive sensor, and therefore the output state. This is maintained until the float passes in the opposite direction by the point where the switch is, returning again to the previous state.

As an optional element, a NAMUR amplifier with a switching relay as an output element can be supplied.

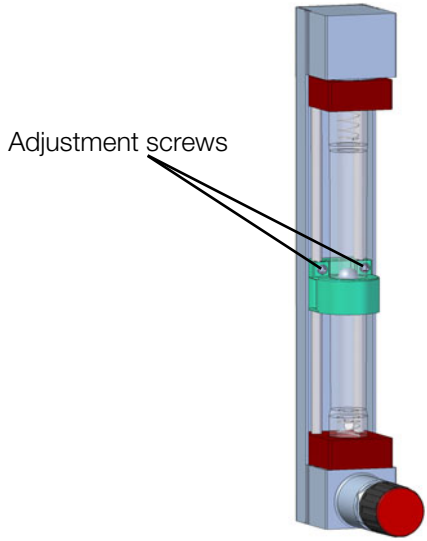
7.3 Switching point adjustment

To access the limit switch, if the equipment has frontal protection, it must be removed.

Loosen the two front drive screws.

Move the limit switch to the desired height on the scale.

Tighten the screws again and install the plastic protection if it is available.



7.4 Electrical connection

The limit switch fits a 2m long cable with two wires. For the electrical installation it is recommended to use a cable similar to the cable of the limit switch. The connection can be made by means of soldering or with a terminal block, always making sure that the connection is protected against the ambient (humidity, dust, etc.).

8 AMR LIMIT SWITCH

8.1 Introduction

The AMR limit switch can be used to generate an alarm or an action when the flow rate that the instrument is measuring reaches a preset value.

It consists of a bi-stable reed switch that is operated by the magnetic field of the float.

It can be supplied as a normally open switch when the float is below the set point (20-AMR NA), or normally closed under the same conditions (20-AMR NC).

8.2 Operation

When the float passes through the point where the limit switch is positioned, it changes the state of the reed switch, and therefore the output state. This is maintained until the float passes in the opposite direction by the point where the switch is, returning again to the previous state.

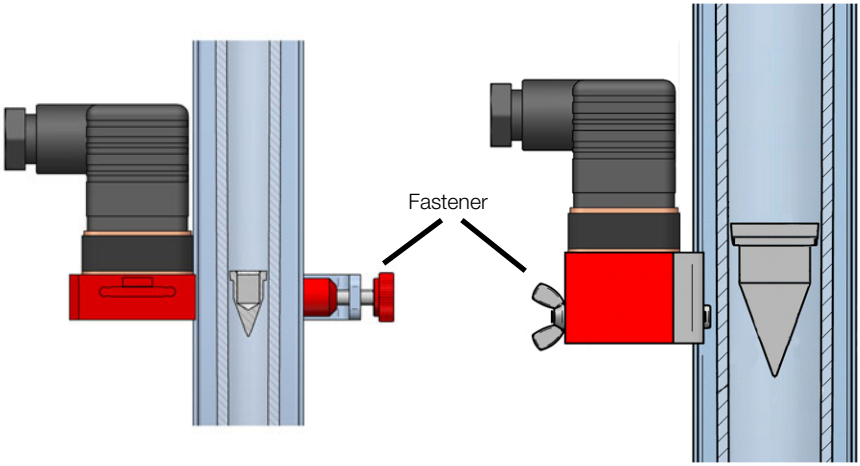
8.3 Switching point adjustment

To hold the limit switch, the 2100 and 2150 models have a circular button type fastener, and the 2300 and 2340 models have a wing nut (DIN 315).

Loosen the fastener.

Move the limit switch to the desired height on the scale.

Tighten the fastener again.

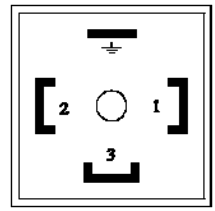


8.4 Electrical connection

For the electrical installation it is recommended to use multiple conductor cables instead of individual cables, in order to obtain a good seal with the cable gland. The connector fits a PG9 cable gland, suitable for cables with outside diameters between 4.5 mm to 7 mm. Connector terminals 1 & 2 are connected to the two ends of the reed sensor.

