

# DHW MIXERS WITH ANTI-LEGIONELLA FUNCTION



## MAS... / AL Eng.

- Supplied with valve, actuator, controller & temperature detector
- Includes device which, in all accessible parts of the distribution circuit, produces a thermal “shock” to neutralize the Legionella bacteria
- Valve connections : DN 1/2" ...2" female threaded
- Temperature control range : 30...70 °C
- Very stable temperature even with low flows
- Power supply: 230 V~; Consumption: 6...9 VA: Protection: IP 55

- **INSTALLATION:** section 7
- **ELECTRICAL CONNECTIONS:** section 8
- **TESTING & CALIBRATION:** section 10

### 1. APPLICATION

MAS.../AL maintains the temperature of the water at the desired value by mixing the hot water coming from the storage tank or from a heat generator with cold water coming from the mains. They provide, therefore, an efficient and economic means of managing the distribution of DHW. MAS.../AL also provides an Antilegionella function.

### 2. OPERATION

MAS.../AL mixers, which are very compact, are supplied in two parts:  
 – electronic unit comprising the control circuit and the actuator for operating the valve.  
 – control ball valve (self-cleaning and so not subject to calcareous incrustations), manufactured with special tooling of the channels where the water flows so as to provide efficient mixing.

On the output for the mixed water is a well inside which is housed a temperature sensor (high-precision thermistor with rapid response).

An essential feature of the mixer is its rapid response to the variations in temperature. The mixer compares the temperature of the water, measured by the sensor, with the value requested by means of the knob on the cover. According to the difference in temperature measured and the Proportional Band, the controller processes the data and sends modulating signals to the valve which optimises the speed and the stability of the system.

**This special type of control permits very good stability even with very low consumptions of DHW. The use of the recycle pump keeps the temperature stable in the whole of the distribution circuit, reducing the delay between the moment when the user requests DHW and the moment it arrives at the tap.**

**MAS ... /AL also perform the important function of tending to neutralize the Legionella bacteria in all parts of the DHW distribution circuit where the water circulates naturally or by means of a pump.**

**All the dead branches of the distribution circuit, where the recycle pump does not reach, are usually less active in creating colonies of Legionella since the volume of water is reduced and it usually has a low temperature.**

**Usually, in the dead zones where the water is seldom changed, the temperature falls to relatively low levels which are not ideal for the rapid development of Legionella.**

**When, in the hydraulic distribution circuit of DHW, dead zones of appreciable volume are identified, it is advisable to include them in the recycle circuit.**

### 3. MODELS

model	Power supply V~ (VA)	Electronic unit	Code	3-way control ball valve						
				DN inches	DN mm	Kvs m <sup>3</sup> /h	Nominal flow l/min	Equivalent number contemporary shower	Max flow l/min	Min flow l/min
<b>MAS 615/AL</b>	230 (6)	MAS 600/AL/E	MAS 615/V	1/2"	15	2.5	40	5	60	2
<b>MAS 620/AL</b>	230 (6)	MAS 600/AL/E	MAS 620/V	3/4"	20	5.0	70	8	100	3.5
<b>MAS 625/AL</b>	230 (6)	MAS 600/AL/E	MAS 625/V	1"	25	9.0	130	15	200	6
<b>MAS 632/AL</b>	230 (6)	MAS 600/AL/E	MAS 632/V	1"1/4	32	13.5	180	20	270	7
<b>MAS 740/AL</b>	230 (9)	MAS 700/AL/E	MAS 740/V	1"1/2	40	19.2	270	30	400	9
<b>MAS 750/AL</b>	230 (9)	MAS 700/AL/E	MAS 750/V	2"	50	28.6	390	43	600	12

N.B. – The nominal flow refers to a mean pressure of 4 bar and a valve pressure drop of about 20%.  
 – The maximum flow permits the supply of DHW even in the exceptional event of very high contemporaneous use.  
 – The minimum flow is that which still guarantees control stability and accuracy.

