iSMACONTROLLI

MVE-2-RS

User Manual

Configurator

iSMA CONTROLLI S.p.A. - Via Carlo Levi 52, 16010 Sant'Olcese (GE) - Italy | support@ismacontrolli.com

Table of Contents

1 Introduction

The MVE-2-RS Configurator allows to configure and monitor the MVE-2-RS actuator for a proper system commissioning, monitoring, and troubleshooting.

The connection between a computer and actuator can be established either by using a USB/RS485 converter (iSMA-B-CVT-RS485) with a serial communication bus and the Modbus protocol (RTU) or by the micro USB port.

Two different configuration tools are available:

- the MVE-2-RS RS485 Configurator suitable for the configuration and real-time monitoring of the actuator by the Modbus RTU protocol; the USB/RS485 converter (iSMA-B-CVT-RS485) is required;
- the MVE-2-RS USB Configurator suitable for the configuration and diagnostic of the actuator (not suitable for real-time monitoring) by USB; a simple micro USB-USB cable is required.

1.1 Revision History

Rev.	Date	Description
1.0	19 Jul 2022	First edition
1.1	9 Nov 2022	Updated table of Modbus register database
1.2	25 May 2023	Updated the default stop bit (it was 2 it become 1)
1.3	6 Oct 2023	Add Phase 2 (BACnet and energy, power loop and limit function)

Table 1. MVE-2-RS Configurator revision history

2 Safety Rules

- Do not use different types of cables to create the same network. Always and only use the same type of cable. The network cable must be used with SELV safety voltage signals and must not be wired in ducts for cables with dangerous voltages (for example, 230 V AC) or carriers of high currents, especially if in alternating current. Also, avoid parallel paths to these power cables.
- Deploy the cable as straight as possible, avoiding folds with tight bending radius, much less wrapping it in useless skeins. Do not twist the cable around power conductors and, if they have to be crossed, provide a 90° cross between the cable and these conductors.
- Keep away from electromagnetic field sources; in particular, from large motors, switchboards, neon ballasts, antennas of all types. Avoid that the pull tension of the cables exceeds 110 N (11.3 kg) to prevent ironing.
- Evaluate the route in advance to shorten it as much as possible and take note of the addresses of the instruments connected with particular reference to their location in orderly sequence. This can be very useful in maintenance. We recommend that you take note of the Modbus address and report it on the product label in the space provided for it.
- Do not invert the polarity "+" and "-" at the connection terminals. Avoid short pieces of cable in the connection terminals to the instruments in order to allow a possible maintenance without tearing or pulling of the cable itself.
- Identify the start and end terminations and avoid "open" segments. 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 borne by the master device; the regulator does not have polarization resistors. The transceiver used by the actuator allows to drive up to 256 knots.

3 MVE-2-RS RS485 Configurator Installation

3.1 Hardware Requirements

- Processor: last generation;
- RAM: 2 GB;
- operating system: Windows 7, Windows 10;
- .NET Framework 4.6.1 (or higher);
- USB-RS485 serial converter (iSMA-B-CVT-RS485);
- not fully compatible with 800x600 screen resolution.

Note: The .NET Framework may not appear in the list of installed software on Window 10, as it is already installed by default by the operating system.

3.2 Software Setup

This tool is supplied with a self-installing file, MVE-2-RS RS485 Configurator.

By starting the self-installing file, depending on the operating system, a user may be asked to give permissions to make changes to the device; click the YES button.

After the installation wizard is finished, the software is ready for use.

3.3 USB-RS485 Serial Converter Installation

iSMA-B-CVT-RS485 is a USB to RS485 converter. The device is equipped with two LEDs, showing the received data packages (RX) and transmitted data packages (TX), and 1 switch to add the bus termination resistor (not needed).

The converter is equipped with a 3-poles terminal block for the RS485 connection. Follow the wiring instructions below:

Converter Terminal	Actuator Terminal
A(+)	M+
B(-)	M-
GND	G

Table 2. Wiring instructions

To use the device, it is necessary to install the driver located in the program folder established through the setup (MVE-2-RS RS485 Configurator). If required by the operating system, search for the driver by selecting the folder, which the driver is located in (here, the configuration tool folder: MVE-2-RS RS485 Configurator\Driver).

4 MVE-2-RS USB Configurator Installation

4.1 Hardware Requirements

- Processor: last generation;
- RAM: 2 GB;
- operating system: Windows 7, Windows 10;
- .NET Framework 4.6.1 (or higher);
- USB to micro USB cable;
- not fully compatible with 800x600 screen resolution.