In the female connector:

Terminal 1:	Reed switch contact
Terminal 2:	Reed switch contact
Terminal 3:	No connection
Earth terminal:	No connection

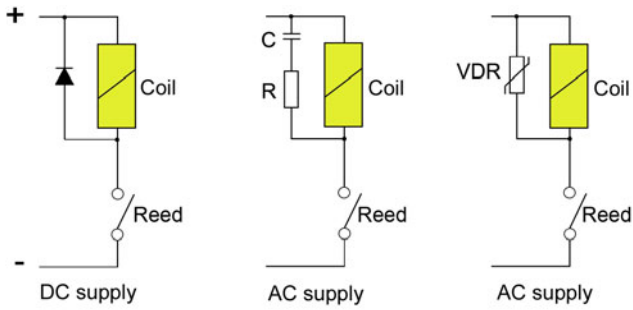


Make sure that the contact rating is not exceeded. If high loads are to be switched, use an auxiliary relay.

When using inductive loads, such as relays or solenoid valve coils, surge arresters should be installed to protect the reed contacts.

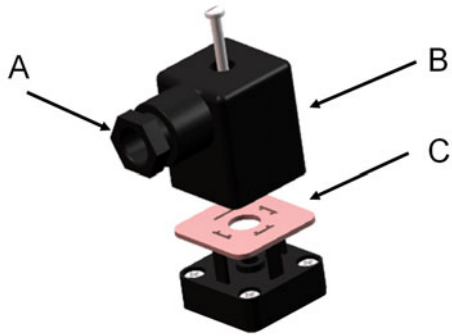
With a DC supply, a diode should be connected as shown.

For an AC supply, a RC circuit can be used as shown, although a varistor (VDR) is better and is easier to select the right value. The VDR should have a breakdown voltage greater than 1.5 times the rms voltage. The standard varistor ratings specify the rms working voltage for the varistor, for example a S05K25 varistor will be for 25 V_{rms} working and will have a breakdown voltage of 39 V at 1 mA.



The electrical installation should provide a fuse or circuit breaker to protect the reed switch from overloads.

When installing the connector, make sure that the cable gland (A) closes over the cable and that the connector (B) with the rubber seal (C) is well screwed down to maintain the IP65 rating.



9 MAINTENANCE

9.1 Series 2000

To perform the maintenance, it is necessary to disassemble some parts of the flowmeter. Check the drawings below for reference.

If the flowmeter has frontal protection (4), remove it.

Turn the locking piston (1) clockwise, in order to separate it from the glass tube (5) until it can be released. Use a Ø3 rod to do it.

Remove the gasket (2) and the glass tube (5).

Remove the springs (3) and (7) or, if applicable, the float stops (9) and (10).

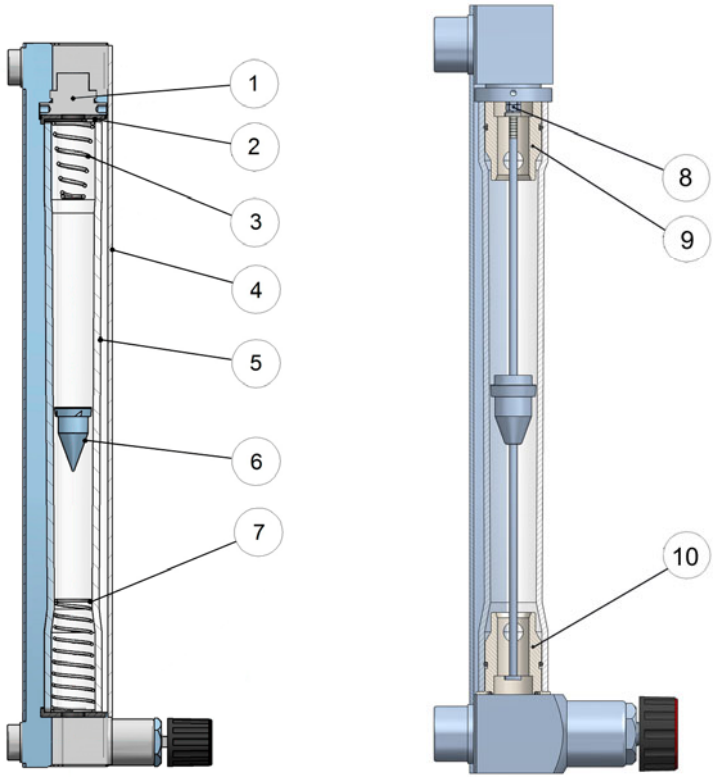
Remove the float (6). If the float is guided, unscrew the nuts (8) first and remove the float guide assembly.

