MVC503x-2-RS

Multiprotocol Network actuator for PICV and Globe Valves with energy and temperature control functions

MODEL	TEMP. SENSORS INPUTS	EMERGENCY RETURN	ENERGY/ POWER, TEMP. FUNCTIONS	POWER SUPPLY	FORCE [N]
MVC503-2-RS	●	-	●	24 V AC/DC	300
MVC503R-2-RS	●	●	●		

APPLICATION AND USE

The MVC503x-2-RS is a compact actuator designed to control hot/cool water flow rate in two/four pipes terminal units, zone, small reheating and dehumidifcation coils. It can be controlled by a Modbus RTU or BACnet MS/TP device via a RS485 network bus as well as by a proportional (modulating) control signal and it is also equipped with a USB port for local configuration and diagnostics.
When MVC503x-2-RS is used in combination with a PICV valve and/or it is equipped with 1 or 2 temperature sensors, it can deliver powerfull functionalities. The below table shows the available functions and the products required in combination with the actuator.

FUNCTION	SUPPLY TEMP. SENSORS	RETURN TEMP. SENSORS	PICV
Supply temperature control	●	-	-
Supply temperature limitation	●	-	-
Return temperature control	-	●	-
Return temperature limitation	-	●	-
DeltaT control	●	●	-
DeltatT limitation	●	●	-
Flow rate calculation	-	-	●
Energy calculation	●	●	●
Power control	●	●	●
Power limitation	●	●	●

The actuators with temperature sensors are able to implement a temperature and power control/limit loop indipendently of the controller with significant savings in terms of hardware (eg. controllers with less I/Os, more compact electrical panels) and field wirings.

OPERATION

MVC503x-2-RS is an electrical bidirectional actuator. The valve stem is activated through a stepper motor and a gear train optimised in order to have high performances and minimal noise emissions.

MVC503R-2-RS is equipped with super capacitors able to provide the energy to fully close or fully open the valve in case of power loss. The final position of the MVC503R-2-RS can be selected via USB or Modbus RTU/BACnet MS/TP configuration.
The actuator is equipped with a mechanism able to stop the motor when the 300 N force is reached. If auto stroke calibration is set, the software enables the stroke calibration, so it can be used on any valve, as long as it is within the maximum stroke range 2-12 mm.

The performances stated in this sheet can be modified without any prior notice.

MVC503x-2-RS is a modulating actuator and it can be controlled by 2 types of signal:
- RS485 command (Modbus RTU or BACnet MS/TP);
- Modulating (or proportional) with selectable type (e.g. voltage or current) and range (e.g. 0-10 V, 2-10V and 4-20 mA).

The control mode can be set via Modbus RTU or BACnet MS/TP, via USB or via the dip-switches (only 0-10 V DC and 4-20 mA are selectable) on the board. All settings and configurations can be done over the RS485 network or USB connection by the free-of-charge software MVC-2-RS Configurator as well as by the BMS over the RS485 network.
Modbus RTU and BACnet MS/TP Registers description is available in Product Manual DMP295en.
The actuator is also equipped with 5 LEDs.

WARNING - Actuator configuration only can be done simply connecting the USB cable to the PC running the Configurator; monitoring and control functionalities are enabled only when regular power supply is available.

WARNING - To use the RS485 Configurator, it is necessary to power the actuator.

VALVE & ACTUATOR COMPATIBILITY

MVC503x-2-RS can work with:
- iC globe valves without spring, the actuator has a joint that allows a solid connection to the valve stem;
- iC PICV valves with spring, in this case the actuator is not solidly connected to the valve stem, but pushes the stem downwards during movement; the return of the stem is done by the spring on the valve itself which guarantees the contact of the stem with the actuator.
- 3rd party PICV valves, configured using custom curves, setting the stroke, action type, max flow rate and design flow rate;
- 3rd party globe valves, configured in automatic and fixed stroke.

WARNING - After set the caliber of the VLX in the configurator remember to set it also manually in the valve.

In case of use iC PICV the design flow rate parameters change according to the caliber and the design flow rate of the selected valve.
The table shows the compatible valve models:

MODEL	VALVES WITHOUT SPRING				
	VSB.T-VMB.T 3/4" .. 2" STROKE 5,5 mm	2-3TGB15B 1/2" STROKE 11,5 mm	2-3TBB.T 1/2" .. 2" STROKE 12 mm	2TGA.BT 3/4" .. 2" STROKE 8,5 mm	VALVES OF OTHER MANUFACTURERS STROKE max 12 mm
MVC503x-2-RS	●	● AG74-03	●	●	●

MODEL	VALVES WITH SPRING			
	VLX / VLX.P 1/2" .. 1 ¼" STROKE 4 mm	VSXT/VMXT/VTXT 1/2" .. 3/4" STROKE 5,5 mm	VSXT.PBP 1 ½" STROKE 5,5 mm	VSBT.-VMBT. 3/4" .. 1 ½" STROKE 5,5 mm
MVC503x-2-RS	●	●	●	●

In case of use of non ISMA CONTROLLI valves please contact technical secretariat for proper adaptor.

WARNING - In case of MVC used on a valve produced before September 2019 to replace an MVT, the 55061 kit must be used.

VALVE (production previous September 2019)	ACTUATOR to be replaced	Replacement KIT
VSB.T-VMB.T	MVT203 MVT403 MVT503	55061
2-3TBB.T		
2-3TGB.B		

ACCESSORIES

AG74-03	2-3TGB.B iSMA CONTROLLI valves adaptor (N.B. to be used in replacing of the spindle extension provided with the valves).
55061	Kit of adapters for coupling the actuator with VSB.T-VMB.T, 2-3TBB.T and 2-3TGB.B series valves produced before September 2019.
SNTC-SL	NTC 10K temperature sensor 1,5 m length (10 m length available on request).
SNTC-SL-3	NTC 10K temperature sensor 3 m length (10 m length available on request).

iSMA-B-CVT-RS485 USB to RS485 Converter, USB 1.0 and 2.0 compatible, built-in: status LED , switchable terminating resistor, EE-PROM memory. Communication over 3-wire bus. The miniUSB to USB cable is not included.