Note: The .NET Framework may not appear in the list of installed software on Window 10, as it is already installed by default by the operating system.

4.2 Software Setup

This tool is supplied with a self-installing file: MVE-2-RS USB Configurator or MVE-2-RS RS485 Configurator.

By starting the self-installing file, depending on the operating system, the user may be asked to give permissions to make changes to the device; to confirm, click the Yes button.

During installation, a message will appear informing the user that the destination folder does not exist, and if it is to be created, click the YES button.

After the installation wizard is finished, the software is ready for use.

5 MVE-2-RS RS485 Configurator User Interface

5.1 General Functionalities

This chapter describes the user interface of the MVE-2-RS RS485 Configurator, which is the most advanced of the 2 available tools. In the user interface of the USB configuration tool, the Info tab does not include the functionality to show the charts, and it is not possible to set the BMS command signal but is possible to use the USB Configuration Tool in the offline mode (simulator).

Opening the application, the following user interface will be displayed:

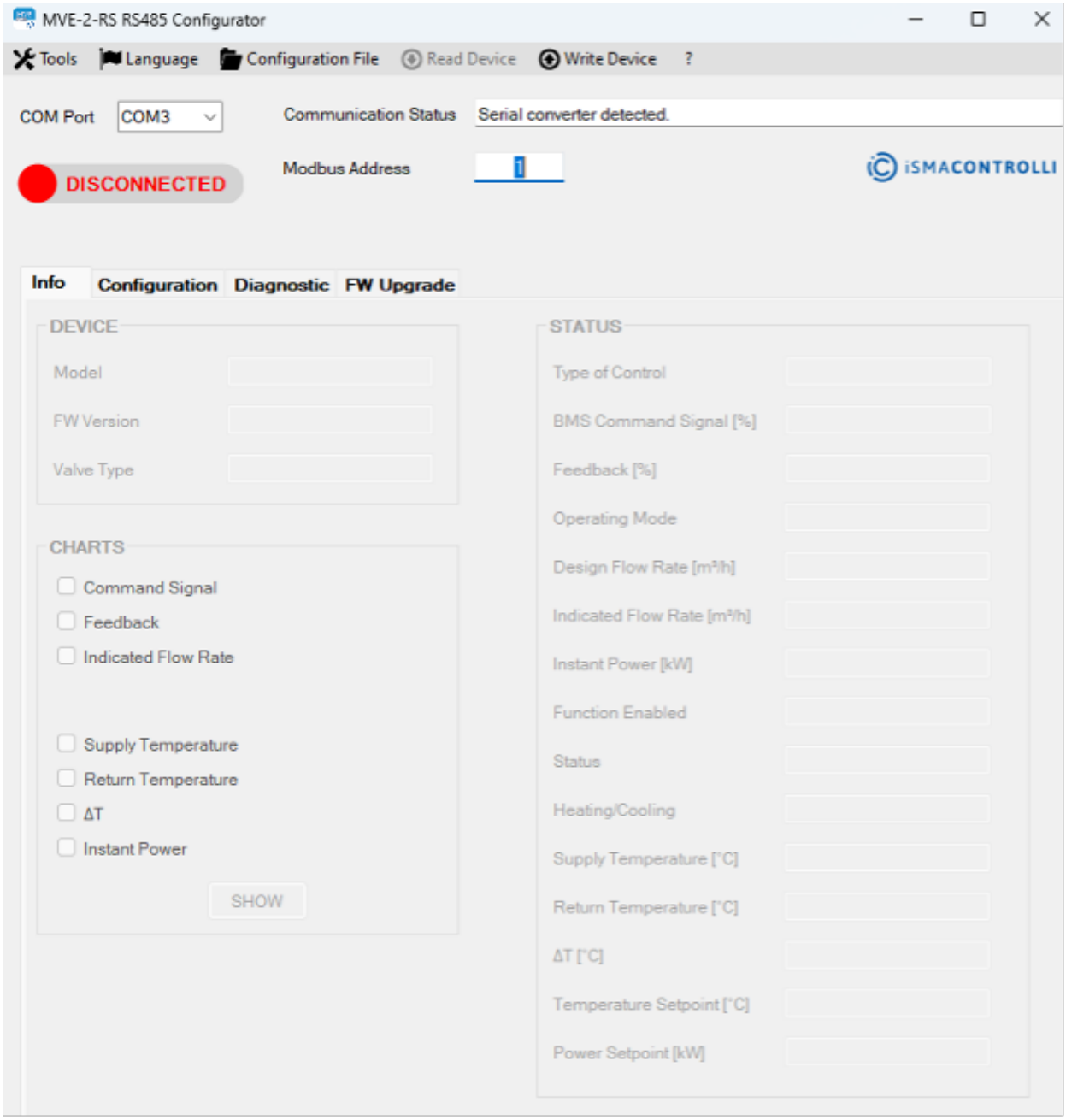

Figure 1. User interface at the startup

To enable the tabs, it is necessary to select the COM connected to the USB-RS485 converter and click the toggle button with the DISCONNECTED label. If the connection is