Once the float is disassembled, the float (6) and the inside of the glass tube (5) can be cleaned.

To remove adhered chemical dirt to the float (6) or metering tube (5), clean the parts with suitable products or solvents and soft brushes, never use metallic tools.

Follow the above steps in reverse to reassemble the flowmeter.

When assembling the glass tube, the original position when the flowmeter was supplied must be taken into account, with the valve at the bottom or top according to the working conditions of the flowmeter.



9.2 Potential problems with the measuring tube

9.2.1 Jammed float

To remove the float, follow the steps in section 9.1.

To remove adhered chemical dirt to the float, the measuring tube or the calibrated orifice, clean the parts with suitable products or solvents and soft brushes, never use metallic tools.

The float may also become clogged by accumulation of metallic particles around it in case the float is magnetic. In this case install a magnetic filter at the inlet of the meter, or just a normal filter depending on the size and nature of the particles.

Follow the steps in section 9.1 to reassemble the flowmeter.

9.2.2 Damaged float

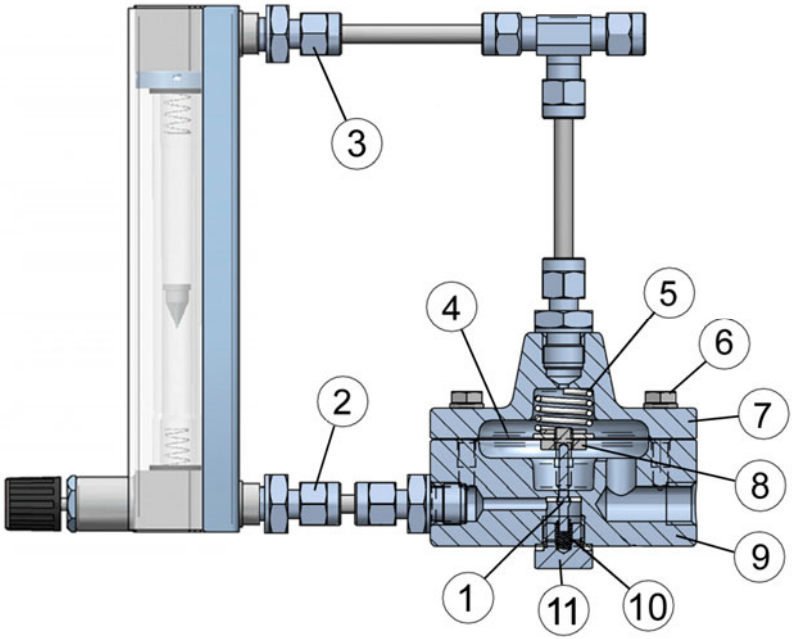
Check that it does not show any impacts or scratches. Also check for any chemical attack. If the float is in bad condition it must be replaced. In this case it is recommendable to re-calibrate the flowmeter at Tecfluid S.A. facilities.

9.3 RCA regulator maintenance

Loosen the spring support (11) with a spanner number 19. Unscrew until remove it. Along with the spring support (11) also the seal, the valve (1) and the balance spring (10) will be removed.

After checking the good condition of the elements if necessary clean with compressed air or with a cloth or paper moistened with alcohol.

Check that the internals of the body and especially seat of the valve (1) have no signs of deterioration. Anyway clean with compressed air or with a cloth or paper moistened with alcohol.



