

## Hybrid electronic mixing valve



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**6000 series LEGIOMIX 2.0**

### INSTALLATION AND COMMISSIONING MANUAL



#### Operating principle

The electronic hybrid mixing valve combines the typical function of the mechanical thermostatic mixing valve and the management efficiency of an electronic mixing valve in a single device.

The thermostatic mixing valve uses the mechanical action performed by the internal control thermostatic element, which responds promptly to any variation in temperature, pressure and inlet flow rate to quickly restore the mixed water temperature value at the outlet.

This standard mixing valve is effectively handled by a motorised actuator that, upon the signal coming from the temperature probes and under the control of a specific regulator, changes the mixed water temperature set position.

The electronic regulator, directly on the actuator, allows the mixed water temperature control according to different functional programs, both for normal control and for the thermal disinfection for the prevention of Legionella.

An optional memory system allows recording every minute of flow temperature, return temperature, alarm and functional statuses, useful for monitoring the operating status of the entire system.

Appropriate relays are used to manage the alarms and external appliances, for example for loading accumulation hot water and switching on/off the recirculation pump.

The regulator is fitted for remote control with specific transmission protocols such as MODBUS, through optional board, for use in Building Management Systems (BMS).

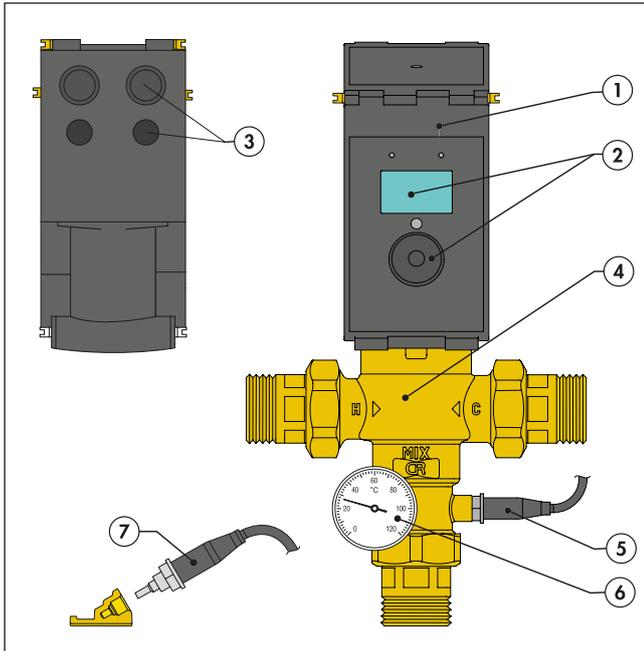
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## Product range

6000 series Hybrid electronic mixing valve \_\_\_\_\_ sizes DN 15 (1/2"), DN 20 (3/4"), DN 25 (1"), DN 32 (1 1/4"), DN 40 (1 1/2"), DN 50 (2")

### Characteristic components



- 1 Digital regulator with actuator in single casing
- 2 Control knob and LCD display
- 3 Fitted for cable seals and cable glands, with holes
- 4 Valve body
- 5 Mixed water temperature probe
- 6 Mixed water temperature gauge
- 7 Return temperature probe and probe holder

### Package content

- Thermostatic mixing valve complete with regulator-actuator
- Temperature gauge
- Flow probe
- Return contact probe
- Cable seals/cable glands
- Installation and commissioning manual
- Programming manual

On the back of the regulator-actuator there are 2 PG7 cable glands, in addition to 2 grommets which should be removed before installing the cable gland (diam. 20 mm), to guarantee protection class IP 54.



### Technical specifications

#### Valve body

Materials:  
 Body: dezincification resistant alloy **CR** EN 1982 CC770S  
 Obturator: PPSG40  
 Hydraulic seals: EPDM  
 Spring: stainless steel EN 10270-3 (AISI 302)  
 Maximum working pressure (static): 10 bar  
 Maximum inlet temperature: 90 °C  
 Temperature gauge scale: 0–120 °C

Connections: 1/2"–2" M (ISO 10226-2) with union

#### Regulator-actuator

Material:  
 Housing: PA6G30 anti-UV black  
 Covers: PA6G30 anti-UV black  
 Electric supply: 230 V (AC) 50/60 Hz  
 Power consumption: 11 VA  
 Adjustment temperature range: 35–65 °C  
 Disinfection temperature range: 50–85 °C

Ambient temperature range:

- Operation: 0–50 °C EN 60721-3-3 Cl. 3K3 max. humidity 85 %
- Transportation: -30–70 °C EN 60721-3-2 Cl. 2K3 max. humidity 95 %
- Storage: -20–70 °C EN 60721-3-1 Cl. 1K3 max. humidity 95 %

Protection class: IP 54

Contact rating:

- Relay OUT1, OUT2, OUT3: 5(2) A / 250 V without potential

Fuses:  
 - primary: self-resettable, non-replaceable  
 - secondary: 5x20, T 630 mA, 250 V

Battery: ER AA Lithium  
 Thionyl chloride 3.6 V lasting about 10 years  
 (for only keeping date and time in the absence of network)

Conformity: CE - UKCA

Insulation class: Class II

#### Temperature probes

Body material: stainless steel  
 Type of sensitive element: NTC  
 Working temperature range: -10–125 °C  
 Resistance: 10000 Ohm at 25 °C  
 Time constant: 2,5  
 Max. distance for flow or recirculation probe: 150 m cable 2x1  
 250 m cable 2x1,5

#### Mixing valve performance

Accuracy: ± 2 °C  
 Max. working pressure (dynamic): 5 bar  
 Max. inlet pressure ratio (H/C or C/H): 2:1

Size	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"
Kv (m³/h)	4,3	4,3	7,6	10,0	13,0	18,0

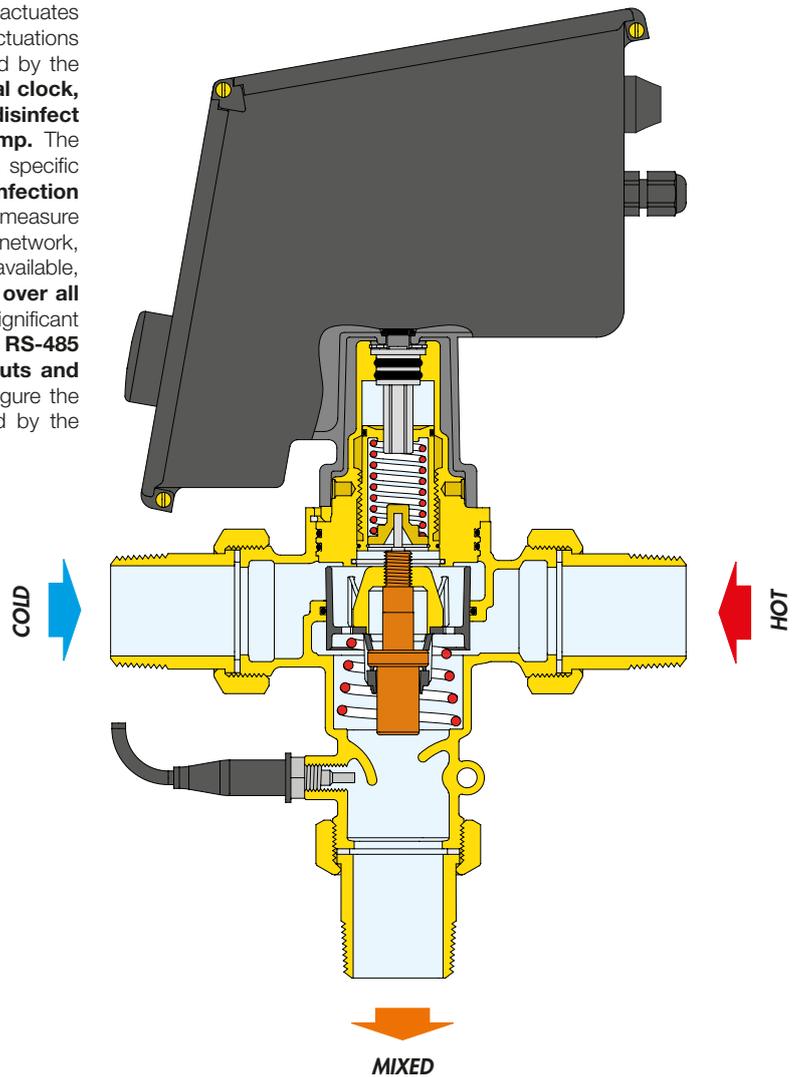
#### RECOMMENDED flow rates to ensure stable operation and an accuracy of ± 2 °C