successful, all tabs will be enabled. To list all COM ports available, click the COM port label.

The user interface allows the following functionalities:

- Reading the main characteristics of the actuator and show real-time graphics (Info tab);
- Configuring the actuator (Configuration tab);
- Checking the actuator's status and its anomalies (Diagnostic tab);
- Setting the Modbus parameters to connect to the actuator with the Modbus master (not available in the USB version);
- Download the Firmware (FW Upgrade tab);
- Uploading a configuration file or download the set parameters in a configuration file;
- Selecting the language (Italian or English).

When any of the tabs is selected, all parameters shown in the page will be refreshed.

> WARNING!
> To read a parameter inside the tab, it is necessary to click the corresponding label.
> To write a parameter inside a textbox, it is required to press Enter after a new value is entered or after selecting an item from a dropdown menu

To write a parameter inside a textbox, it is required to press Enter after a new value is entered or after selecting an item from a dropdown menu.

5.1.1 Dropdown Menu

The main window at the top shows the following dropdown menu:

Figure 2. Dropdown menu

- **Tools:** allows to define the Modbus connection options related to the iSMA-B-CVT-RS485 converter. If the user intends to change the Modbus connection options, the parameters have to be changed before clicking the toggle button to connect to the MVE-2-RS RS485 Configurator:

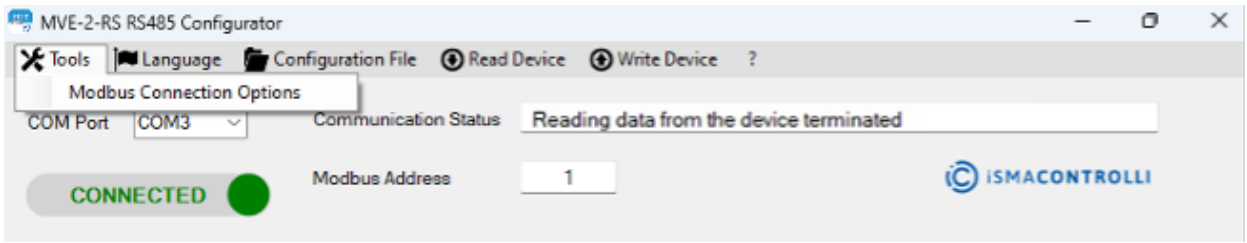

Figure 3. Tools menu

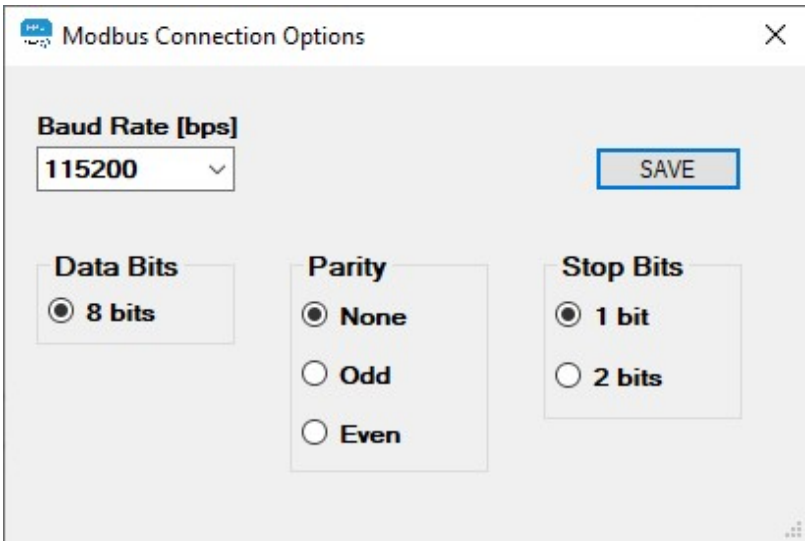

Figure 4. Modbus connection options

- **Language:** allows to choose a language: Italian or English.