**3. TECHNICAL DATA**

**• Controller**

Power supply	230 V~
Frequency	50...60 Hz
Consumption :	
- MAS 6../AL	6 VA
- MAS 7../AL	9 VA
Rotation angle	90 °
Run time for 90°	30 seconds
Setting range	30...70 °C
Materials :	
- base	nylon 66
- cover	polycarbonate
Ambient temperature :	
- operating	0...45 °C
- storage	- 20...60 °C
Ambient temperature	Class F DIN 40040
Protection	IP 55

**• Valve**

Test pressure	1000 kPa (10bar)
Working pressure	600 kPa (6bar)
Maximum differential pressure	600 kPa (6bar)
Fluid temperature	5...120 °C

**Materials :**

- valve body	nickel-plated OT58 brass
- ball	hard-chromed OT 58 brass
- spindle	OT58 (UNI 5705) brass
- ball gasket	PTFE (Teflon)
- spindle gasket	Viton O-Ring

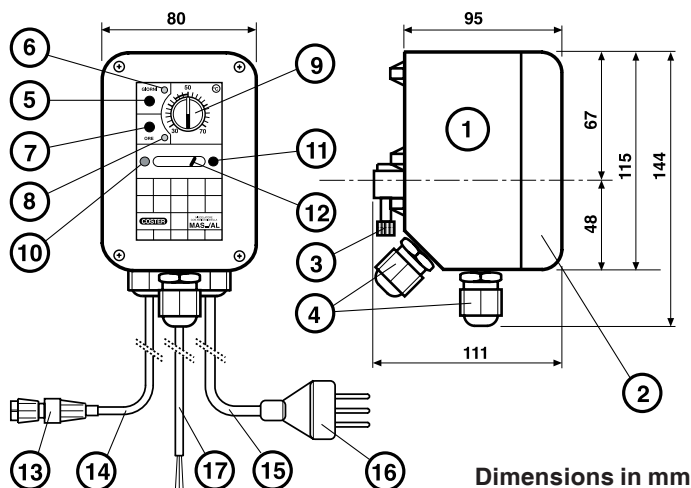
**• Anti-Legionella function**

- manual	when desired
- automatic	once a week

on day and at time required  
**(factory setting: 02.00 hours night between Sunday and Monday, with GMT)**

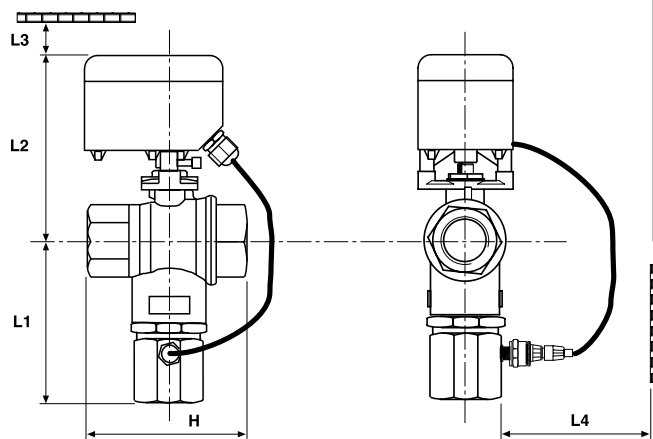
**4. OVERALL DIMENSIONS**

**4.1 Electronic controller**



- 1 - Base
- 2 - Protective cover for printed circuit board
- 3 - Screws for securing coupling pins to valve
- 4 - PG 11 conduit entry gland
- 5 - "Days" button
- 6 - "Days" LED
- 7 - "Hours" button
- 8 - "Hours" LED
- 9 - Desired temperature dial
- 10 - Red indicator (Open)
- 11 - Blue indicator (Closes)
- 12 - Valve position indicator
- 13 - Connector for temp. detector
- 14 - Temperature detector cable (30 cm)
- 15 - Power supply cable (1 metre)
- 16 - Power supply plug
- 17 - Cable for signalling alarms and anti-Legionella function in progress (1 metre)

**4.2 Overall dimensions and weight**



Model	DN	L1 mm	L2 mm	L3 min. mm	L4 min. mm	H mm	Weight Kg
MAS 615/AL	1/2"	75	146	30	100	64	1.5
MAS 620/AL	3/4"	79	151	30	100	74	1.7
MAS 625/AL	1"	94	156	30	100	89	2.2
MAS 632/AL	1"1/4"	106	161	30	100	100	2.8
MAS 740/AL	1"1/2"	113	167	30	100	110	3.3
MAS 750/AL	2"	136	178	30	100	130	4.8

