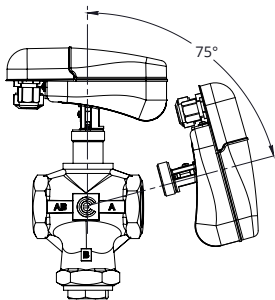


# MVC503x-2-RS

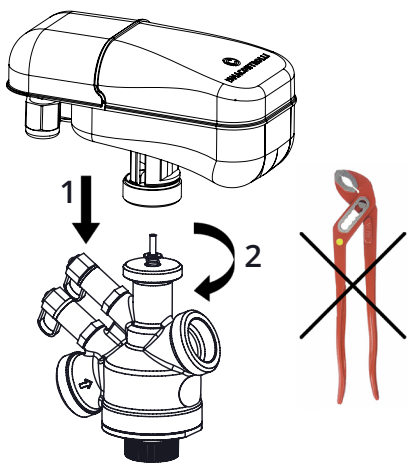
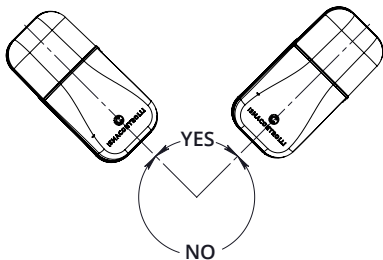


## Multiprotocol Network actuator for PICV and Globe Valves with energy and temperature control functions

### INSTALLATION

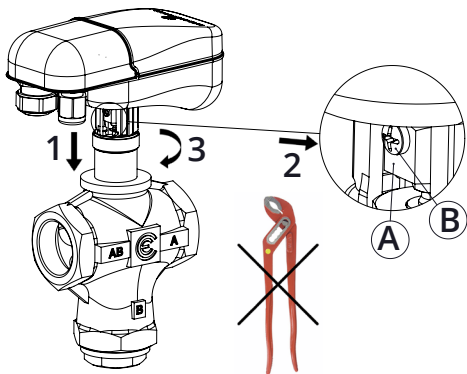


Do not use the actuator if not coupled with the valve



**Libra, V.XT, VSXT.PBP, VSBT.-VMBT.**

Set the actuator spindle in the retract position



**VSBT.-VMB.T, 2-3TGB.B, 2-3TBB.T, 2TGA.BT**

1. Put the stem adaptor of the valve on the top of the stem (the stem must not exceed the inlet of the stem adaptor);
  2. lock the stem adaptor position with the locknut;
  3. using the manual override make the screw jack go up;
  4. lock the M30x1,5 ring nut of the actuator on the valve;
  5. using the manual override make the screw jack go down 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).
- It is suggested to apply a threadlocker (for example Loctite 2400) on the screw between the screw and the stem adapter.

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

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

| MODEL        | VALVES WITHOUT SPRING                         |                                             |                                           |                                           |                                                  | VALVES WITH SPRING                            |                                                 |                                     |                                            |
|--------------|-----------------------------------------------|---------------------------------------------|-------------------------------------------|-------------------------------------------|--------------------------------------------------|-----------------------------------------------|-------------------------------------------------|-------------------------------------|--------------------------------------------|
|              | VSBT.-VMB.T<br>3/4" .. 2"<br>STROKE<br>5,5 mm | 2-3TGB.B<br>1/2" .. 2"<br>STROKE<br>11,5 mm | 2-3TBB.T<br>1/2" .. 2"<br>STROKE<br>12 mm | 2TGA.BT<br>3/4" .. 2"<br>STROKE<br>8,5 mm | OTHER MANUFACTURER VALVES<br>STROKE<br>max 12 mm | VLX-VLX.P<br>1/2" .. 1 1/4"<br>STROKE<br>4 mm | VSXT-VMXT-VTXT<br>1/2" .. 3/4"<br>STROKE 5,5 mm | VSXT.PBP<br>1 1/2"<br>STROKE 5,5 mm | VSBT.-VMBT.<br>3/4" .. 2"<br>STROKE 8,5 mm |
| MVC503x-2-RS | ●                                             | ● AG74-03                                   | ●                                         | ●                                         | ●                                                | ●                                             | ●                                               | ●                                   | ●                                          |

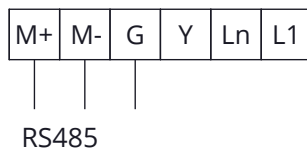
The performances stated in this sheet can be modified without any prior notice.