PA 1/2"M immersion sensor pocket pair, length 45 mm, internal Ø 6 mm

PB 1/2"M immersion sensor pocket pair, length 85 mm, internal Ø 6 mm

TECHNICAL CHARACTERISTICS

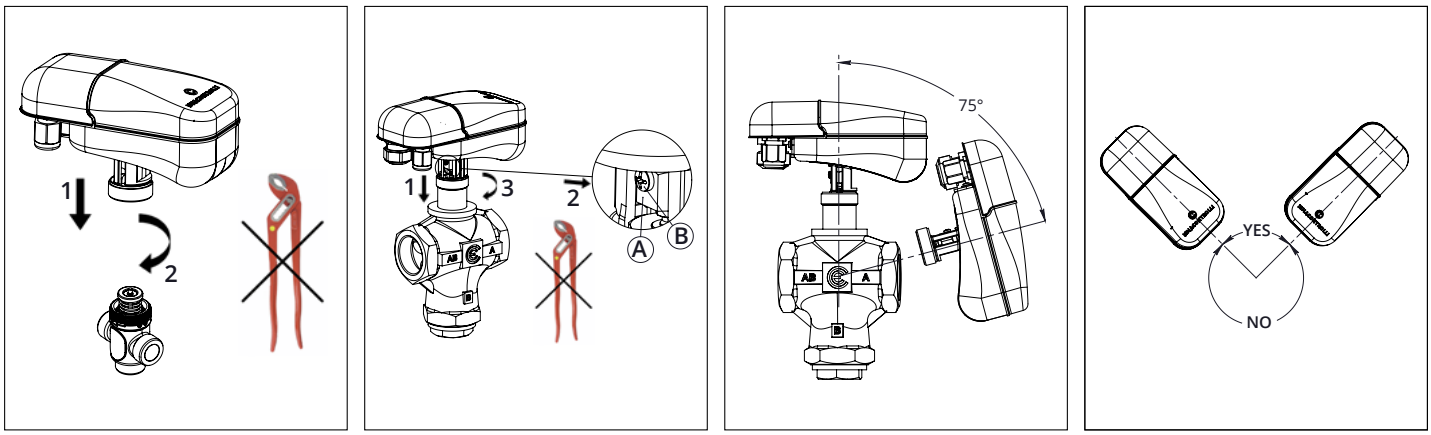
CHARACTERISTIC		DESCRIPTION
Power supply		AC: 24 V AC ± 20% 50-60 Hz DC: 22-30 V DC
Running time		5 s/mm (default) or 3 s/mm
Force		300 N
Duty cycle		Max 50% / 60 minutes
Weight		0,4 kg
Protection degree		IP54
Insulation class		III
Feedback signal		Modbus RTU / BACnet MS/TP
Charging time for supercapacitors		~ 45 s
Speed in emergency positioning		3 s/mm
Transformer size		30 VA
Consumption	supercapacitor charging	12 W
	moving	6 W
	holding position	1,5 W
Manual override		with 3 mm hex key
Type of action		Type 1
Type of movement		Linear or EQP
Stroke		2-12 mm
Operation temperature		-5°C to 55°C
Storage temperature		-25°C to 65°C
Room humudity		Max 90% R.H.
Reference Directives and Standards		EMC 2014/30/UE according to EN 60730-2-14

INSTALLATION

When assembled with valve with spring, before assembling the valve and the actuator, check that the actuator screw jack is fully retracted. If not, remember that, to mount the actuator on the valve in the right position, you have to overcome the spring force of the valve itself. Screw in the M30x1,5 ring nut firmly on the valve thread.

For all the valves without spring:
1. put the stem adaptor of the valve on the top of the stem (The stem must not exceed the inlet of the stem adapter);
2. lock the stem adaptor position with the locknut;
3. using the manual override move upward the screw jack;
4. lock the M30x1,5 ring nut of the actuator on the valve;
5. using the manual override move downward the screw jack until to align the actuator spindle slot with the locknut (A);
6. secure the screw jack with the stem adaptor with the screw (B) through the non-threaded hole of the spindle adapter (A).

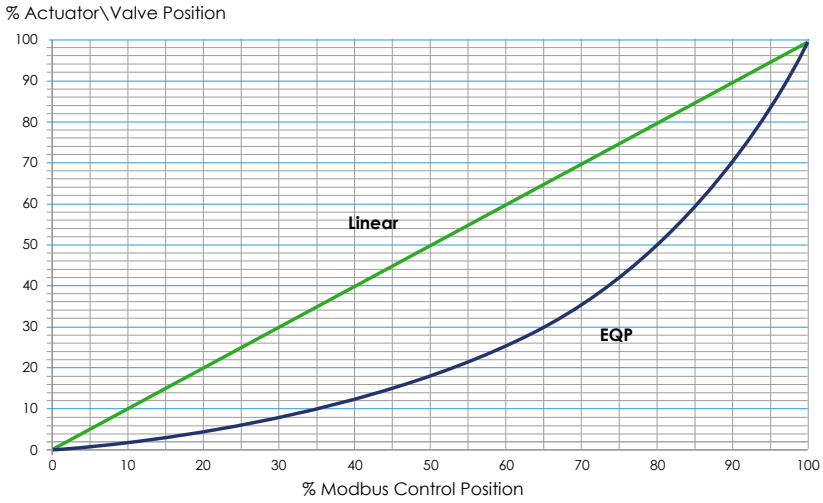
Respect the orientation of the actuator shown in the figures below.
To move the stem manually it is necessary to remove the screw cover, the trasparent cover and use an hex key of 3 mm to move Up/Down the stem.
It is suggested to apply a Threadlocker (for example Loctite 2400) between the screw and the stem adapter.



SETTINGS AND FUNCTIONS

Position Control

The actuator receive modulating signal coming from a control loop implemented by BMS and the valve is positioned from 0% to 100% accordingly to the voltage (0...10 V DC, 2...10 V DC) or the current (4...20 mA) or RS485 (Modbus RTU or BACnet MS/TP) Command.
When it is installed with PICV (iC PICV or 3rd party with custom curve set) the set point is the desired flow rate that is a % (from 0% to 100%) of the maximum flow rate.
Actuator position characteristic is normally linear, but MVC503x-2-RS allow to set an equal percentage behaviour allowing to make a linear valve working like an equal percentage valve.