**5. CONSTRUCTION**

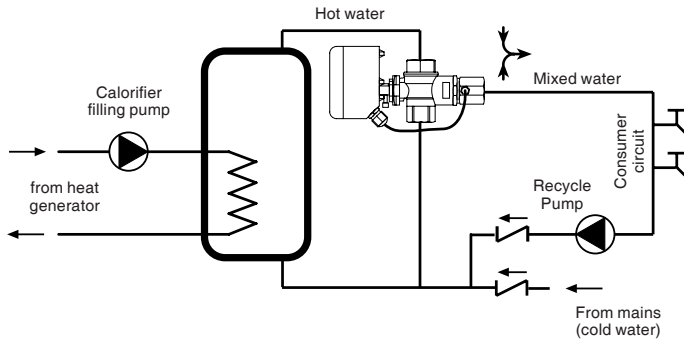
- MAS.../AL mixers are very compact. They are manufactured in two parts:
  - electronic unit comprising the electronic circuit board and the actuator for operating the valve.
  - From the electronic unit originate three pre-wired cables: power supply, temperature detector, malfunctioning (alarms) and anti-Legionella function in operation.
  - control ball valve (self-cleaning and so not subject to calcareous deposits), manufactured by special tooling of the water passages that permits accurate mixing. On the output port for the mixed water a pocket is inserted inside which is housed the temperature sensing element (thermistor with high accuracy and response speed).

**6. OPERATIONAL DIAGRAMS**

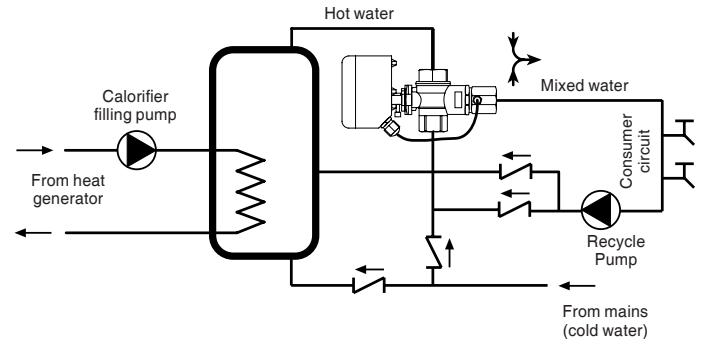
**Warning: to ensure that the anti-Legionella thermal “shock” reaches as much of the DHW hydraulic circuit as possible, a recycle pump must be installed.  
Without the recycle pump there is no point in using the anti-Legionella function.**

**For a good result keep the calorifier temperature at 70°C minimum.**

**6.1 Installation with calorifier without recycle input**



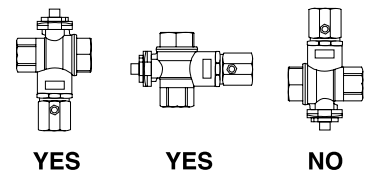
**6.2 Installation with calorifier fitted with recycle input**



**7. INSTALLATION**

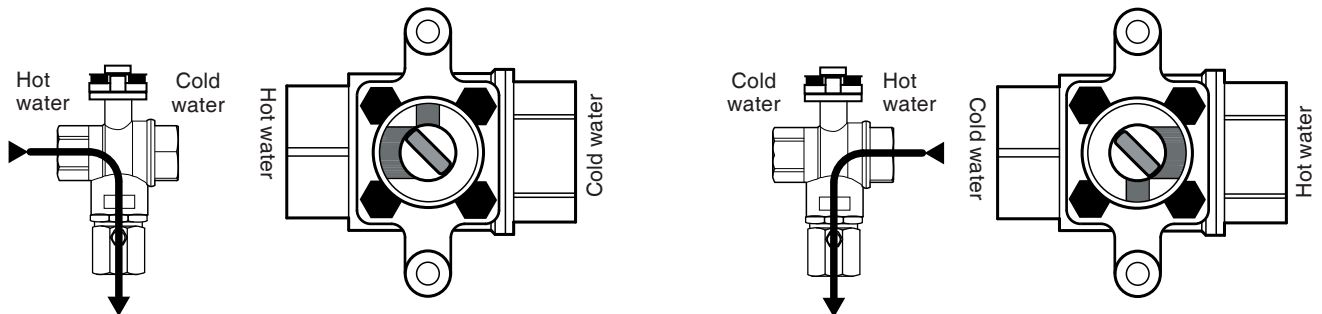
**7.1 Installing the valve**

The valve can be installed in any position except that with the control spindle facing downwards.  
One of the two opposite ports (it does not matter which) is connected to the hot water from the calorifier, and the other is connected to the combination cold water - recycle.  
From the central port, where the pocket containing the temperature sensing element is inserted, flows the mixed hot water directed to the consumer circuit.