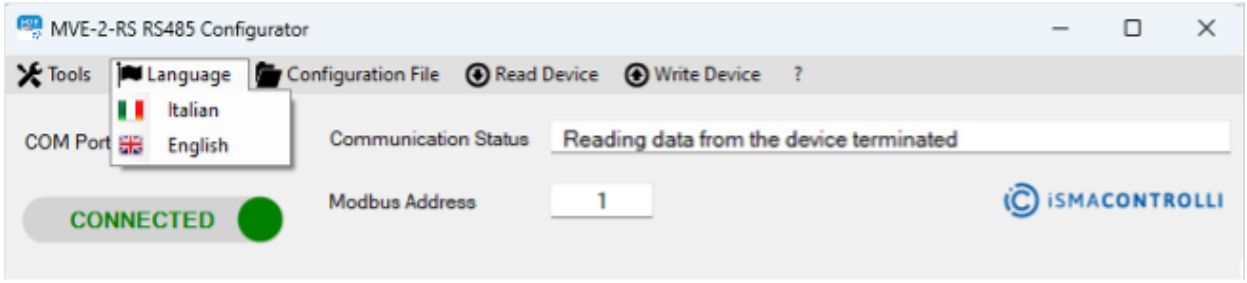

Figure 5. Language menu

- **File Configuration:** allows to:
  - **Load File:** load a .csv file with actuator parameters and send them to the actuator;
  - **Read File:** load a .csv file to show values on the tabs of the Configuration Tool without sending them to the actuator;
  - **Write File:** save a .csv file with the parameters set on the Configuration Tool.

Note: Only writable parameters will be saved in the .csv file.

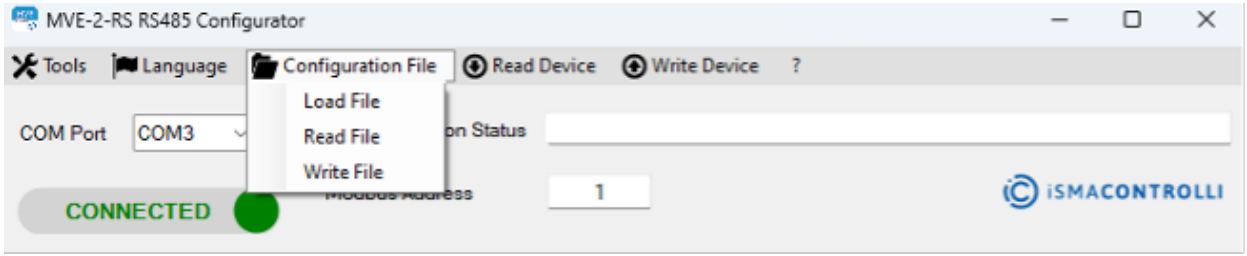

Figure 6. File configuration menu

- **Read Device:** allows to update the values in all tabs of the Configuration Tool;
- **Write Device:** allows to write all configuration parameters into the actuator;
- **?:** allows to read the software version of the Configuration Tool.

5.1.2 Other Functions

The following other items are shown:

- **CONNECT/DISCONNECT toggle button:** connects/disconnects the RS485 Configuration Tool. In the MVE-2-RS USB Configuration Tool, the toggle button

enables/disables the connection with the actuator via USB. In the MVE-2-RS USB Configuration Tool, the offline mode is available. The offline mode allows the user to use the Configuration Tool without the need of a real actuator connected to the USB of the PC. Offline mode is not available in the MVE-2-RS RS485 Configuration Tool.

When the application starts, the toggle button is in the DISCONNECTED status; to initiate the communication between the actuator and master device, it is necessary to click the toggle button and the status of the button will change to CONNECTED.

If the connection has been successful, the Communication Status label will state OK.

Figure 7. Communication Status shows the status of the USB communication

To disconnect the communication between the actuator and master device, click on the toggle button when it is in the CONNECTED status. If the disconnection has been successful, the DISCONNECTED notice will appear in the Communication Status field.

- COM PORT (dropdown list): if the serial converter is already connected at startup, only the relative COM port is shown. Otherwise, click the COM PORT label above the dropdown menu; all the COM ports active on the PC will be listed. To select the correct COM port, which the USB-RS485 converter is connected to, follow the procedure in the Modbus Configuration section;
- Modbus ADDRESS (textbox): shows the Modbus address of the device, to which the Configuration Tool will send all the command/operations. By default, the address is set to 1;
- Communication STATUS (textbox): allows to view the status of the communication showing the outcome of the performed actions. If an action is successful, the OK status is shown.