Diagnostics

The actuator is equipped with a self-diagnostic algorithm able to detect the following conditions\anomalies:

- actuator status (Normal Operation, Calibration, Initialization, Fault, Manual).
- Calibration on a stroke not in the range 2-12 mm.
- Unexpected stall (e.g. valve blocked or extra stroke due to actuator not correctly coupled); the number of detected events is stored permanently.
- Supply voltage outside the allowed range; the number of detected events is stored permanently.
- Total number of opening and closing cycles.
- Temperature sensors outside the allowed temperature range (if any).

All this diagnostic information is available through dedicated Modbus RTU or BACnet MS/TP registers and can be read by the BMS and the MVC-2-RS Configurator. Diagnostic data is also available via the USB connection.
Furthermore, the anomaly conditions are locally shown by means of two green and red LEDs on the board which are suitably flashing (see “Diagnostic alarm function” paragraph).

Manual Override

To operate the manual override, remove the power supply, remove the transparent cover and insert a 3 mm hex key into the front hole and turn the key until the desired position is reached.

Position Feedback

The current position of the actuator is made available via Modbus RTU or BACnet MS/TP (0-100%).

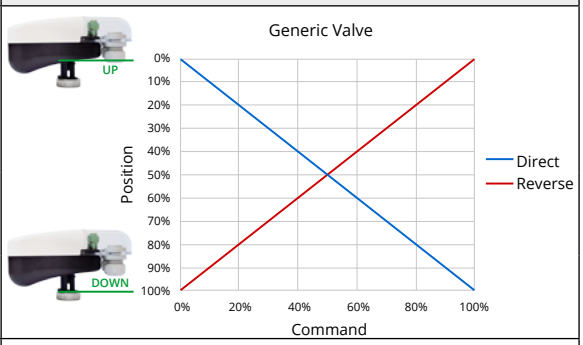
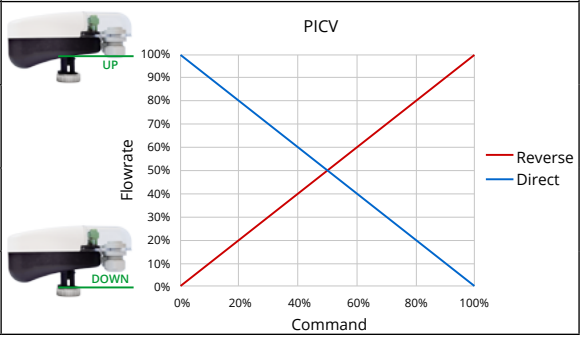
Calibration function

MVC503x-2-RS is equipped with an automatic calibration function.
The plug & play function enables the calibration at the first start-up of the actuator and therefore no further calibration operations are required unless maintenance is required on the valve or particular alarm conditions occur. If it is necessary to repeat the calibration, it can be activated by pressing the push button on the electronic board or remotely via Modbus RTU or BACnet MS/TP.

Auto stroke calibration / Fixed stroke

Through Modbus RTU/BACnet MS/TP or via USB the user can choose (on the basis of the coupled valve) if the stroke must be fixed or automatically calibrated. Valve stroke can be set via Modbus RTU/BACnet MS/TP or via USB by the MVC-2-RS Configurator at any values ranging from 2 mm and 12 mm.
The actuator can be coupled with valves without spring using auto stroke calibration or to valves with spring return using fixed stroke mode.

Direct/Reverse action

Valve type	Type of action	Command	Actuator position	Feedback	Calculated flow	
GENERIC VALVE (with automatic or fixed stroke)	Direct	0%	Up	0%	Not applicable	
	Direct	100%	Down	100%		
	Reverse	0%	Down	0%		
	Reverse	100%	Up	100%		
PICV (Stem-Down-Closed)	Reverse	0%	Down	0%	0%	
	Reverse	100%	Up	Max	Max	
	Direct	0%	Up	Max	Max	
	Direct	100%	Down	0%	0%	

Initial Positioning

It is executed every time the actuator is powered and after the calibration phase, after reset, after restore default setting, after changing action and after passing from a PICV to generic valve. This operation allows the actuator to start from a known position and then follow the command signal. This position depends on the selection of direct or reverse action.

Actuator Speed setting

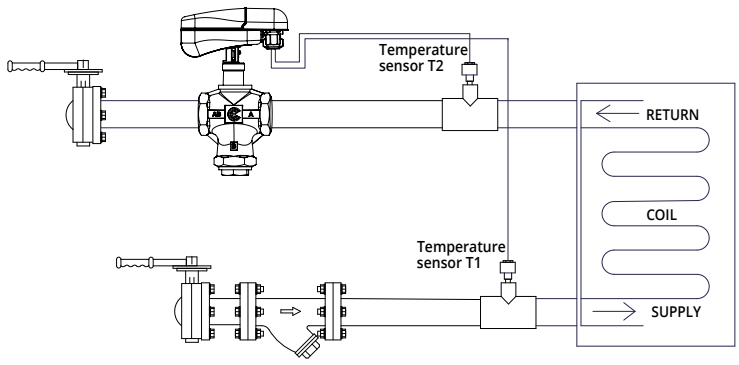
The speed of the actuator can be set via Modbus RTU/BACnet MS/TP or via USB by the MVC-2-RS Configurator to 5 s/mm (default value) or to 3 s/mm.

Restore factory settings

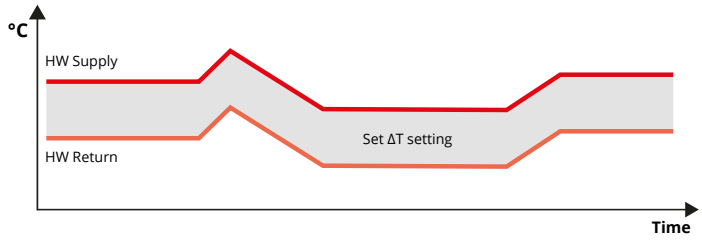
To restore the device to factory settings:
1. Switch DIP3 to ON;
2. Disconnect the actuator and in case of model with emergency return wait until the supercapacitors are completely discharged (all the LEDs are OFF);
3. Power up the actuator;
4. Switch DIP3 to OFF;
5. Auto stroke calibration restarts automatically.