If visual inspection shows important dirt, in addition to the above steps, the regulator must be disassembled completely. To do it proceed as follows:

Unscrew the connection (2) that connects the bottom of the regulator with the flowmeter.

Unscrew the connection (3) that connects the top of the regulator with the flowmeter.

Unscrew the 6 screws M6 (6). Remove them with the washers.

Pull apart the bodies (7) and (9). The spring (5) and the membrane (4) will be visible.

Clean with compressed air or with a cloth or paper moistened with alcohol.

To reassemble the set, follow these steps:

Place the membrane (4) so the holes match the threaded holes in the regulator body (9). Note that the valve guide (8), which acts as stop of the center of the membrane, has a hole whose function is to guide the shut-off valve (1) and it has to be on the inner side of the regulator body (9).

Place the spring (5), centering it by the valve guide (8) and making it rest on the PTFE disk of the regulating membrane (4).

Place the membrane body (7) so that the 6 holes match those of the regulating membrane (4), ensuring that the spring (5) locks in its correct position inside the body cavity (7).

Fit and tighten the screws M6 (6) with their respective washers, alternately and crosswise to ensure an uniform pressure over the entire membrane surface.

Place the balance spring (10) in the spring support housing (11).

Place the shut-off valve (1) into the balance spring (10) on the side of the short shaft.

Install or replace by another with the same thickness, the PTFE seal of the spring support (11).

Screw completely the spring support (11) in the regulator body (9), making sure that the long shaft of the valve (1) passes through the hole and fits in the valve guide (8).

Screw the connection (2) that connects the bottom of the regulator to the flowmeter.

Screw the connection (3) that connects the top of the regulator to the flowmeter.

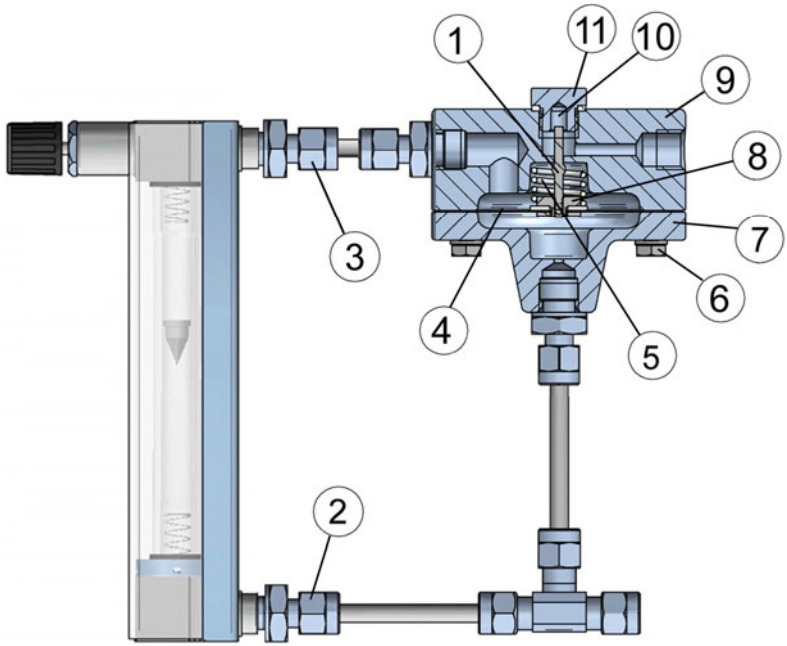
9.4 RCD regulator maintenance

Unscrew the connection (2) that connects the bottom of the regulator the flowmeter.

Unscrew the connection (3) that connects the top of the regulator to the flowmeter.

Unscrew the 6 screws M6 (6). Remove them with the washers.

Pull apart the bodies (7) and (9). The spring (5), the membrane (4) and the valve (1) will be visible.



Unscrew the valve (1) from the metallic element (8) housed in the membrane (4).

Loosen the support (11) with a spanner number 19. Unscrew until removing it. Along with the support (11) it will leave the seal.

After checking the good condition of the elements, also check that the inside of the body and especially the seat of the valve (1) do not show any sign of deterioration.