Size	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"
Min (m³/h)	0,6	0,6	1	1,2	1,5	2,0
Max (m³/h)*	5,3	5,3	9,3	12,5	16,0	22,1

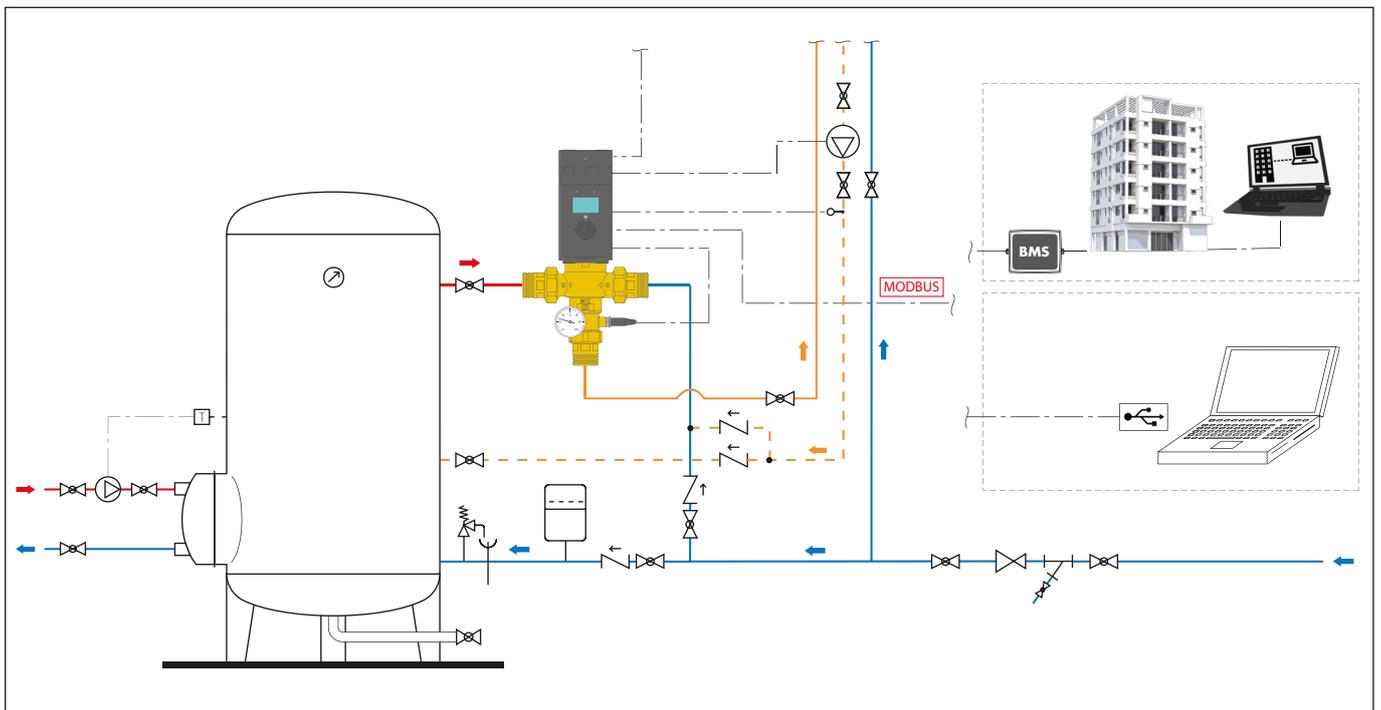
\* Δp = 1,5 bar

## Operating principle

At the inlets the mixing valve has the hot water from the storage and the cold water from the water mains. At the outlet there is the flow mixed water. By means of a specific probe, the regulator measures the temperature of the mixed water at the valve outlet and actuates an obturator in order to maintain the setting. Temperature fluctuations caused by flow rate or pressure variations are compensated by the thermostat in the valve. **The appliance has a built-in digital clock, which can be used to set anti-legionella programs to disinfect the water system and to manage a recirculation pump.** The system is disinfected by raising the water temperature to a specific value for a set time duration. **For the best thermal disinfection control**, in this type of system it may also be necessary to measure the temperature of the water returning from the distribution network, **using the recirculation probe.** When this measurement is available, it is used to check and **control the temperature reached over all or part of the network**, since the probe may be located at a significant remote point of the system. The appliance is equipped with **RS-485 interface (optional), with MODBUS protocol, for readouts and remote setting.** To use the device, it is necessary to configure the MODBUS system with the addresses of the registers used by the device (PC software is available).



## Application diagram



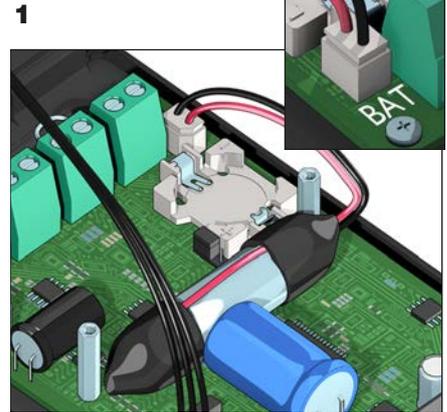
## Regulator-actuator



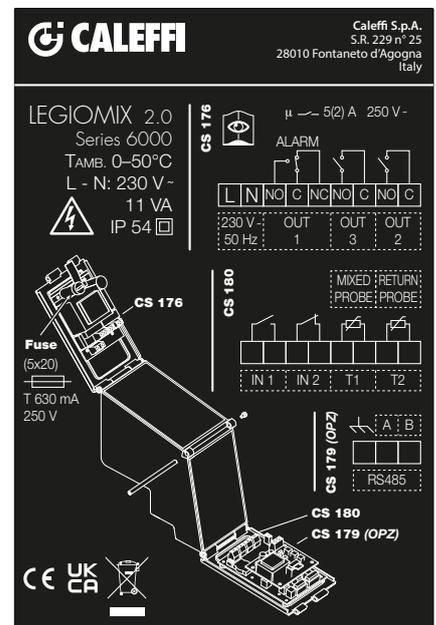
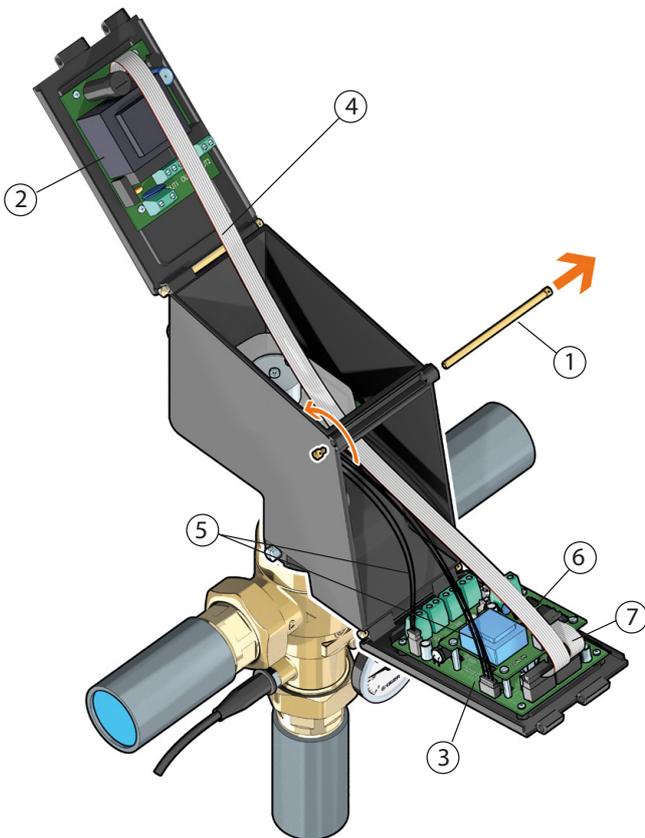
### Battery installation