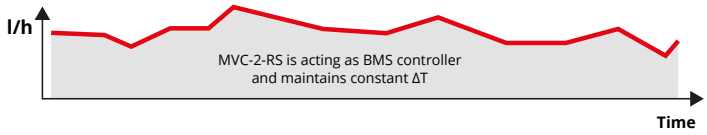
Temperature control loop

MVC503-2-RS and MVC503R-2-RS can be connected to 2 sensors for measuring the supply and return temperature of a hydraulic circuit for monitoring purposes or for control purposes.
The actuator can implement a temperature control loop (PID): the actuator independently controls the supply or the return temperature or the ΔT according to a set-point provided by the BMS; the BMS only sets the temperature\ΔT setpoint and the actuator works independently even in the absence of the RS485 connection.
If only temperatures monitoring is required, the measured values are made available to the BMS through dedicated Modbus RTU or BACnet MS/TP registers.
Temperature setpoints, PID control parameters, Heating/Cooling mode can be set via Modbus RTU or BACnet MS/TP or via USB by the MVC-2-RS Configurator.

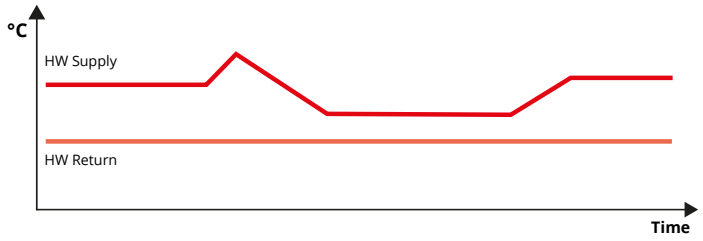


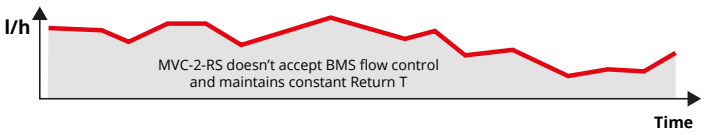
ΔT control loop (water heating example)





T Return control loop (water heating example)

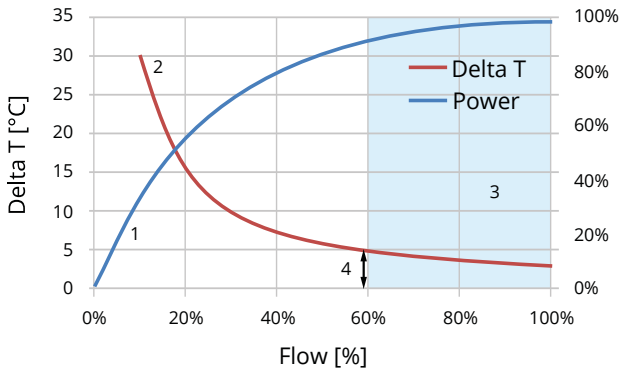




ΔT limit function

If a heating or cooling system works with a differential temperature between the supply and return too low, it means that there is no heat exchange between the fluid and the air flow and therefore it is more efficient to reduce the flow rate as this does not generate any heating or cooling effect. This means that the pumps circulate too much water with unnecessary increase of energy consumption.

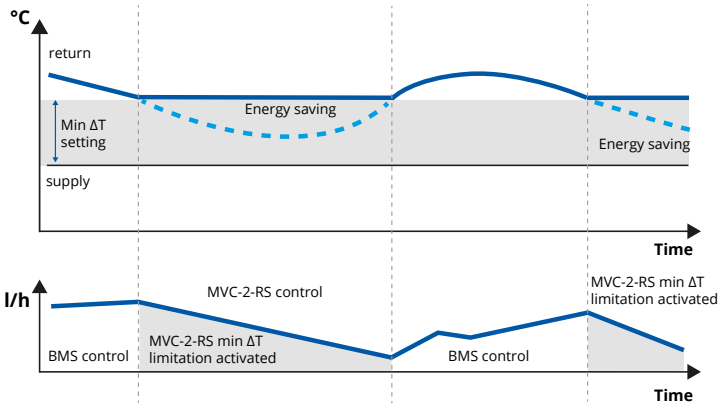
The ΔT limit function automatically limits the flow rate to prevent the ΔT level from falling below the desired differential temperature.



1 – Power output of the heating or cooling coil
2 – Diff. temperature between supply and return
3 – Loss zone (heating or cooling coil saturation)
4 – Adjustable minimum differential temperature

This function overrides the control signal from the BMS when the ΔT is lower than the setpoint; BMS will be again in charge of the valve positioning when the ΔT is higher than the setpoint.
The minimum value of ΔT and the other parameters of the control loop (PID) can be set via Modbus RTU or BACnet MS/TP or via USB.

Min ΔT limitation (water cooling example)