Clean with compressed air or with a cloth or paper moistened with alcohol.

To reassemble the set, follow these steps:

Screw the valve (1) to the metallic element (8).

Place the spring (5), in the housing of the regulator body (9).

Insert the valve (1) through the hole of the regulator body (9).

Place the membrane (4) so that its holes match the threaded holes of the regulator body (9).

Place the membrane body (7) so that the 6 holes match those of the membrane (4).

Fit and tighten the screws M6 (6) with their respective washers, alternately and crosswise to ensure an uniform pressure over the entire membrane surface.

Install or replace by another with the same thickness, the PTFE seal of the support (11).

Screw completely the support (11) in the regulator body (9).

Screw the connection (2) that connects the bottom of the regulator to the flowmeter.

Screw the connection (3) that connects the top of the regulator to the flowmeter.

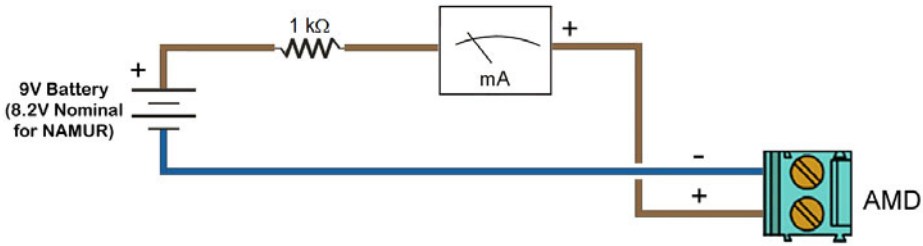
9.5 AMD limit switch maintenance

9.5.1 Electrical verification

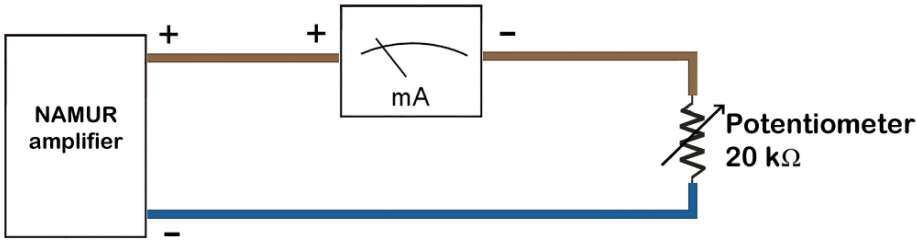
Check that the voltage at the terminals + and - is over 7.5 V when the vane is in the slot. Connect a multimeter with the scale in DC mA, in series with the terminal +.

Verify that the current is less than 1 mA when the vane is into the slot and more than 3 mA when the vane is out of the slot.

If a NAMUR amplifier is not available, the verification can be done with the following circuit diagram:



Without the sensor, the operation of the amplifier can be checked by using the following circuit diagram:



With the potentiometer the current through the NAMUR amplifier can be modified. The switching point must be between 1.2 mA and 2.1 mA. That is, with the current below 1.2 mA the output relay must have a state and above 2.1 mA the output relay must have the other state.

9.6 AMR limit switch maintenance

If the limit switch must be changed from a 20-AMR NC to a 20-AMR NA or vice-versa, the procedure is the following:

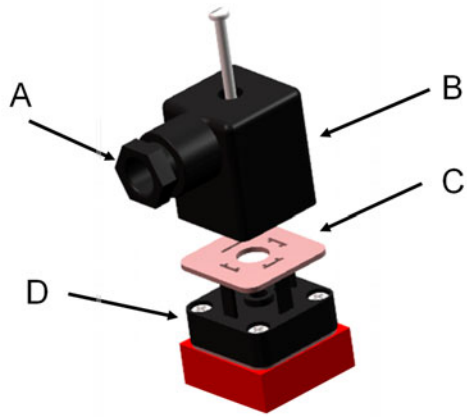
Remove the female connector (B) by unscrewing the central screw and then the rubber seal (C).

Unscrew the 4 screws that hold the male connector (D).

Withdraw the connector, rotate it 180º and reassemble it carefully.

Fit the gasket (C) and then the female connector (B). Screw the central screw.