**7.2 Positioning the valve spindle**

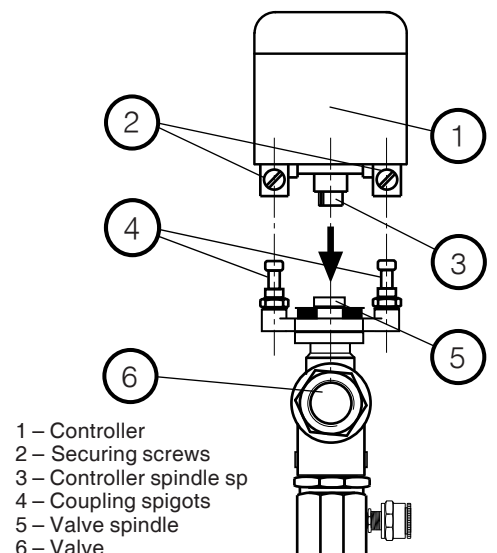
When the valve has been installed hydraulically, position the control spindle so that the entry port for hot water coming from the calorifier is open, as shown in the following diagrams.



**7.3 Coupling the controller to the valve**

The controller is supplied in the “open” position, corresponding, hydraulically, to the open position for water from the calorifier. The valve position indicator, seen in the slot in the diagram (4.1.12) must be turned in the direction of the red mark.  
If it is not in this position, plug in the power supply cable to a 230 V~ earthed mains socket: the controller should open.  
Next, loosen the two controller securing screws (2), couple the housing on the coupling spigots (4), insert the controller spindle (3) in the valve spindle (5) and then secure it by tightening the two securing screws.

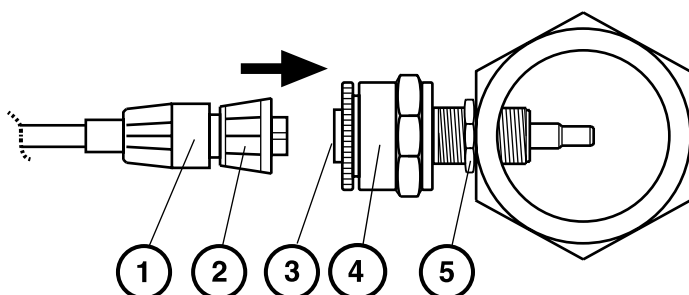
**Warning: install the controller on the valve so that the electric cable entry glands are not facing upwards. This is to ensure that water from pools of condensation or from drops falling from overhanging objects might, over time, penetrate to the inside of the electronic controller.**



## 7.4 Connecting the temperature detector

To connect the controller to the temperature detector:

- rest the female connector (1) of the pre-wired cable against the male connector (3) of the sensing element pocket,
- rotate until you find the correct position of the groove and then press so that the female connector is fully inserted in the male connector,
- rotate the nut clockwise for about half a turn until you feel it click into place
- rotating it slowly, press the securing ring nut until it is inserted in the fixed male union



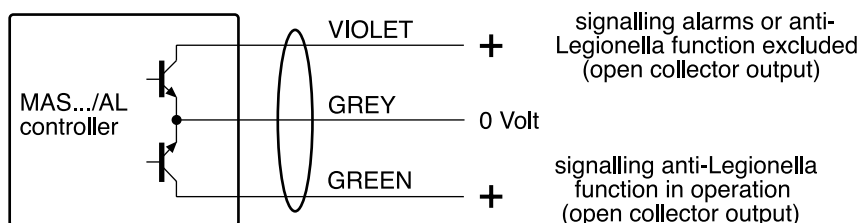
- 1 – Flexible female connector
- 2 – Securing ring nut
- 3 – Fixed male union
- 4 – Pocket with temperature sensing element
- 5 – Nut for securing pocket at desired position

Should it be necessary to replace the sensor pocket, position the lock nut at the same distance as the one mounted so that the sensing element is in the centre of the flow inside the valve.