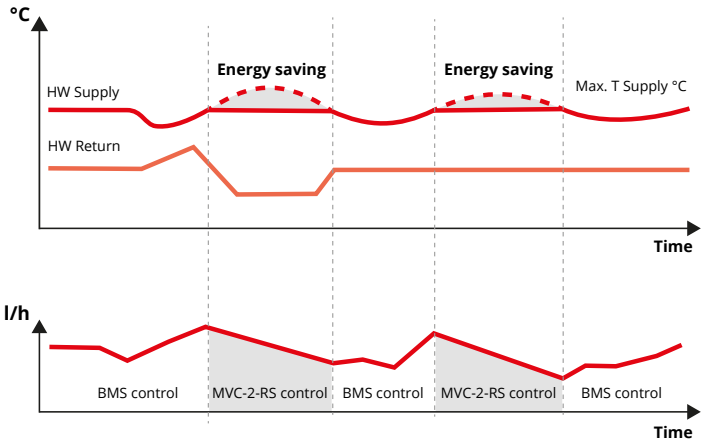


Supply/Return temperature limit function

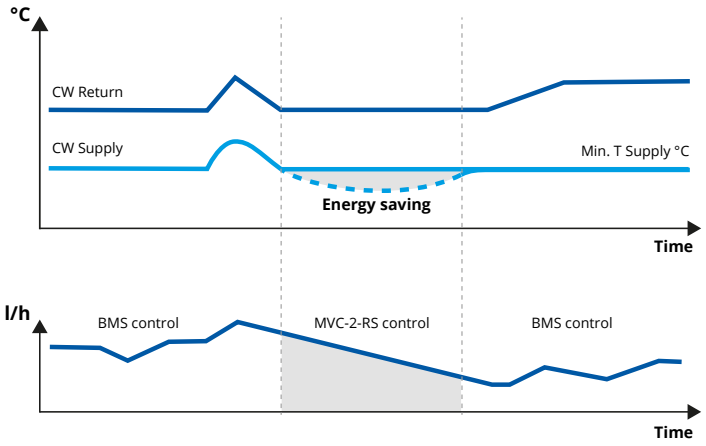
MVC503-2-RS and MVC503R-2-RS can implement a limit control loop on the return temperature or on the supply temperarature in order to override the BMS control when energy efficiency conditions are not respected (e.g. in cooling mode return temperature lower than a limit value). The following limiting functions can be implemented:

- Maximum temperature limit control loop: the actuator will override the BMS control signal when the supply \return temperature is higher than the setpoint; the user can select if the loop has to be implemented on the supply or return temperature sensor. For example in a domestic hot water application the acuator can override the BMS control signal if the supply temperature exceded a setpoint value that could be dangerous for the user.
- Minimum temperature limit control loop: the actuator will override the BMS control signal when the supply \return temperature is lower than the setpoint; the user can select if the loop has to be implemented on the supply or return temperature sensor. For example in a cooling application the actuator can override the BMS control signal if the return temperature is lower than a setpoint value in order not to affect the chiller efficiency

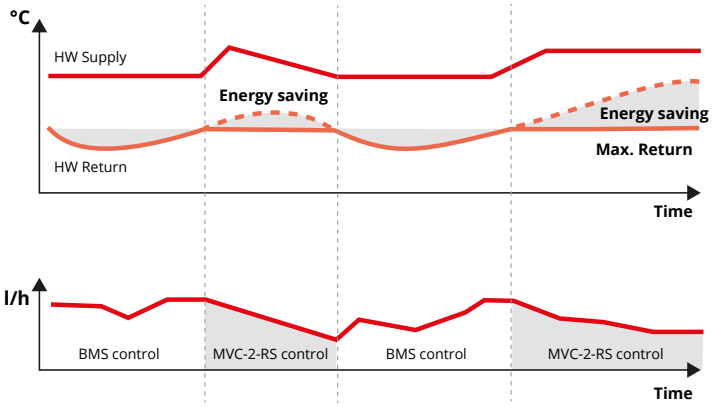
Max T Supply limitation (water heating example)



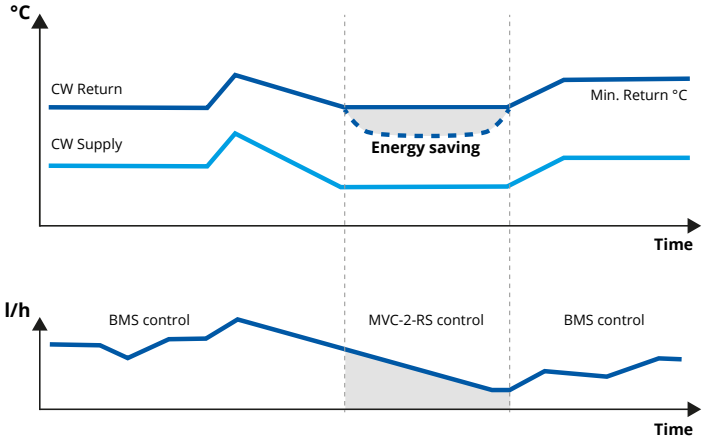
Min T Supply limitation (water cooling example)



Max T Return limitation (water heating example)

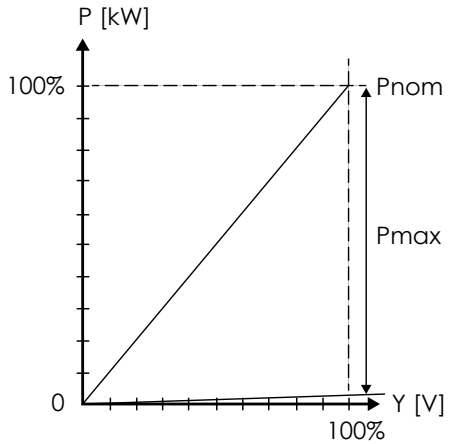


Min T Return limitation (water cooling example)



Power Control Function

When MVC503-2-RS and MVC503R-2-RS are installed on PICV valves (iC or 3rd party with custom curve set), the Power Control function is enabled and both temperature sensors are installed, the MVC503x-2-RS calculates the thermal power transferred from the coil and control it independently of pressure fluctuations in the systems and other external conditions that could affect the heat transfer process, lowering the overall efficiency.
It is possible to set the maximum desired power (Design power Pmax) whose value is between the nominal power values (Pnom) defined for the valve at the various ΔT and shown in the following graphic.



To do this, the configuration tool can be used with the Modbus RTU or BACnet MS/TP connection or via USB. For further details refer to the DMP295en manual.

Power limit function

When MVC503-2-RS and MVC503R-2-RS are installed on PICV valves (iC or 3rd party with custom curve set), the Power Limit function is enabled and both temperature sensors are installed the actuator limits the actuator position when the BMS command is greater than of Set Max. Power Limit value (Set Power Limit Set point).

Energy function

When the MVC503-2-RS and MC503R-2-RS are installed with PICV valves (iC or 3rd party with custom curve set), the Energy function is enabled and both temperature sensors are installed the actuator calculate the instantaneous thermal power and the energy (heating/cooling) delivered by the controlled coil and store energy values into the monthly registers with the relative time and date. The current data, e.g. temperatures, flow rates, heating/cooling energy consumption etc. can be saved and readed at any time by means Modbus RTU or BACnet MS/TP or USB connection.