Take care that the seals are properly fitted to maintain the ingress protection.



10 TECHNICAL CHARACTERISTICS

10.1 Series 2000

Accuracy:	According to VDI/VDE 3513 sheet 2 (q_G=50%)
	2100 3.5%
	2150 3%
	2300/2340 1.6%
Scales:	In l/h, l/min, %, etc.

Mounting:	Vertical (Upwards flow)
Scale range:	10:1
Fluid density:	No restrictions
Working temperature:	-20ºC ... +80ºC
Ambient temperature:	-20ºC ... +80ºC
Working pressure:	15 bar max
Connections:	2100 / 2150 / 2300: ¼" BSP / NPT 2340: ½" BSP / NPT

10.2 AMD limit switch

Nominal voltage	8 V
Working voltage	5 ... 25 V
Power supply internal resistance	1 kΩ
Current with the vane into the slot	< 1 mA
Current with the vane out of the slot	≥ 3 mA
Standard:	DIN EN 60947-5-6 (NAMUR)
Ambient temperature	-25ºC ... +100ºC

10.3 AMR limit switch

DIN 43650 A connector

Technical characteristics of the reed sensor:

Maximum switching power:	12 VA
Maximum switching voltage:	250 VAC
Maximum switching current:	0.5 A
Hysteresis:	±5% of full scale value
Ingress protection:	IP65
Ambient temperature:	-20ºC ... +80ºC

11 SAFETY INSTRUCTIONS

The series 2000 flowmeters are in conformity with all essential requirements of all EC directives applicable to them:

2014/68/EU Pressure equipment directive (PED)

Limit switches and transmitters:

2014/30/EU Electromagnetic compatibility directive (EMC)

2012/19/EU Waste electric and electronic equipment (WEEE).

Equipment for hazardous areas:

2014/34/EU Equipment and protective systems intended for use in potentially explosive atmospheres (ATEX).

The declarations UE of conformity can be downloaded from the section "Download" of the Tecfluid S.A. website.

11.1 Pressure equipment directive

Devices of series 2000, due to their size, are rated as Category I are not within the scope of the directive and therefore they have not the CE mark according to pressure directive. These devices are subject to applicable sound engineering practice (SEP).

This equipment is considered as being a pressure accessory and **NOT** a safety accessory as defined in the 2014/68/EU directive, Article 2, paragraph 4.

11.2 Certificate of conformity TR CU (EAC marking)

Tecfluid S.A. have subjected the series 2000 of flowmeters to a certification procedure according to the technical regulations of the Customs Union of the Eurasian Economic Union (EEU).

This Certificate is an official document confirming the quality of production with the standards on the territory of the Customs Union, particularly regarding safety requirements and electromagnetic compatibility.

12 ADDITIONAL INSTRUCTIONS FOR THE ATEX VERSION

This chapter only applies to equipment intended for use in explosive atmospheres (instruments with AMD limit switch).

These equipment conform with the directive 2014/34/EU (Equipment and protective systems intended for use in potentially explosive atmospheres) as indicated in the EC-type examination certificate and in its marking.

Given that this instrument is group II, it is intended for use in places likely to become endangered by explosive atmospheres, but not in mines.

The category is 2G, that is, it is intended for use in areas in which explosive atmospheres caused by mixtures of air and gases, vapours, mists are likely to occur in normal operation.

12.1 Non-metallic parts

WARNING: POTENTIAL RISK OF ELECTROSTATIC CHARGE

The front window of the equipment consists of a transparent plastic protection in order to let the user see the position of the float and the scale.

Since the danger of ignition by electrostatic discharge when rubbing this protection can not be avoided, **the instrument must always be cleaned with a damp cloth**.