Before switching on the device, make sure the battery is connected correctly (fig. 1). The presence of the battery allows continuous updating of the clock. If the battery is flat or not installed, the device will not maintain the correct time and date (if the mains power is also cut off). This means the device may not guarantee that disinfection cycles take place as scheduled.

NOTE: battery code F0000692, type ER AA Lithium - thionyl chloride 3.6 V has a life of around 10 years. If it needs to be replaced, connect the new battery as shown in fig. 1.



## Wiring diagrams



- 1 Actuator-regulator opening/closing pin
- 2 Power supply board (CS176)
- 3 Control board (CS180)
- 4 Multi-pole cable for board connection\*
- 5 Motor connection cables\*
- 6 RS-485 Interface board (CS179) (OPTIONAL)
- 7 RS-485 Interface connection cable (OPTIONAL)

\* already assembled in factory



### IMPORTANT:

Risk of electric shock. The CS176 board is live. Cut off the electric supply before carrying out any work. Failure in following these instructions may result in injury of persons or damage to property. In case of power failure the system can activate an alarm through OUT1 relay. Date and time are maintained by the battery. If the battery is low, the system displays the "BATTERY LOW" alarm.

**Electronic boards description**

**CS176 - Electric supply and relay**

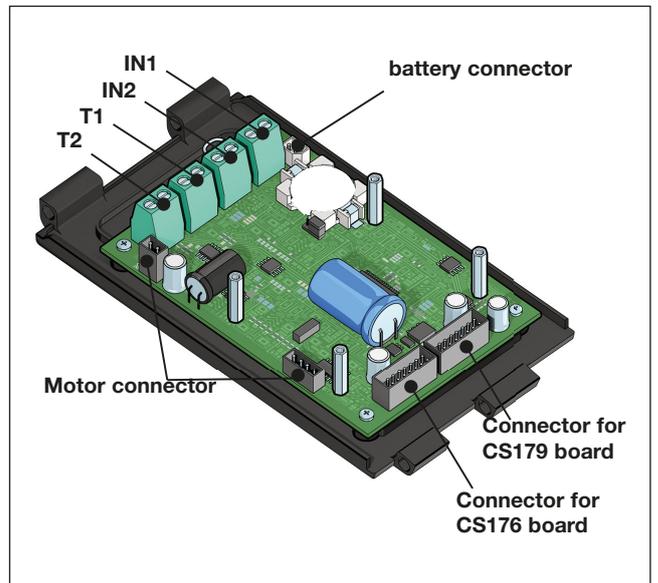
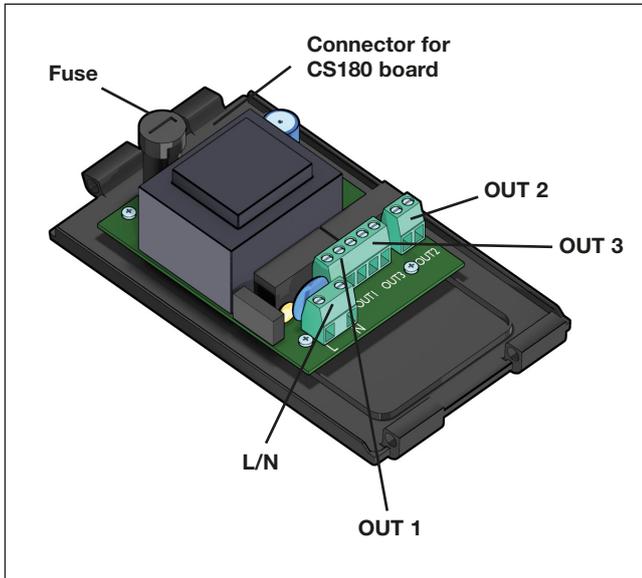
The following connection inputs are on the board:

- L/N = Power supply 230 V 50/60 Hz
- OUT 1 = ALARM Relay: Contact in derivation without potential
- OUT 3 = DISINFECTION IN PROGRESS relay without potential
- OUT 2 = RECIRCULATION PUMP relay without potential  
(it activates the pump during thermal shock disinfection and when recirculation programming is active)
- FUSE = 5x20, T 630 mA, 250 V

**CS180 - Contacts and probes**

The following connection inputs are on the board:

- IN1 = NO (normally open) potential-free contact for disinfection start-end depending on the mode set
- IN2 = Potential-free contact (by default forced in closing by jumper) for disinfection/thermal shock stop (emergency)
- T1 = Delivery probe
- T2 = Return probe



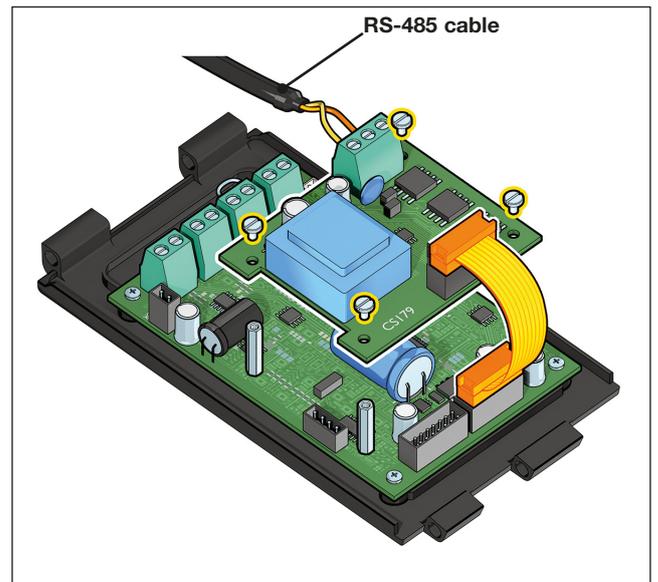
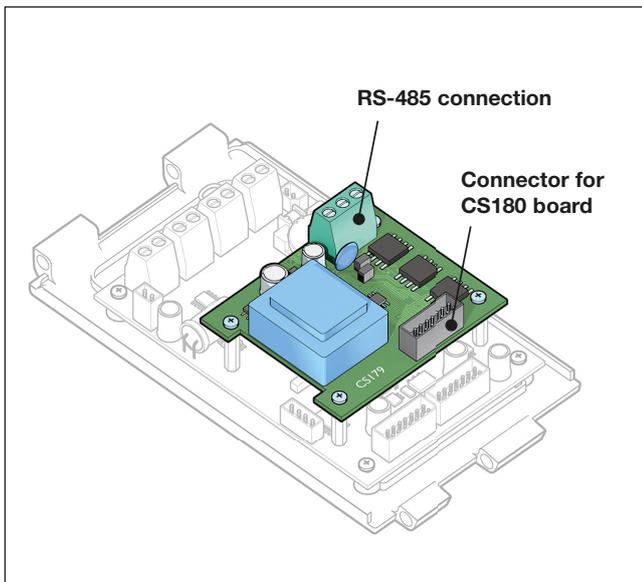
**CS179 - Data transmission (optional) code 600001**

RS-485 interface MODBUS connection.