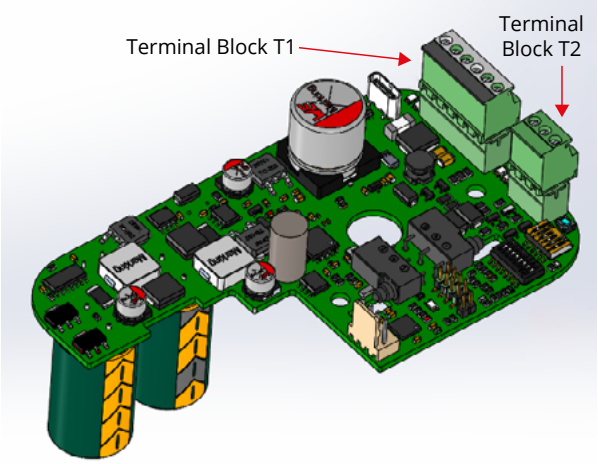
MAINTENANCE

The actuator is maintenance free.

ELECTRICAL CONNECTIONS

Remove the cover screw with a screwdriver and then remove the cover.

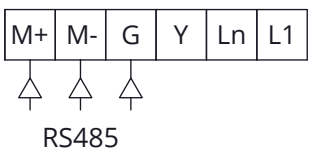
The actuator is equipped with 2 removable terminal block:
- A removable 6-poles terminal block (T1) dedicated to the RS485 bus connection (Modbus RTU or BACnet MS/TP); Modulating control input and power supply;
- A removable 3-poles terminal block (T2) dedicated to the connection of the temperature sensors.



The actuator is supplied with 2 cable glands with die-cut membranes for safe wiring.
- Cable gland PG9 is for 1 cable: power cable;
- Cable gland PG13 is for 4 cables: temperature sensor T1, temperature sensor T2, Modbus RTU or BACnet MS/TP cable and modulating control input cable.

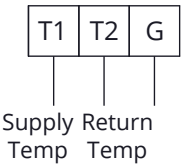
Terminal block T1

Label	Description	Function	Cable Type	Wire colour	Max. Wire Length
M+	RS485+	Modbus RTU/BACnet MS/TP connection	Belden 8771	Red	See chapter RS485 connection
M-	RS485-			Black	
G	Common/shield			Clear	
Y	0-10 V / 4-20 mA	Modulating control input	AWG 16-28 (min 0.3 mm^2 - max 1.5 mm^2)	Green	Depends on the wire section (30-150 m)
Ln	0 V	Power supply		White	
L1	24 V AC/DC			Brown	



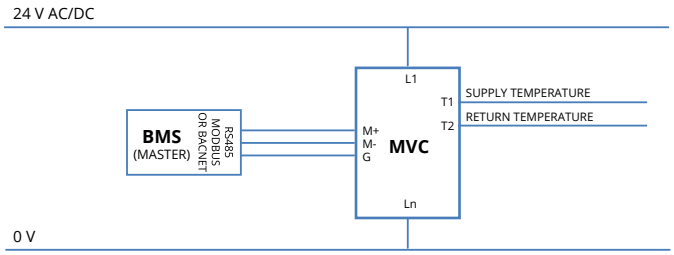
Terminal block T2

Label	Description	Function	Wire colour	Max. Wire Length
T1	Supply temp. sensor	Temperature control loop/ΔT limit function, power control/ limit function and energy function	Red	10 m
T2	Return temp. sensor		Red	
G	Common		White (White cable for T1 and white cable for T2 merged)	

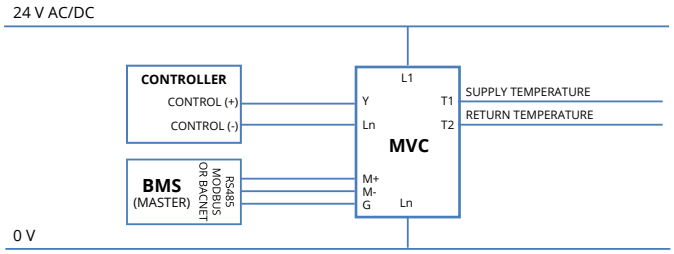


Wiring diagram

RS485 control



Modulanting Control & Modbus RTU or BACnet MS/TP Supervisory

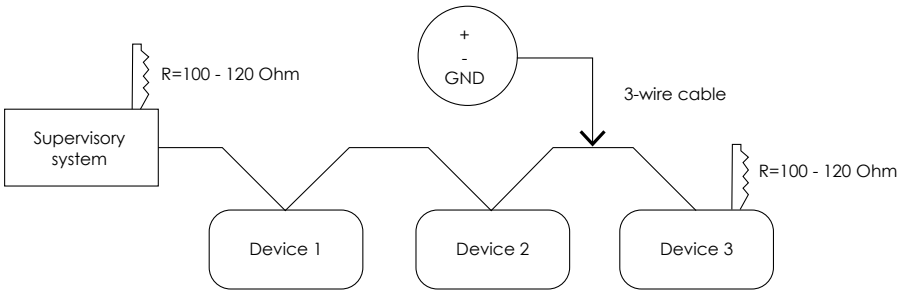


RS485 connection

The RS485 network is implemented with a 3-conductor which will be later identified as “+”, “-” and “GND”.
For “disturbed” areas is suggested model 3-conductor AWG22 cable Belden® model 8771 using the twisted pair to connect the “+” and “-“, the reference wire to connect to “GND” and the shield to connect to ground.
Alternatively you can use a cable with the following electrical and mechanical characteristics:

- AWG 20/22;
- characteristic impedance of 120Ω;
- copper wire, “plait” type, twisted;
- shielded braided and insulated.

The shield must be connected to controller GND.
The network must be wired only in accordance with the principle shown here, called “daisy chain” (the device is composed by a single RS485 port). Star connections are not allowed.