## 8. ELECTRICAL CONNECTIONS

From the MAS.../AL electronic unit emerge three pre-wired cables:

- a metre-long power cable (4.1.15) fitted with a plug (4.1.16) for insertion in a 230 V~ earthed mains socket. If it is desired to eliminate the plug and make a permanent connection to the power supply it is advisable to include an on/off switch for the controller, thereby facilitating the programming of the anti-Legionella function.
- cable (4.1.14), about 30 centimetres long, for connecting the temperature detector. It is fitted with a female connector (4.1.13) for insertion in the male socket of the pocket situated on the mixed water outlet (see section 7.4).
- three-core cable (4.1.17), one metre long, which provides the two optoisolated outputs (open collector): one output signals the alarm for the presence of one of the possible controller faults (see section 11), while the other signals that the anti-Legionella function is in operation.



The two outputs “Signalling alarm or anti-Legionella function excluded” and “Signalling anti-Legionella function in operation” can be connected to the input terminals D (0 Volt) and E1, E2, ... (+) of Coster devices suitable for acquiring On-Off alarms (e.g. DTE 611), or for devices (e.g. ACR 328) that can convert the signals into a relay control.

## 9. OPERATION

### 9.1 Temperature control

An essential and indispensable feature of the mixer is its speed of response to the variations in temperature. The mixer compares the temperature of the water, measured by the detector, with the value set on the dial on the fascia. According to the temperature difference measured and to the Proportional Band, the controller processes the data and sends to the valve modulating controls which optimize the speed and the stability of the system (PID with exponential time band).

### 9.2 Anti-Legionella function

According to the temperature, the Legionella bacteria behave as follows:

- below 20°C Legionella can live but in a lethargic state (do not multiply, but do not die).
- between 20 and 50°C Legionella multiply, at a particularly high rate between 35 and 46 °C: that is, in the temperature range for normal DHW use.
- between 50 and 55°C Legionella can live, but in a lethargic condition (do not multiply, but do not die).
- between 55 and 60°C Legionella are eliminated in about six hours.
- between 60 and 66°C Legionella are eliminated in about 35 minutes.
- above 66°C Legionella are eliminated in about three minutes.

In order to neutralize Legionella bacteria in the DHW distribution circuit (at all points reached by the thermal "shock"), and allowing a certain safety margin, the MAS.../AL units open the valve fully (thereby raising the temperature of the distribution circuit to that of the storage calorifier) for a length of time depending on the water temperature:

- below 55°C duration of function = 7 hours (anti-Legionella function considered not to be in operation)
- between 55 and 57.5°C duration of function = 6 hours
- between 57.5 and 60°C duration of function = 3 hours
- between 60 and 65°C duration of function = 1 hour
- above 65°C duration of function = 30 minutes

If during the anti-Legionella function period the water temperature changes, the duration of the function is also modified automatically to meet the new condition.

**For a good result keep the calorifier (before the mixer) at minimum 70°C .**

## 10. TESTING AND CALIBRATING

### 10.1 Control of the temperature

After having installed the controller on the valve (7.3) and connected the temperature detector (7.4), plug in the power supply cable to the mains. The temperature of the water coming from the calorifier must be above 35°C. Then proceed as follows:

- set the desired temperature dial to minimum (30°C): the controller should close the valve completely (the indicator moves towards the blue mark) and the mixed water should be cold.
- set the desired temperature dial to maximum (70°C): the controller should open the valve completely or start making adjustments if the calorifier temperature exceeds 70°C (the indicator moves towards the red mark) and the mixed water should be hot.
- set the desired temperature dial to the required temperature (generally between 47°C and 50°C = black zone of scale): check that the temperature of the mixed water is at the desired value.

If the test gives a negative result, first of all check that the installation is correct (see section 7).

### 10.2 Programming the time of activating the anti-Legionella function

**WARNING:** the activation of the anti-Legionella function can bring about the release, in the distribution circuit, of DHW at very high temperatures (calorifier temperature). Accordingly, it is preferable for the function to operate at times when the use of DHW is improbable.