An optional memory system allows recording the flow temperature, return temperature, alarms and functional statuses, useful for monitoring the operating status of the device. The connection also allows the remote control of the mixing valve for both parameter acquisition and modification. The communication is made with the MODBUS RTU 9600 ON protocol.

**Board installation CS179 (optional) on CS180 board**

The supply includes 4 screws for correct installation on the 4 spacers already fitted for on the CS180 board and the multi-pole connection cable with the CS179 board (RS-485 cable NOT supplied).



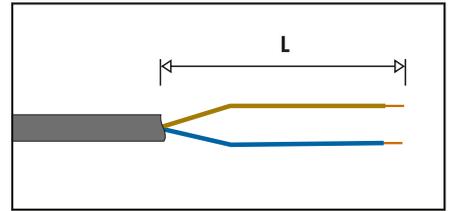
**IMPORTANT:**

When fitting cables for electric connections, be careful not to damage the electronic board components. Every time the regulator-actuator is removed from the valve it is necessary to perform a new zero acquisition by means of the appropriate control. Do not disassemble the electronic boards from the appropriate supports. Do not disassemble the motor.

## Cables pathway

**Minimum dimensional characteristics to respect for board electric connections: connection cable cross sections and lengths.**  
Observe the applicable regulations in force in the country of installation.

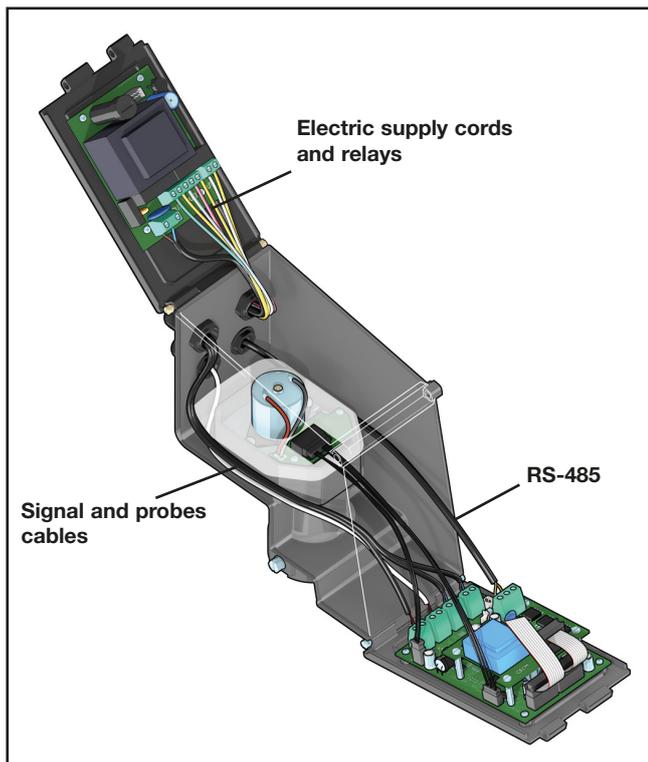
BOARD	TERMINAL	CABLE TYPE	UNSHEATHING IN mm (L) POS. A *	UNSHEATHING IN mm (L) POS. B *
CS176	L/N	2 X 0,75 (H05VV-F)	250	140
	OUT1	3 X 1	250	140
	OUT2	2 X 1	250	140
	OUT3	2 X 1	250	140
CS180	T2	2 X 0,75	140	250
	T1	2 X 0,75	140	250
	IN1	2 X 0,75	140	250
	IN2	2 X 0,75	140	250
CS179	RS-485	2 X 1 TW+SCH	190	300



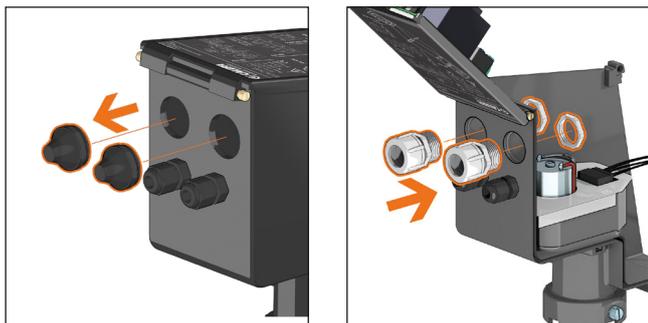
\* NOTE: for installation, see page 9.

## Cables wiring and positioning

The passage of the connecting cables must be prepared trying to separate the electric supply cables from the signal cables using the appropriate clamps. This image shows an example of a possible cable layout and their passage through the cable seals and cable glands included in the supply. For different cases use special insulating sheaths.



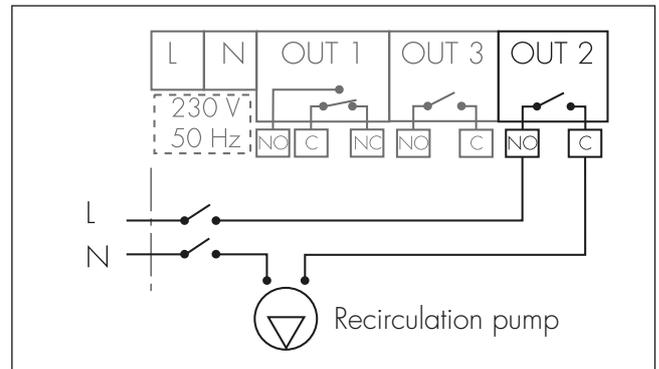
If it becomes necessary to use the top cable glands, remove the grommets and insert the cable glands



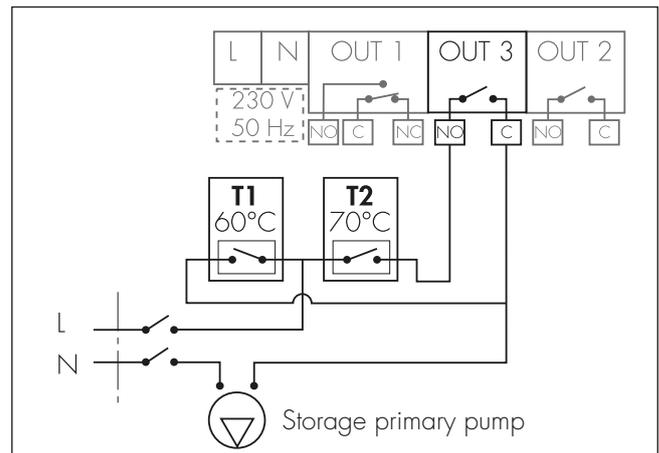
**Connections layout: connections must not create thrust stresses on the circuit board.**

## Relay contact for recirculation pump and second storage thermostat and alarm management

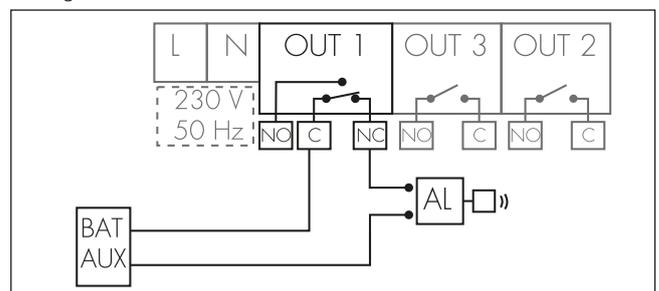
Here following the wiring diagram of the OUT 2 relay for managing the recirculation pump. The device incorporates a digital clock used to manage a recirculating pump according to pre-set time slots.