Connection warnings

For proper network cabling is recommended to take the following precautions:

1. Do not use different types of cable to achieve the same network, but always use only the same type of cable;
2. The network cable carries out safety voltage signals (SELV) and must not be wired together with dangerous voltage signals (e.g., 230Vac) or carriers of high currents, especially if in alternating current. Also avoid parallel paths to these power cables;

3. Wire the cable lying avoiding kinks, narrow bending radii and unnecessary wrapping in hanks or skeins;
4. Do not twist the cable cord around the power conductors and, if they should cross, consider an intersection at 90 ° between the cable and these conductors;
5. Keep away from sources of electromagnetic field in particular by large motors, electrical cabinet, reactors for neon, all types of antennas;
6. Do not pull the power cable exceeds 110N (11.3kg) to prevent ironing;
7. Assess in advance the route so that it will be as short as possible and note addresses of connected instruments with particular reference to its location in the orderly sequence. This can be very useful in maintenance; we recommend to note the Modbus RTU Address on the product label.
8. Do not reverse the polarity "+" and "-" of the connection terminals;
9. Avoid short lengths of cable terminations in connection tools to make a maintenance without tearing or flues of the cables possible;
10. Identify start and ending terminations and avoid cuts "open".

Termination resistors and network polarization The slew-rate control, common to all our converters, and the baud rate limited to 9600 baud (bit/sec) make termination resistors unnecessary.
The RS485 network requires polarization typically born by the Master device; the regulator does not have polarization resistors.
The tranceiver used by the actuator allows to drive up to 256 knots.

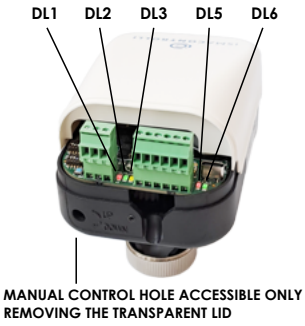
The RS485 standards provide for a maximum length of 1200 m and/or 32 devices on the network. However, it should be noted that the more the "standard" limits are exceeded (maximum limit of 32 devices or cable lengths greater than 1200 m), the higher the probability that communication problems will arise. The phenomenon is not systematic and may not even occur.
Vice versa, if it occurs, and none of the points indicated in this paragraph has allowed to solve the problem, the connection of a repeater (code CONV-RS485-RIP) is suggested.

Recharge supercapacitors (only for models MVC503R-2-RS)

When the actuator is powered on the supercapacitors charging phase start automatically.

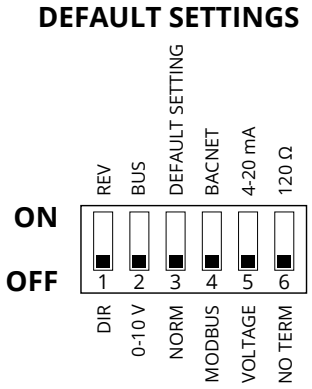
1. During the charging phase DL1 (red), DL2 (green), DL3 (yellow) and DL5 (red) are ON (solid);
2. Charging phase will be completed after about 40 s when DL1 (red), DL2 (green), DL3 (yellow) and DL6 (green) are ON;
3. The actuator is ready for operation when DL2 (green) switch OFF and DL1 (red), DL3 (yellow) and DL6 (green) are ON.

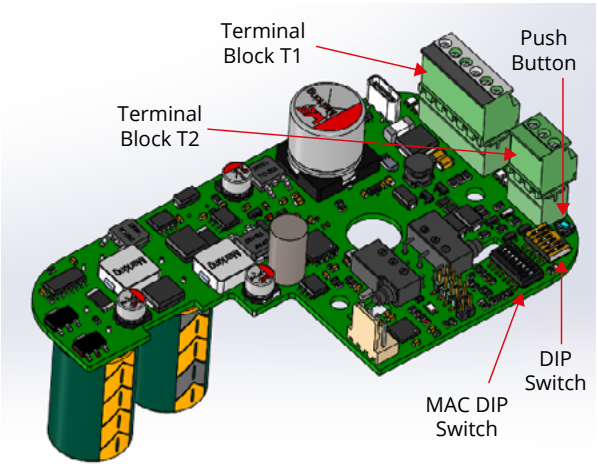
During the supercapacitors recharge phase, Modbus RTU/BACnet MS/TP communication is not possible.



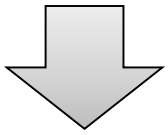
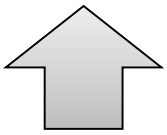
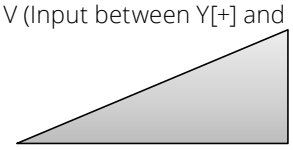
DIP SWITCH SETTING & PUSH BUTTON

Set the DIP switches according to the tables below. In order to be sure that any modification has been accepted by the actuator, power down and power up it again to be sure that settings will be loaded.





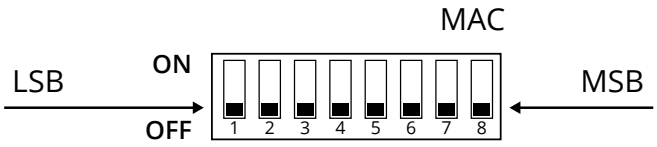
Push button	Function
Pressed	Stroke Calibration phase enable

DIP switch	OFF	ON
1	Direct action 	Reverse action 
2	0-10 V (Input between Y[+] and Ln [-]) 	Bus
3	Normal	Default setting
4	Modbus RTU	BACnet MS/TP
5	Voltage	4-20 mA*
6	No term	120 Ω

***Note:** In order to select 4-20 mA control signal put DIP5 in ON and set the actuator with 2-10 V control signal.

MAC DIP Switch

The MAC DIP switch allow to set the Modbus RTU or BACnet MS/TP MAC address.



Modbus RTU and BACnet MS/TP MAC Address Ranges

DIP switch	OFF	ON
1	Add 0 to BACnet MS/TP/Modbus RTU MAC Address	Add 1 to BACnet MS/TP/Modbus RTU MAC Address
2	Add 0 to BACnet MS/TP/Modbus RTU MAC Address	Add 2 to BACnet MS/TP/Modbus RTU MAC Address
3	Add 0 to BACnet MS/TP/Modbus RTU MAC Address	Add 4 to BACnet MS/TP/Modbus RTU MAC Address
4	Add 0 to BACnet MS/TP/Modbus RTU MAC Address	Add 8 to BACnet MS/TP/Modbus RTU MAC Address
5	Add 0 to BACnet MS/TP/Modbus RTU MAC Address	Add 16 to BACnet MS/TP/Modbus RTU MAC Address
6	Add 0 to BACnet MS/TP/Modbus RTU MAC Address	Add 32 to BACnet MS/TP/Modbus RTU MAC Address
7	Add 0 to BACnet MS/TP/Modbus RTU MAC Address	Add 64 to BACnet MS/TP/Modbus RTU MAC Address
8	Add 0 to BACnet MS/TP/Modbus RTU MAC Address	Add 128 to BACnet MS/TP/Modbus RTU MAC Address