The AMD limit switch is certified as intrinsic safety with the following parameters:

Specific parameters	Ui : 16 V
	Ii : 25 mA
	Pi : 64 mW
	Ci : 30 nF
	Li : 100 µH

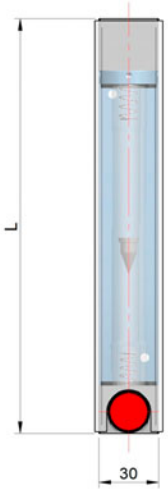
13 FLOW RANGES

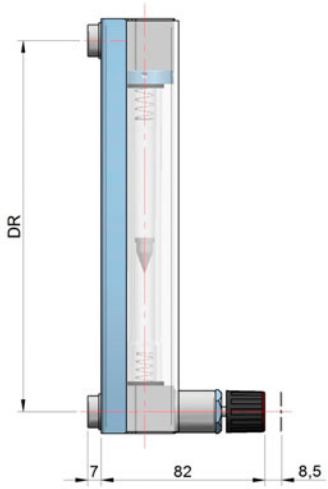
Model Nº	Tube length (mm)	Flow scales, float type ECG						ΔP (mbar)
		l/h water		Nl/h air 1.013 bar abs 20ºC				
		AISI 316L (EN 1.4404)	GLASS	AISI 316L (EN 1.4404)	GLASS	PLASTIC	CERAMIC	
Model 2100								
C110/0001	100	0.1-1	0.05-0.5	4-40	1-15	1-11	2-20	5
C110/0002		0.2-2.5	0.1-1	8-80	4-40	2-16	6-60	10
C111/0005		0.5-5	0.2-2	15-160	7-70	2-25	10-100	15
C111/0010		1-10	0.4-4	30-350	10-210	10-110	30-260	20
C111/0016		1.6-16	0.6-6	40-490	20-250	10-140	30-330	35
C112/0025		2.5-25	1-10	80-840	40-420	20-270	50-560	40
C113/0040		4-40	1.6-16	120-1200	70-700	40-420	80-880	45
C114/0060		6-60	2-20	200-2200	100-1200	70-800	150-1500	50
C115/0100		10-100*	4-40	300-3500	150-1800	100-1100	200-2400	55
Model 2150								
C210/0001	150	0.1-1	0.05-0.5	3-30	1-12	1-10	2-17	5
C210/0002		0.2-2,5	0.1-1	4-40	4-40	2-16	6-60	10
C211/0005		0.5-5	0.2-2	8-80	8-80	3-30	10-110	15
C211/0010		1-10	0.4-4	15-180	15-180	10-100	20-230	20
C211/0016		1.6-16	0.6-8	25-260	25-260	10-150	30-340	35
C212/0025		2,5-25	1-12	40-440	40-440	20-270	50-540	40
C213/0040		4-40	1.6-20	70-700	70-700	40-440	80-880	45
C214/0060		6-60	2-30	100-1100	100-1100	70-740	100-1400	50
C215/0100		10-100 *	4-40	150-1900	150-1900	100-1200	100-2400	55

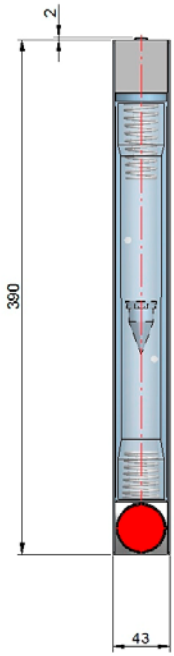
* Also available with AC float

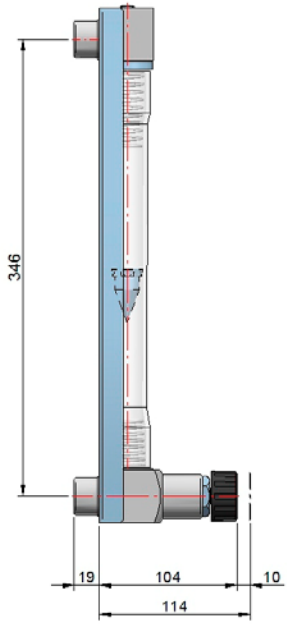
Model Nº	Tube length (mm)	Flow scales, float type AC, excepte Glass float type ECG						ΔP (mbar)
		l/h water		Nl/h air 1.013 bar abs 20ºC				
		AISI 316L (EN 1.4404)	GLASS	AISI 316L (EN 1.4404)	ALUMINIUM	PVC	PTFE	
Model 2300								
C311/0025	300	2.5-25	1-10	120-860	60-15	40-490	40-20	55
C311/0040		4-40	1.6-16	150-1300	80-40	50-530	50-60	80
C311/0060		6-60	2-20	150-2000	100-70	60-800	60-100	110
C312/0100		10-100		300-3000	180-210			130
C312/0160		16-160		490-4900	300-250			160
C312/0250		25-250		770-7700	460-420			180
Model 2340								
C313/0400		40-400		1200-12000	740-7300			90
C313/0630		60-630		1900-19000	1100-11000			200
C313/1000		100-1000		3000-30000	1800-18000			300