## CABLE GLAND

Cable glands supplied are PG13 (4 holes) and PG9 (1 hole) model with a class protection of IP68.  
PG13 is used for RS485 communication, voltage/current signal command and NTC 10K temperature sensors. Use suitable cables with Ø variable between 4.5 and 6 mm. Suggested cable for RS485 is belden 8771.  
PG9 is used for main power. Use suitable cables with Ø variable between 1.5 and 6 mm.

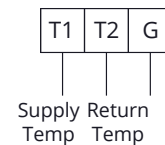
## TERMINAL BLOCK T1

| 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<br>(min 0.3 mm <sup>2</sup> - max 1.5 mm <sup>2</sup> ) | Green       | Depends on the wire section (30-150 m) |
| Ln    | 0 V              | Power supply                         |                                                                   | White       |                                        |
| L1    | 24 V AC/DC       |                                      |                                                                   | Brown       |                                        |



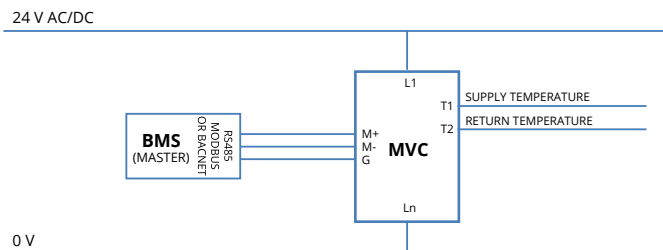
## TERMINAL BLOCK T2

| Label | Description         | Function                                                                                              | Wire colour                                              | Max. Wire Length |
|-------|---------------------|-------------------------------------------------------------------------------------------------------|----------------------------------------------------------|------------------|
| T1    | Supply temp. sensor | Temperature control loop/ $\Delta T$ 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) |                  |

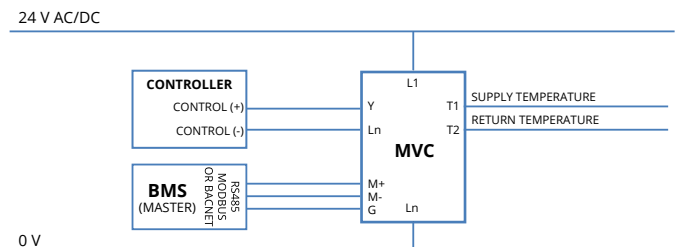


## WIRING DIAGRAMS

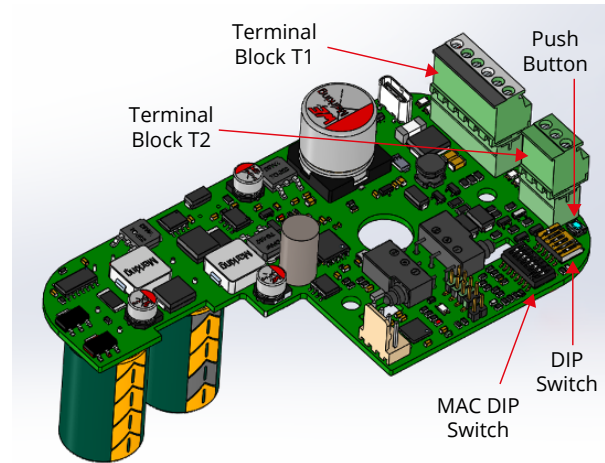
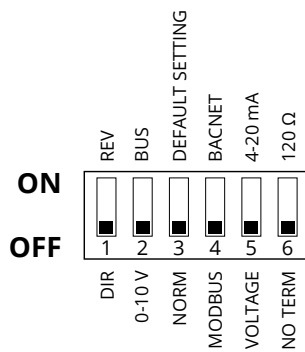
### RS485 control



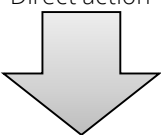
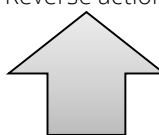
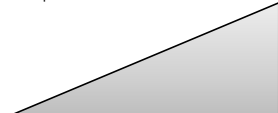
### Modulating Control & Modbus RTU or BACnet MS/TP Supervisory