Here following the wiring diagram of the OUT 3 relay for connection to the second storage thermostat.



Here following the wiring diagram of the OUT 1 relay for alarm management.



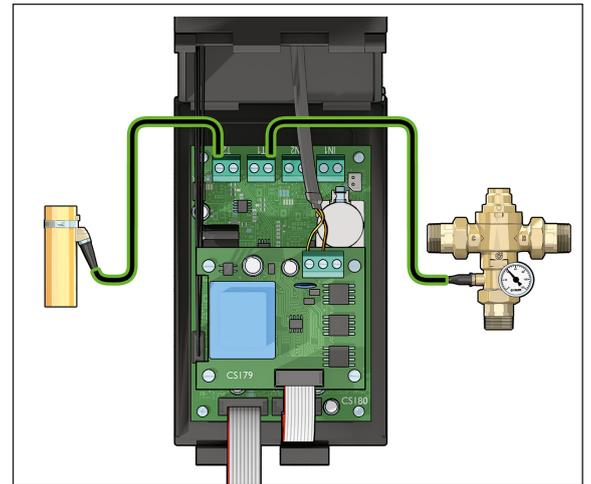
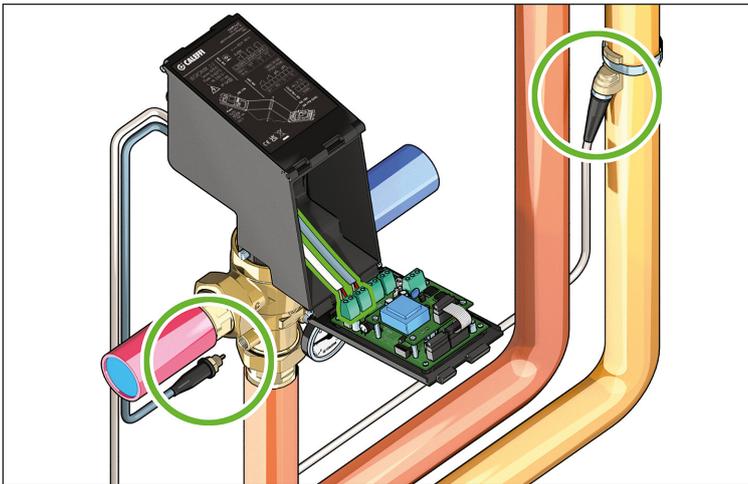


**Connection of probes:**

If necessary for the installation, the cable connecting the flow and return probes with the controller must be installed in a raceway. If the connection cable shares the raceway with other power cables, an earthed shielded cable must be used.

**Probe resistance table**

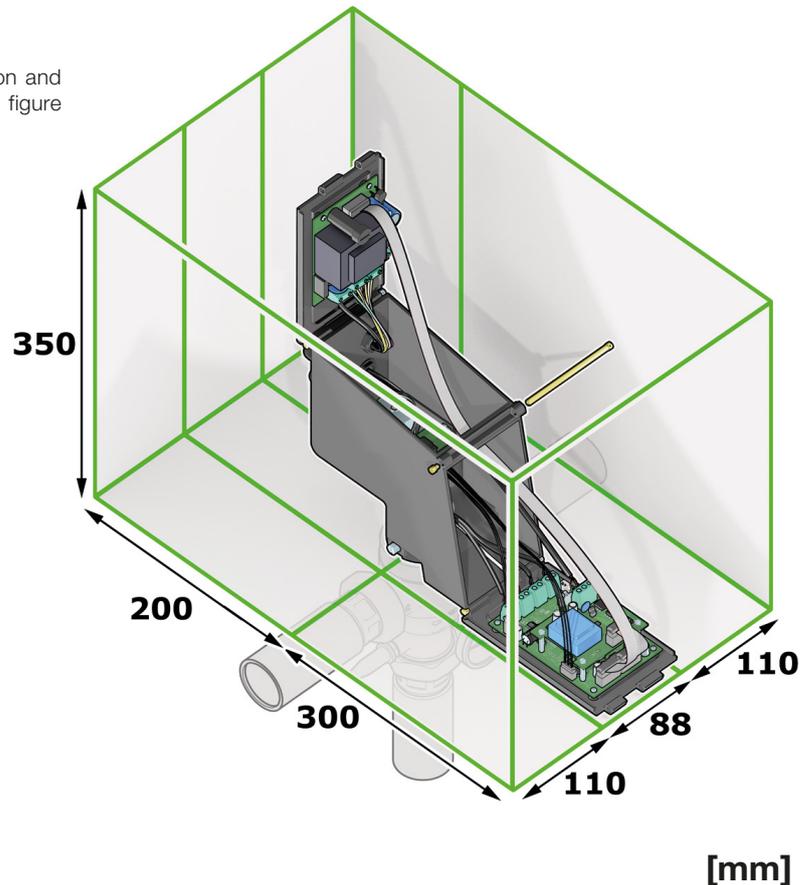
°C	Ω	°C	Ω	°C	Ω	°C	Ω
-20	97060	20	12493	60	2488	100	680
-15	72940	25	10000	65	2083	105	592
-10	55319	30	8056	70	1752	110	517
-5	42324	35	6530	75	1480	115	450
0	32654	40	5327	80	1255	120	390
5	25396	45	4370	85	1070	125	340
10	19903	50	3603	90	915		
15	15714	55	2986	95	787		



Perform the hydraulic installation of the temperature probes and provide electrical wiring.

**Recommended minimum distances**

In order to ensure adequate space for proper installation and maintenance of the device, the distances shown in the figure must be observed.



## Front panel



- 1 LCD display
- 2 Control knob
- 3 Green LED: - On (network presence)
- 4 Red LED: - Fixed (disinfection or thermal shock in progress, full scale acquisition)  
- Flashing (alarm condition)

## Indication on LCD display

On the front of the device there is a backlit alphanumeric LCD display for parameter setting, interventions programming, working statuses and alarms display.

Navigating through appropriate menus, using the control knob only, it is possible to configure the device and set the various parameters.



## Operating status

Depending on the times and the programs that have been set, the device may be in one of the following operating modes:

- Regulation
- Disinfection
- Thermal shock\*
- Zero and full scale acquisition

\*(this function has priority over the disinfection/regulation).

In the event of anomalies, the device manages and signals an alarm trying to set into a safety condition for the user. The device is equipped with a non-rechargeable battery that keeps the clock working in the event of electric supply failure.

## Regulation

The electronics must adjust the flow temperature through the actuator in order to reach the working set-point. The electronic actuator adjusts the flow so as to have a temperature centered in a suitable working range, within which the fine and dynamic adjustment is made by the thermostat. The mixing temperature is set through the interface. The management system always checks in real time the flow temperature detected by the probe: if the flow temperature deviates excessively from the set value, a correction is made through the electric motor. In the case of installation with a return probe present, it is not used for the water mixing temperature adjustment.

## Disinfection

In this mode, the device performs thermal disinfection, which consists in raising the mixed water temperature for a defined period of time.