14 DIMENSIONS



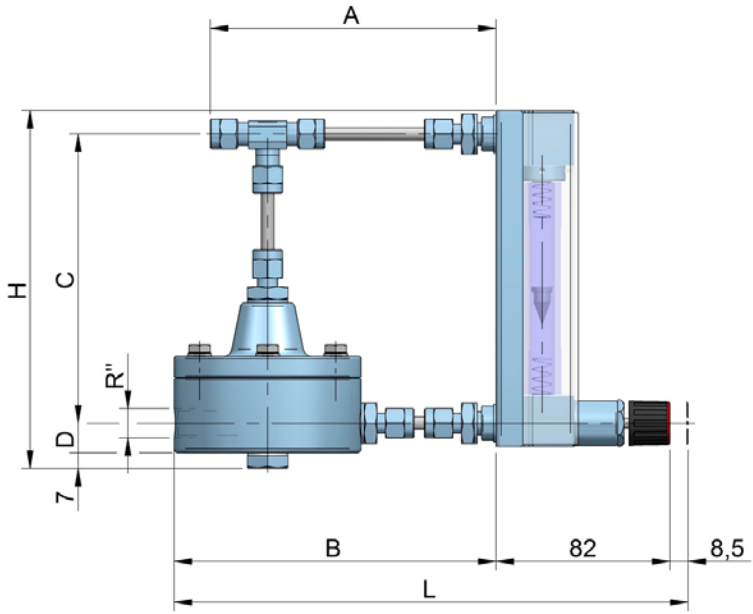






Model	DR	L	R" BSP/NPT
2100	136	158	¼"
2150	186	208	¼"
2300	336	358	¼"
2340	346	390	½"

(dimensions in mm)



Model	Flow rate (l/h water) *	A	B	C	D	H	L	R" BSP / NPT
2100	≤ 10-100	150	170	136	13	172	266	¼"
2150	≤ 10-100	150	170	186	13	222	266	¼"
2300	≤ 10-100	150	170	336	13	372	266	¼"
2340	≤ 60-630	1180	200	346	18	397	320	½"

* Also for air equivalent flows, according to chart on page 21

(dimensions in mm)

WARRANTY

Tecfluid S.A. guarantee all the products for a period of 24 months from their sale, against all faulty materials, manufacturing or performance. This warranty does not cover failures which might be imputed to misuse, use in an application different to that specified in the order, the result of service or modification carried out by personnel not authorized by Tecfluid S.A., wrong handling or accident.

This warranty is limited to cover the replacement or repair of the defective parts which have not damaged due to misuse, being excluded all responsibility due to any other damage or the effects of wear caused by the normal use of the devices.

Any consignment of devices for repair must observe a procedure which can be consulted in the website www.tecfluid.com, “After-Sales” section.

All materials sent to our factory must be correctly packaged, clean and completely exempt of any liquid, grease or toxic substances.

The devices sent for repair must enclose the corresponding form, which can be filled in via website from the same “After-Sales” section.

Warranty for repaired or replaced components applies 6 months from repair or replacement date. Anyway, the warranty period will last at least until the initial supply warranty period is over.

TRANSPORTATION

All consignments from the Buyer to the Seller´s installations for their credit, repair or replacement must always be done at freight cost paid unless previous agreement.

The Seller will not accept any responsibility for possible damages caused on the devices during transportation.

Tecfluid
The art of measuring

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ATEX European Directive 2014/34/EU certified by

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