Example: with DIP1, DIP2 and DIP8: MAC ADDRESS = 1 + 2 + 128 = 131
In Modbus RTU: MOSDBUS ADDRESS = 131
In BACnet MS/TP: BACNET_ID = VENDOR_ID*1000 + MAC ADDRESS = 826*1000+131=826131

DIAGNOSTIC ALARM FUNCTIONS

N°	Error type	Actuator status	Actuator behaviour	Notification type LEDs	Possible anomaly	Restore procedure
1	Stroke lower than 2 mm	Calibration/ first installa-tion	The actuator returns to its initial position and does not respond to the command. The actuator keeps the previous stroke or the default stroke	DL1 Blinking 1 Hz DL2 ON DL3 ON	Valve with stroke less than 2 mm	Remove power and re-power again

2	Stroke greater than 12 mm	Calibration/ first installation	The actuator exceed the maximum range of 12 mm and moves to the new extreme. Once the new stroke limit is reached, it returns to the initial position signaling an anomaly. The actuator does not learn the new stroke	DL1 ON DL2 Blinking 1 Hz DL3 ON	Valve with stroke greater than 12 mm or incorrect coupling	Remove power and re-power again
3	Unexpected stall	Normal operation	The actuator checks the stall condition 5 times. At the end of the attempts it signals an anomaly. The actuator does NOT learn the new stroke, but after 60 s repeats the attempts to check the blocking conditions	DL1 and DL2 Blinking 5 Hz DL3 ON	Valve blocked	Reverse the control signal
4	Extra stroke	Normal operation	The actuator moves to the new stall position signaling an anomaly. The actuator does NOT learn the new stroke	DL1 Blinking 5Hz DL2 OFF DL3 ON	Damaged valve or incorrect coupling	Reverse the control signal
5	Under voltage	Normal operation	The actuator continues to operate but performance is not guaranteed. If the low voltage events persist (events greater than 10), the actuator stops working	DL1 OFF DL2 OFF DL3 Blinking 1 Hz	Unstable power supply	Check and restore power
6	Over voltage	Normal operation	The actuator continues to operate but performance is not guaranteed. If the high voltage events persist (events greater than 10), the actuator stops working	DL1 OFF DL2 OFF DL3 Blinking 5 Hz	Unstable power supply	Check and restore power
7	Temperature sensors error	Normal operation	Temperature or ΔT control loops not working	DL1 Blinking 5 Hz DL2 ON DL3 OFF	Incorrect temperature sensor connection Temperature sensor damaged Temperature detected outside the range of use	Check the connection and the condition of the temperature sensor

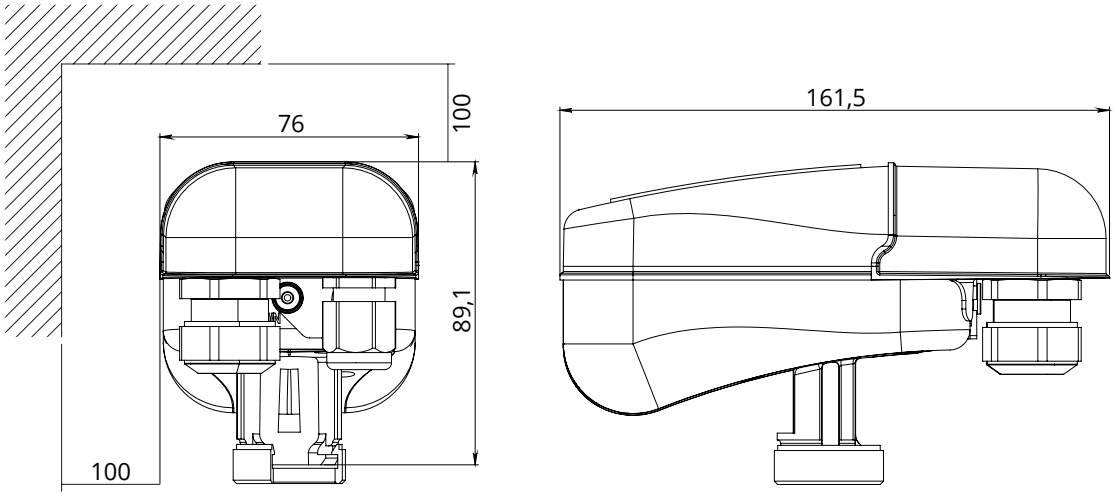
STANDARD LEDS BEHAVIOUR

Description	DL1 (red)	DL2 (green)	DL3 (yellow)
Calibration	Alternate blinking 5 Hz		ON
Initial positioning	Alternate blinking 1 Hz		ON
Running UP	OFF	Blinking 1 Hz	ON
End of stroke UP	OFF	ON	ON
Running DOWN	Blinking 1 Hz	OFF	ON
End of stroke DOWN	ON	OFF	ON
Holding	OFF	OFF	ON
Unexpected stall	Blinking 5 Hz		ON
Low voltage power supply	OFF	OFF	Blinking 1 Hz
High voltage power supply	OFF	OFF	Blinking 5 Hz
Calibrated stroke lower than minimum	Blinking 1 Hz	ON	ON
Calibrated stroke higher than max	ON	Blinking 1 Hz	ON
Extra stroke	Blinking 5 Hz	OFF	ON
Actuator OFF	OFF	OFF	OFF
Emergency positioning	Blinking 1 Hz		OFF

Description	DL1 (red)	DL2 (green)	DL3 (yellow)
Supercapacitor charging phase	ON	ON	ON
Actuator in Bootloader mode	Blinking 5 Hz		OFF
Temperature sensors error	Alternate blinking 5 Hz	ON	OFF
Actuator powered only by USB cable	Blinking 1 Hz		

Description	DL5 (red)	DL6 (green)
Emergency return phase / Supercapacitor charging phase	ON	OFF
Supercapacitor charging phase completed	OFF	ON

DIMENSIONS [mm]



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