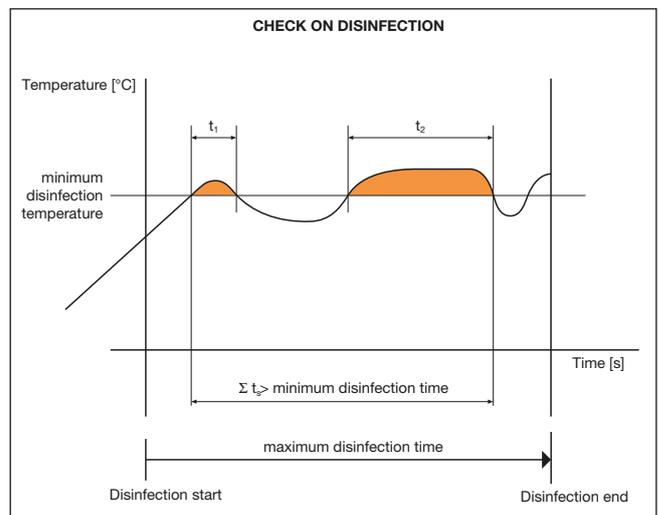
The following can be set:

- Days of the week for performing the disinfection
- Minimum disinfection temperature
- Disinfection start time
- Minimum stay time above the minimum disinfection temperature in order to evaluate the successful outcome of the disinfection
- Maximum time within which it is possible to perform the disinfection

The disinfection can be:

- Programmed: it starts in the days and hours set
- Activated through the control: it can be controlled by the device from the "Controls submenu" or remotely through optional board
- Activated by IN1 inlet

The disinfection in progress OUT3 relay and the recirculation pump management OUT2 relay are always activated during the disinfection. If the disinfection temperature does not last for sufficient time and the maximum available time is exceeded, the disinfection will be considered as failed by signalling the relevant alarm.



## Thermal shock

In this mode, the device raises the flow temperature to the set value for a certain period of time. The disinfection in progress OUT3 relay and the recirculation pump management OUT2 relay are always activated during the thermal shock.

## Zero and full scale acquisition

In the zero acquisition mode, the device totally closes the adjusting screw to check the correct phasing between the motor and the valve. In full scale acquisition mode, the device fully opens the adjusting screw so it can check all the stroke (potentially hazardous condition indicate with fixed red LED). The zero and full scale acquisition controls are activated during the installation or after the "Reset alarms" control.

Additionally, the zero acquisition mode is activated whenever an electric supply failure occurs for at least 60 minutes and at the outlet from any disinfection/thermal shock. It is recommended to perform the full scale acquisition with shut-off valves closed at the mixing valves inlets.

## Reset

In the menu there is a special control to reset to the initial conditions. The history is not reset.

## Test

The device performs full strokes in order to check that there are no obstructions during the motor opening and closing strokes. The display shows the encoder steps and the power consumption (mA). It is possible to interrupt the test function at any time pressing the control knob.

## Plumbing installation

Before installing the Caleffi mixing valve, the pipes must be flushed to prevent impurities in the water from affecting performance. The following are indicated on the body of the mixing valve:

- H hot water inlet
- C cold water inlet
- MIX mixed water outlet

In systems with mixing valves, check valves must be installed to prevent undesired backflow.

We recommend always installing strainers of sufficient capacity at the inlet of the water mains and shut-off valves for any maintenance operations.

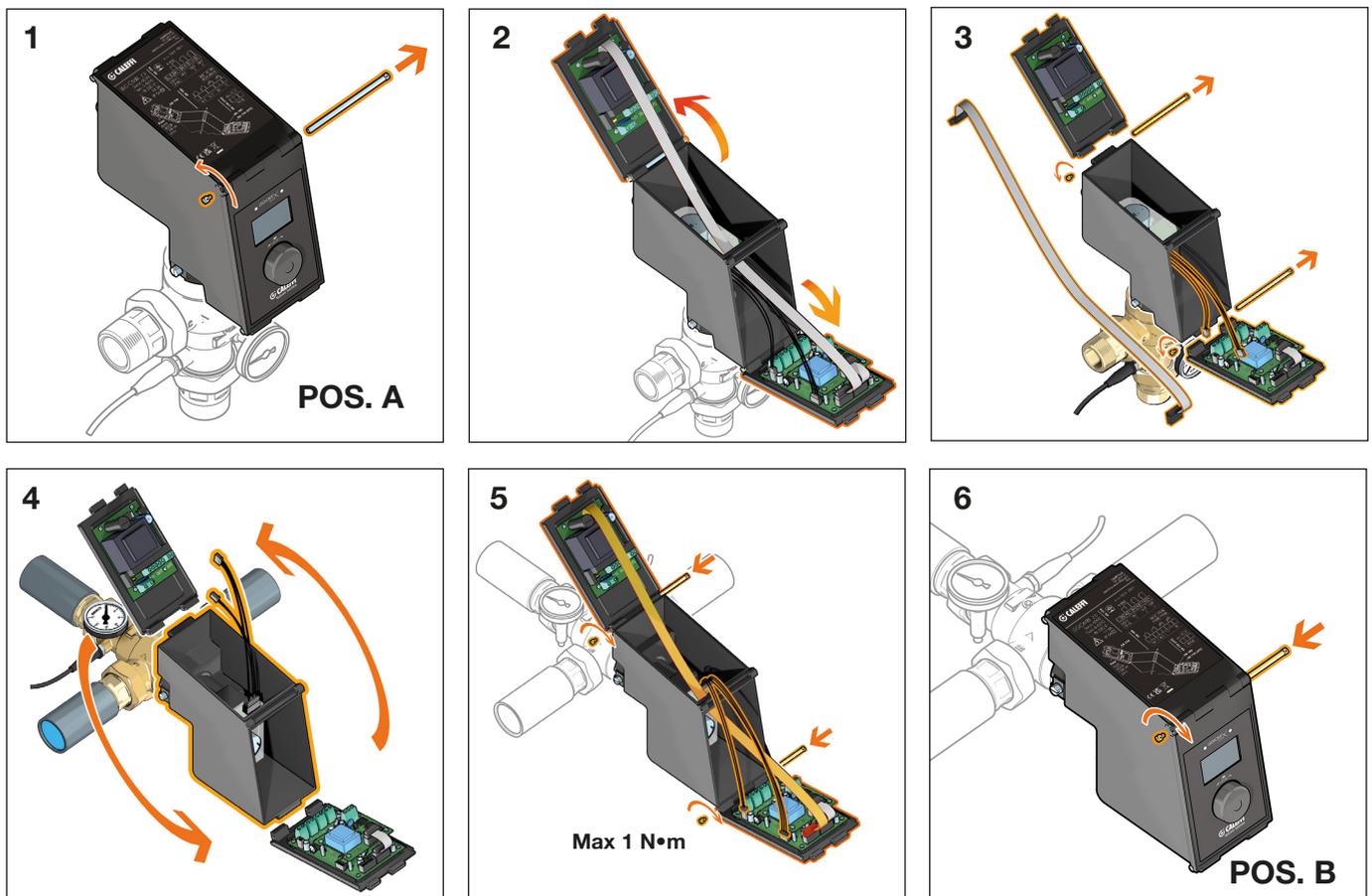


If the system is flushed with chemicals, leave the plug of the temperature probe installed.  
For future flushing procedures, disconnect the temperature probe and fit the relevant plug.  
Connect the probe only after the flushing operation.

The mixing valves must be installed according to the installation diagrams in this manual; they can be installed either vertically or horizontally, with actuator not overturned. To facilitate the display reading and setting, it is possible to change the position of the motor related to the valve in four positions at 90°, there is also the possibility to reverse the two panels.

In order to reverse the panels, before to electrically wire the device, it is necessary to carry out the following operations:

- 1 - Remove the opening/closing pin (POS. A: factory setting).
- 2 - Open the panels.
- 3 - Disconnect the board connectors, motor connector, and remove the pins.
- 4 - Remove and reverse the panels.
- 5 - Reconnect the boards connector and the motor connector, insert the pins.
- 6 - Close the panels and insert the opening/closing pin (POS. B).