On the basis of this consideration, **the controller is programmed in the factory to operate the anti-Legionella function at 02.00 (British Summer Time) during the night between Sunday and Monday:** this is considered to be one of the periods when the use of DHW is least likely

**If you want to change the day and time, do as follows:**

- 1) when the controller is powered, the "HOURS" and "DAYS" LEDs light, alternately, a number of times equal to the hours and days to go before the activation of the anti-Legionella function, according to the program existing in the MAS.
- 2) remove power by taking out the plug from the mains socket, wait a few seconds, and then power up by re-inserting the mains plug.
- 3) from this moment there are two minutes (120 seconds) available in which to press the buttons to start setting the new time and day (if during the two minutes no buttons are pressed the previous programming is maintained). For each depression of either of the two buttons a new period of 30 seconds starts: it is necessary to act within this period in order to continue the programming. After 30 seconds have elapsed from the last depression of the buttons, MAS memorises the programming up to that moment.

Then proceed as follows:

- \* press the "HOURS" button **as many times as the number of hours which separate the actual hour from the desired hour (each time the button is pressed the corresponding LED lights).**
- \* press the "DAYS" button **as many times as the number of days which separate the actual day from that desired (each time the button is pressed the corresponding LED lights).**

**WARNING:** if the time to be programmed is previous to the actual time and so, in the course of its setting, midnight (24.00 hours) is passed, it is necessary to count one day less.

- 4) 30 seconds after the last depression of either of the two buttons, the controller memorises the setting made and the "HOURS" and "DAYS" LEDs will indicate, by flashing, the number of days and hours which must pass before the anti-Legionella function is activated.
- 5) in this way it is possible to check the correctness of the new programming. In the event of an error, repeat the programming starting from point 2.

**Example 1:** display of the days and hours before the start of the anti-Legionella function

- current time = 17.00.
- current day = Thursday
- time programmed for anti-Legionella = 03.00 Monday morning (night between Sunday and Monday).
- "HOURS" LED will light 10 times: between 17.00 and 03.00, in fact, 10 hours elapse. (18-19-20-21-22-23-24-01-02-03).
- "DAYS" LED will light 3 times: between Thursday and Monday four days pass, but since one day has already been taken into account by passing 24.00, the number of days becomes 3.
- in fact, between the two dates elapse exactly 3 whole days and 10 hours.

**Example 2:** changing time of intervention of anti-Legionella function to a time later than that set:

- current time = 09.15
- current day = Wednesday
- desired day and time for activating anti-Legionella = 11.15 Tuesday morning
- hours lacking (number of depressions of "HOURS" button) = 2 (10,15,11,15)
- days lacking (number of depressions of "DAYS" button) = 6 (Thursday-Friday- Saturday-Sunday-Monday-Tuesday). The days are counted entirely since the time programmed is later than the actual time and, in the course of its setting, midnight has not been passed).
- wait 30 seconds and the "HOURS" and "DAYS" LEDs will start to light according to the program set, i.e. exactly twice for the hours and 6 times for the days.

**Example 3:** changing time of intervention of anti-Legionella function to a time earlier than that set:

- current time = 17.00
- current day = Friday
- desired day and time for activating anti-Legionella = 13.00 Monday
- hours lacking (number of depressions of "HOURS" button) = 20 (18-19-20-21- 22-23-~~24~~-01-02-03-04-05-06-07-08-09-10-11-12-13)
- days lacking (number of depressions of "DAYS" button) = 2 (Saturday-Sunday. The days become "3-1" since the programmed time is earlier actual one and, during its setting, midnight has been passed).
- wait 30 seconds and the "HOURS" and "DAYS" LEDs will start to light according to the program set i.e. exactly 20 times for the hours and twice for the days.

**Comment :**

- if the time programmed is already correct and you want to change only the day, use only the "DAYS" button. If, on the other hand, you want to program the start of the function within 23 hours of the current time, use only the "HOURS" button.

### 10.3 Manual activation of the anti-Legionella function

At any time, even during the first two minutes of start-up dedicated to programming, the anti-Legionella function can be activated by pressing at the same time the "DAYS" and "HOURS" buttons for at least 10 seconds. In the period "Anti-Legionella function active" the "DAYS" and "HOURS" LEDs are both lit and remain lit.

### 10.4 Switching off anti-Legionella function

If the anti-Legionella function has been activated manually, this function can be switched off manually by pressing the "DAYS" and "HOURS" buttons at the same time for at least 10 seconds.