### DEFAULT SETTINGS



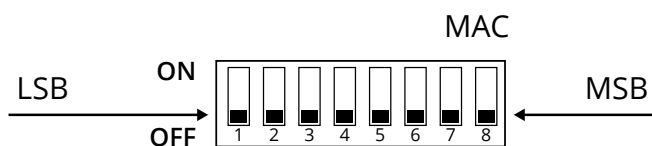
| Push button | Function                        |
|-------------|---------------------------------|
| Pressed     | Stroke Calibration phase enable |

| DIP switch | OFF                                                                                                                           | ON                                                                                                     |
|------------|-------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| 1          | Direct action<br>                           | Reverse action<br> |
| 2          | 0-10 V (Input between Y[+] and Ln [-])<br> | 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 4-20mA control signal put DIP5 in ON and set the actuator with 2-10V 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:** MODBUS ADDRESS = 131

**In BACnet MS/TP:** BACNET\_ID = VENDOR\_ID\*1000 + MAC ADDRESS = 826\*1000+131=826131

#### RS485 CONNECTION

The RS485 network is implemented with a 3-conductors which will be later identified as "+", "-" and "GND". For "disturbed" areas is suggested model 3-conductors 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.

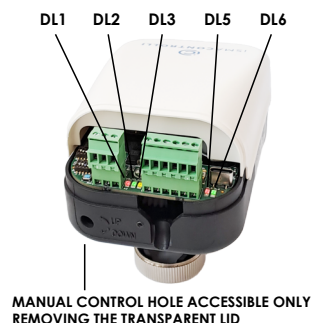
The network must be wired only in accordance with the principle shown here, called "daisy chain" (the device is composed by a single RS485 port). Star connections are not allowed.

#### RECHARGE SUPERCAPACITORS (only for MVC503R-2-RS)

When MVC503R-2-RS is powered on the supercapacitors charging phase start automatically.

- during the charging phase DL1 (red), DL2 (green), DL3 (yellow) and DL5 (red) are ON (solid);
- charging phase will be completed after about 40 s when DL1 (red), DL2 (green), DL3 (yellow) and DL6 (green) are ON;
- the actuator is ready for operation when DL2 (green) is OFF and DL1 (red), DL3 (yellow) and DL6 (green) are ON.

During the supercapacitors recharge phase, Modbus and BACnet communication is not possible.



#### CONFIGURATOR

**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.

## DIAGNOSTIC FUNCTIONS

| N° | Error type                | Actuator status                    | Actuator behaviour                                                                                                                                                                                                     | Notification type LEDs                  | Possible anomaly                                                                                                         | Restore procedure                                                |
|----|---------------------------|------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|--------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|
| 1  | Stroke lower than 2 mm    | Calibration/<br>first installation | 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<br>DL2 ON<br>DL3 ON   | Valve with stroke less than 2 mm                                                                                         | Remove power and re-power again                                  |
| 2  | Stroke greater than 12 mm | Calibration/<br>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<br>DL2 Blinking 1 Hz<br>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<br>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<br>DL2 OFF<br>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<br>DL2 OFF<br>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<br>DL2 OFF<br>DL3 Blinking 5 Hz | Unstable power supply                                                                                                    | Check and restore power                                          |
| 7  | Temperature sensors error | Normal operation                   | Temperature or $\Delta T$ control loops not working                                                                                                                                                                    | DL1 Blinking 5 Hz<br>DL2 ON<br>DL3 OFF  | Incorrect temperature sensor connection.<br>Temperature sensor damaged.<br>Temperature detected outside the range of use | Check the connection and the condition of the temperature sensor |

## RESTORE FACTORY SETTINGS

To restore the device to factory settings:

1. Switch DIP3 to ON;
2. Remove power supply to 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. Move DIP3 to OFF;
5. Auto stroke calibration restarts automatically.

## LED 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           |
| Supercapacitor charging phase        | ON                      | ON            | ON            |
| Actuator in Bootloader mode          | Alternate blinking 5 Hz |               | OFF           |
| Temperature sensors error            | 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          |