## Commissioning

Due to the special purposes for which the electronic mixing valve will be used, it must be commissioned in accordance with current regulations and by qualified personnel using suitable measuring instruments. Check that the hot and cold water supply pressures are within the operating limits of the mixing valve. Check the temperature of the hot water from the storage,  $T \geq 60^{\circ}\text{C}$ .

In the installation log book, record all the parameter settings made and the measurements taken.

**Thermal disinfection**

The temperatures and corresponding times for disinfection of the system must be selected according to the type of installation and its intended use. To meet the requirements of the most recent world legislation on this matter, the following criteria can generally be followed:

- T = 70 °C for 10 minutes
- T = 65 °C for 15 minutes
- T = 60 z°C for 30 minutes

Thermal disinfection is generally carried out at times when there is less demand on the system, for example at night; this is to minimize the risk of users being scalded. It is recommended to perform thermal disinfection every day and at least once a week.

**Maintenance**

Tests are carried out while in service, to regularly monitor the performance of the mixing valve, since any loss of performance may indicate the need for maintenance of the valve and/or the system. During these tests, if the temperature of the mixed water is found to have changed significantly compared with previous tests, we recommend referring to the sections on installation and commissioning and carrying out maintenance.

We recommend carrying out the following checks periodically to ensure that the valve continues to deliver optimum levels of performance. At least every 12 months, or more frequently if required.

- 1) Check and clean the filters in the system
- 2) Check that any check valve installed at the inlet of the Caleffi valve is functioning correctly, and there are no leaks caused by dirt.
- 3) Once the maintainable components have been checked, we recommend following the commissioning procedure again.

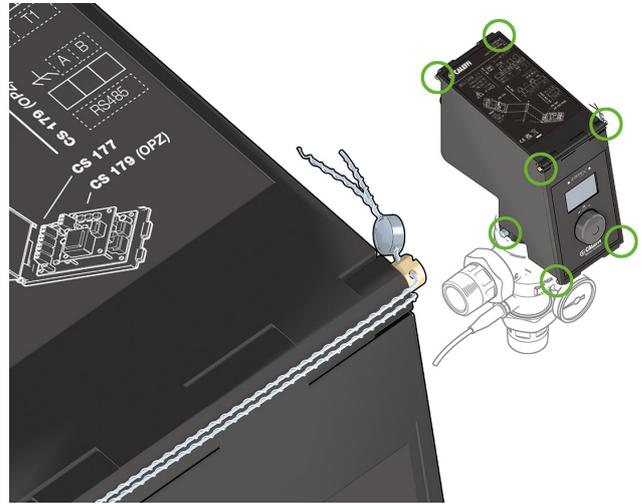
On the system log book, record all operations carried out.

**Functional faults**

A special set of alarms has been fitted to help manage possible faults that can occur in the device. Refer to the dedicated section of the "Programming Manual" (code H0003581).

**Seals**

The screws are fitted for the installation of anti-tampering seals.



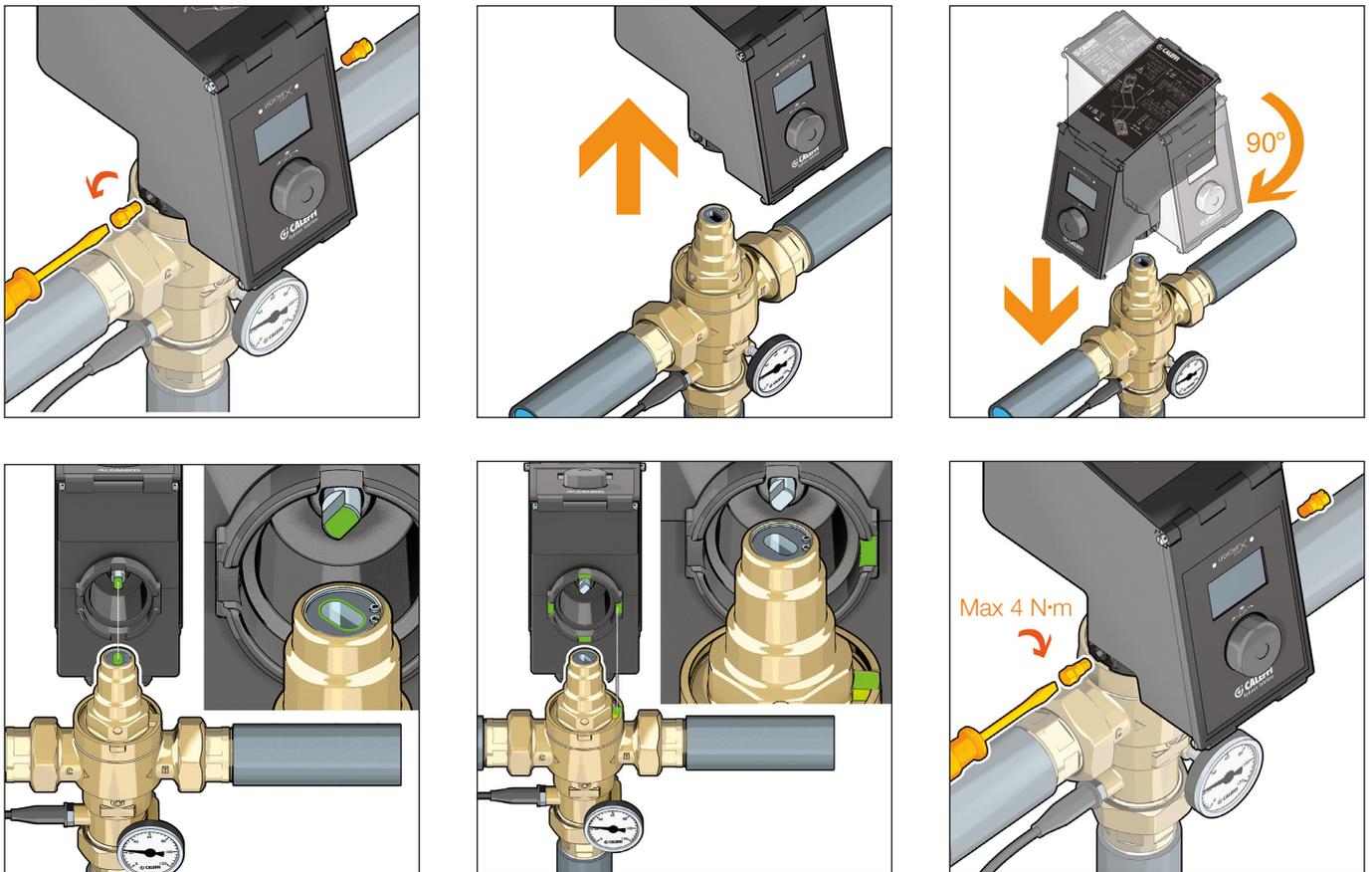
**Troubleshooting**

In normal operating conditions, Caleffi series 6000 hybrid electronic mixing valves provide outstanding performance. However, in special circumstances when our maintenance schedule is not observed, the following problems may arise:

Problem	Cause	Solution
Hot water supplied to cold water taps	a) Inlet check valves not operating correctly or seals worn/damaged b) Check valves not fitted	Replace damaged check valves Install check valves
Mixed water temperature fluctuations	a) Incorrect inlet water temperatures b) Inlet water supply failure c) Bad commissioning	Restore inlet conditions to within valve specification range
Incorrect valve outlet flow rate	a) Insufficient water supply b) Inlet water temperature/pressure fluctuations c) Adverse conditions due to other water draw off points in the system	Stabilise supply conditions at the inlet
No valve outlet flow	a) In-line strainers obstructed b) Insufficient supply pressure c) Dirt obstructing water flow through the valve	Clean the strainers Restore supply conditions Remove dirt/scale from the valve

### Regulator-actuator replacement/rotation

In case of replacement of the regulator-actuator it is necessary to remove all electric connections and perform the following operations:



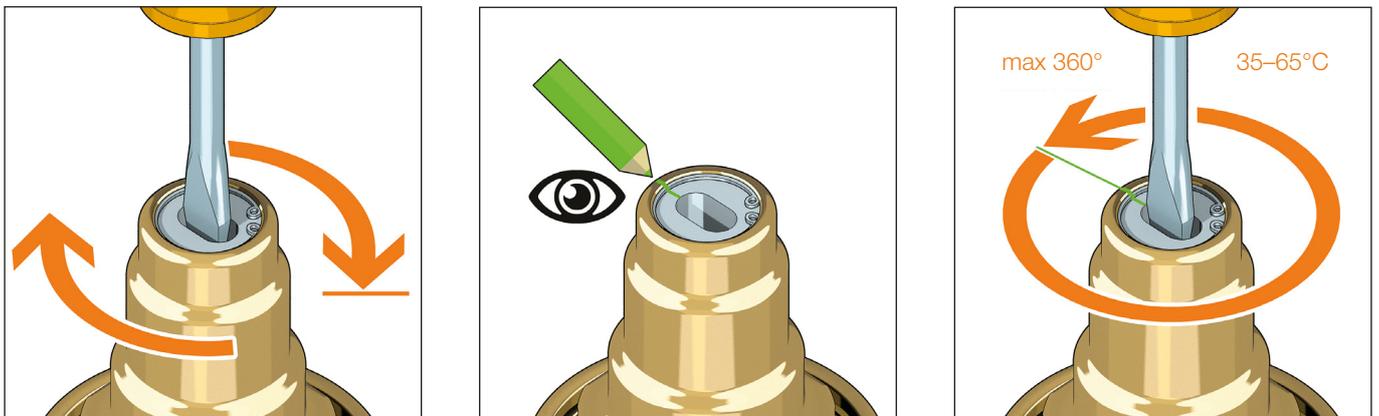
NOTE: Following the above operations, perform the zero and full scale acquisition.

### Thermostatic function

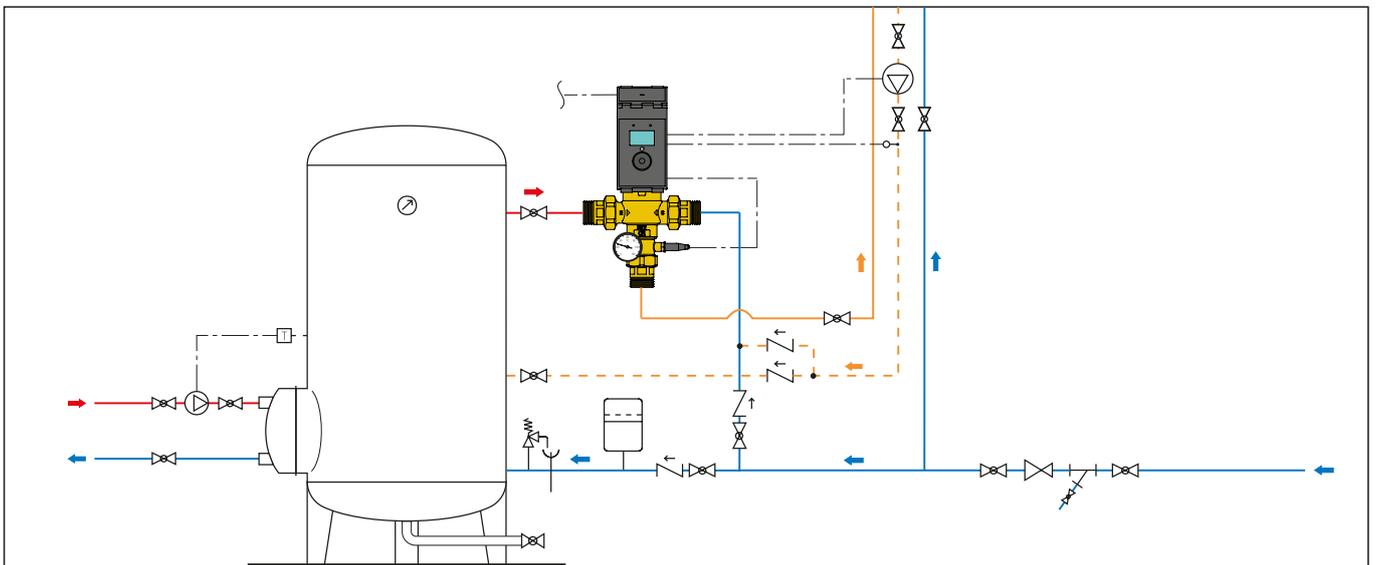
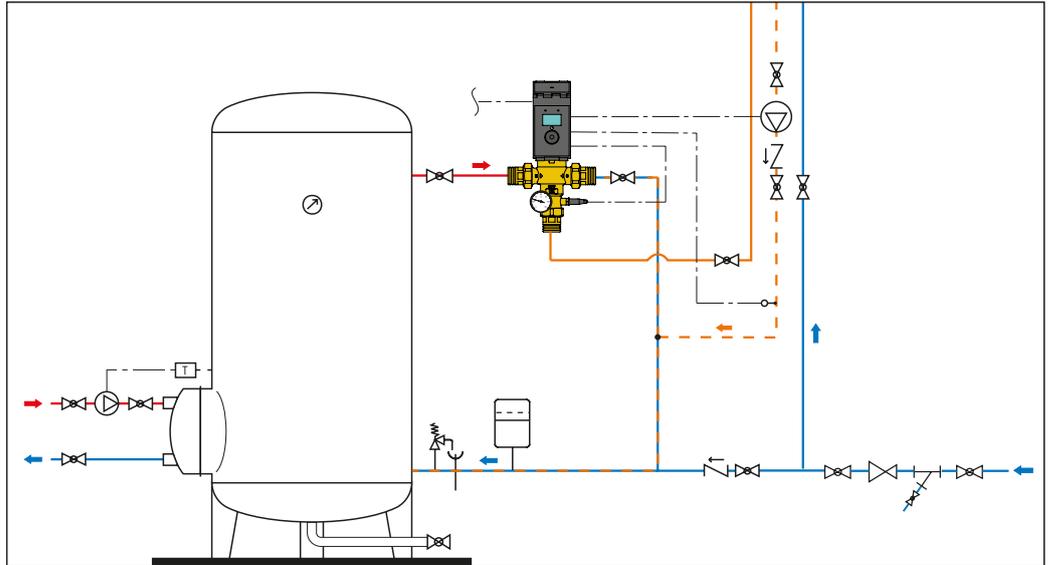
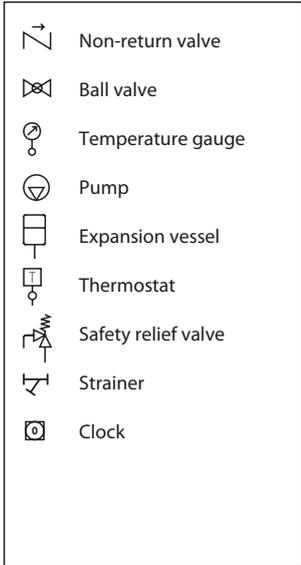
In case of motor failure or power failure, the device is able to guarantee the temperature adjustment through the thermostatic element. To ensure thermostatic adjustment, perform the following operations:

- Screw up to stop (clockwise)
- Make a reference
- Adjust the desired set point reading the temperature using suitable instruments (make a maximum of 1 turn)

It is possible to temporarily perform the disinfection/thermal shock turning over one turn, disabling the thermostatic control.



**Application diagrams**



**LEAVE THIS MANUAL AS A REFERENCE GUIDE FOR THE USER**