The exclusion of the anti-Legionella function will be indicated by the "DAYS" and "HOURS" LEDs which, from the fixed lit condition will start signalling respectively the days and the hours to go before its next automatic activation or, in the event of an error status, will indicate which error.

The function cannot be switched off manually if it has been activated automatically.

### 10.5 Permanent exclusion of anti-Legionella function

During the first two minutes after activation (time for programming) press the "DAYS" key exactly 10 times: in this condition the intervention of the anti-Legionella function will be completely excluded.

If the function is excluded, the "DAYS" and "HOURS" LEDs will flash simultaneously in cycles of three.

## 11. LIGHT SIGNALS

The two LEDs provide an immediate visual indication of the operational status.

- 1) **Normal operation with anti-Legionella function programmed:** this is the normal operating condition and the "HOURS" and "DAYS" LEDs flash separately. The number of flashes indicates respectively the number of days and hours to go before the activation of the function.
- 2) **Anti-Legionella function in progress:** both LEDs remain lit.
- 3) **Programming phase:** during the programming of days and hours the LEDs indicate, with a flash, that the relative key has been pressed.
- 4) **Temperature detector fault (Priority 1):** the LEDs flash at the same time once only. The temperature detector might be short-circuited (in this event the valve closes); or there could be an open circuit (in this event the valve opens).
- 5) **Clock incoherent (Priority 2):** the LEDs flash twice at the same time. In this condition the anti-Legionella function is disactivated.
- 6) **Anti-Legionella function excluded (Priority 3):** as indicated in 10.5. The LEDs flash three times simultaneously.
- 7) **Incomplete anti-Legionella function (Priority 4):** the LEDs flash 4 times simultaneously. The anti-Legionella function has not been implemented because the calorifier water temperature was too low at that moment. These LED signals disappear if, automatically or manually, the function is activated and completed with a positive result.

**Warning :** the indications of malfunctioning or of the exclusion of the anti-Legionella function (indicated by "Priority 1...4") are not displayed during the first two minutes of start-up dedicated to programming. Moreover, in the event of the presence of several contemporary warnings, that with the lowest priority is displayed: that it, precedence is given to the most important warning.

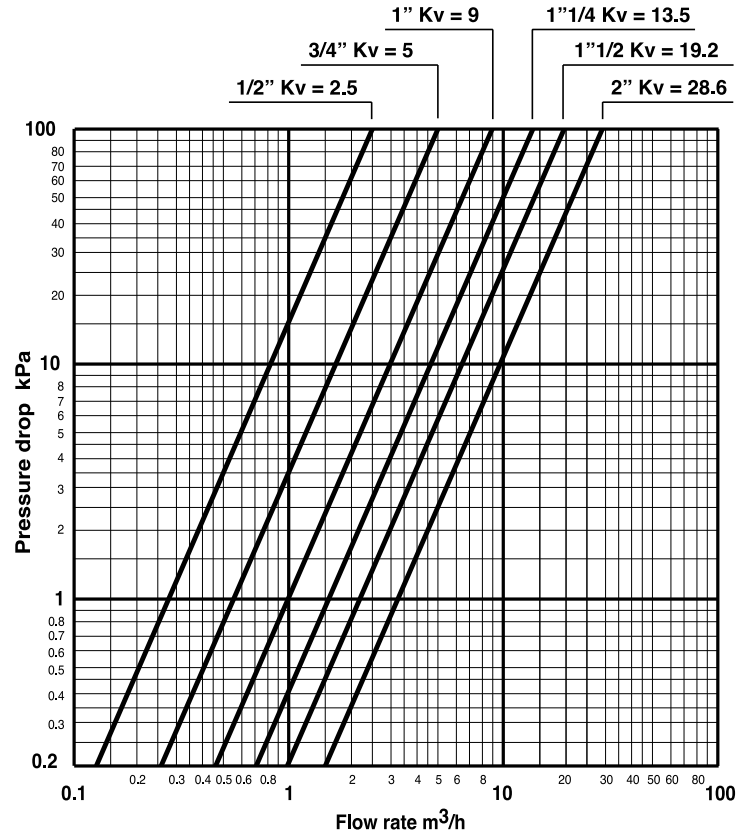
**12. OUTPUT SIGNAL**

The controller has two electronic-type outputs deriving from two optoisolators (open-collector):

- output 1: warning that the anti-Legionella function is in progress.
- output 2: warning of the presence of at least one of the four possible types of malfunctioning indicated in section 11 under points 4), 5), 6) and 7).

These two warnings are available for further automations or remote alarms.

**13. PRESSURE DROP CHART**



100 kPa = 1 bar = 10 mWG

## 14. REPLACEMENT OF ELECTRONIC CONTROLLERS MAS 66/E - MAS 77/E

### 14.1 Replacement of MAS 66/E by MAS 600/AL/E

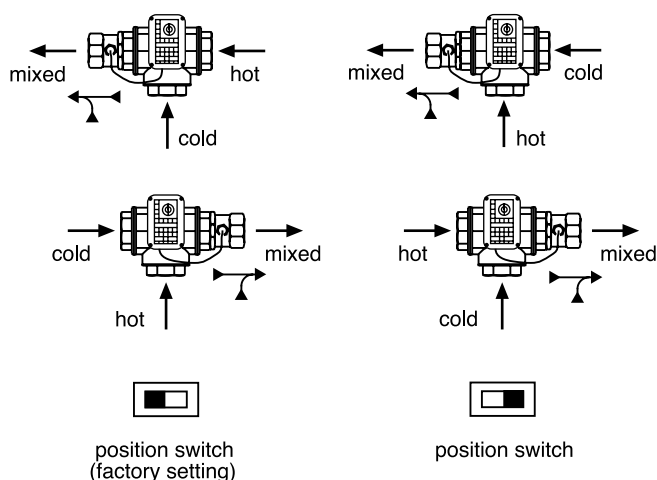
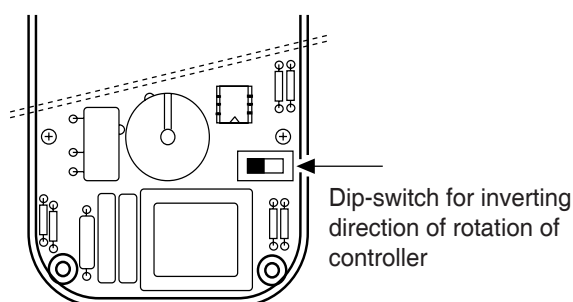
If you want to replace a MAS 66/E electronic controller (controller for MAS 660-661-662-663) by electronic controller MAS 600/AL/E you must:

- replace the existing pocket with a new pocket and temperature sensing element.  
Position the lock nut so that the extremity of the pocket, where the sensing element is housed, is in the centre of the flow of water inside the valve. The pocket must be sealed to the valve with a hydraulic glue (Teflon or hemp) to ensure there is no water leakage to the outside.
- Install MAS 600/AL/E controller. Connect the female union of the controller to the male union of the sensing element pocket as described in section 7.4.

### 14.2 Replacement of MAS 77/E by MAS 700/AL/E

If you want to replace MAS 77/E electronic controller (controller for MAS 770-771) by a MAS 700/AL/E unit you must:

- replace the pocket as described in section 14.1 (replacement of MAS 66/E by MAS 600/AL/E).
- on the valve plate insert in the two actuator securing holes the two spacing collars supplied with MAS 700/AL/E.
- install MAS 700/AL/E controller on the spacing collars so that the protruding spindle of the actuator fits into the groove on the valve spindle. Connect the female union of the controller to the male union of the sensing element pocket as described in section 8.4.
- the valves of MAS 770-771 had, as output for mixed water, not the central port but one of the two opposite ports; therefore, according to the type of installation, the correct direction of rotation of the controller may be the factory setting or the opposite.
- If it should be necessary to invert the direction of rotation of the valve output control, set the desired temperature dial to minimum (in order to have a definite reference position); then, after having loosened the four securing screws, remove the cover and handle. Move the dip-switch on the printed circuit to the right (see diagram below) and then replace the cover and the handle (which should still be in the minimum position), taking care that the waterproofing seals are not damaged.



#### Amendment to data sheet

Date	Revision No.	Page	Section	Details of amendment
02.10.07 MZ	<b>01</b>	3	7.2. Positioning the valve spindle	Update valve spindle diagram
03.11.08 MZ	<b>02</b>	2	4.2 Overall dimensions & weight	Update overall dimensions
27.02.09 AM	<b>03</b>	1	3. MODELS	Update table