5.2 Modbus RTU Configuration

In the upper area of the main window, there is a dropdown list that displays the COM port currently in use by the PC. To identify the number of the serial port (COM Port), which the USB-RS485 converter is connected to, it is necessary to access the PC Control Panel and select the Device Manager:

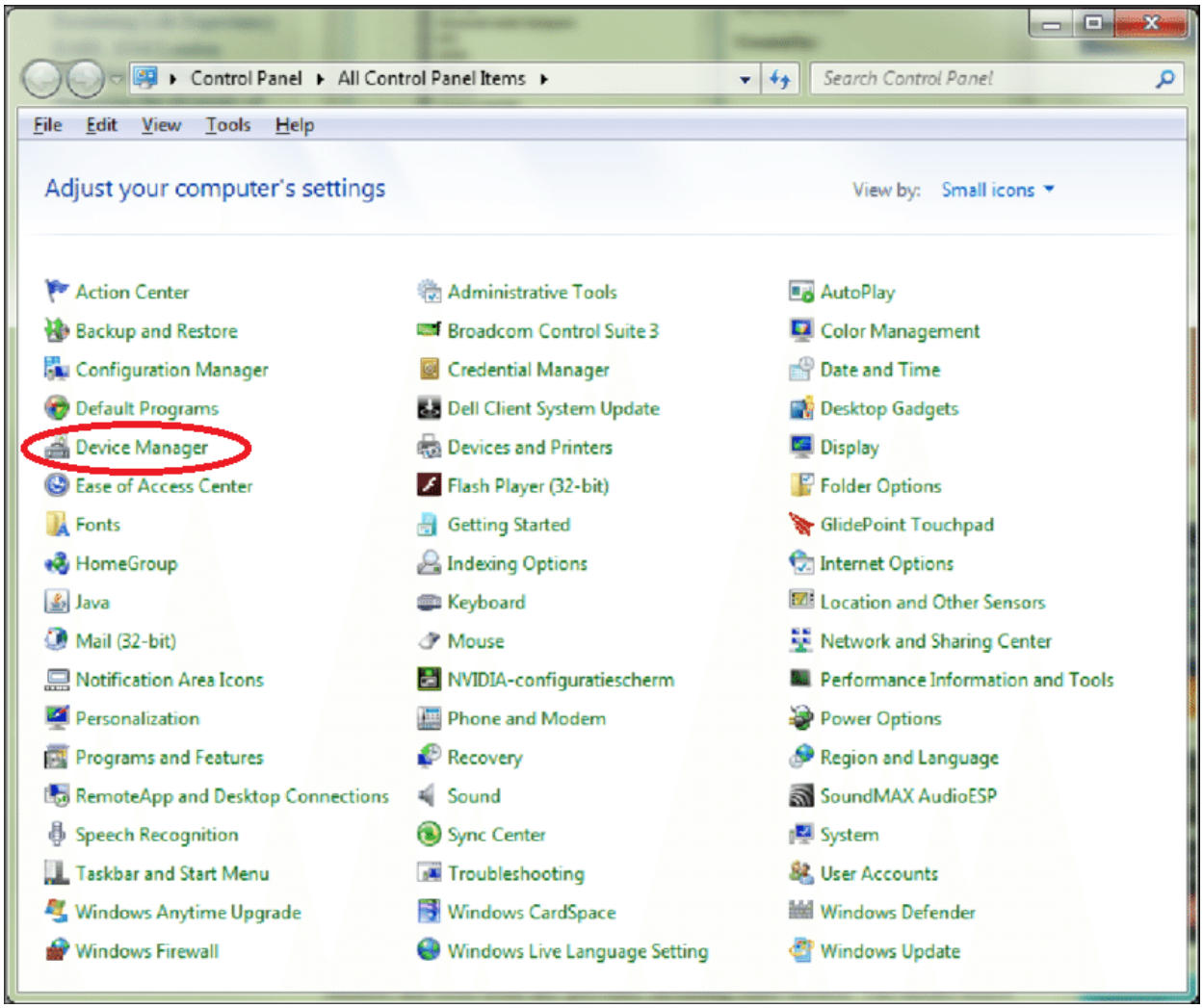

Figure 8. Device Manager in the Windows Control Panel

Select the Ports (COM and LPT) field to check the serial port number, which the serial converter is connected to (COM5 in the example below).

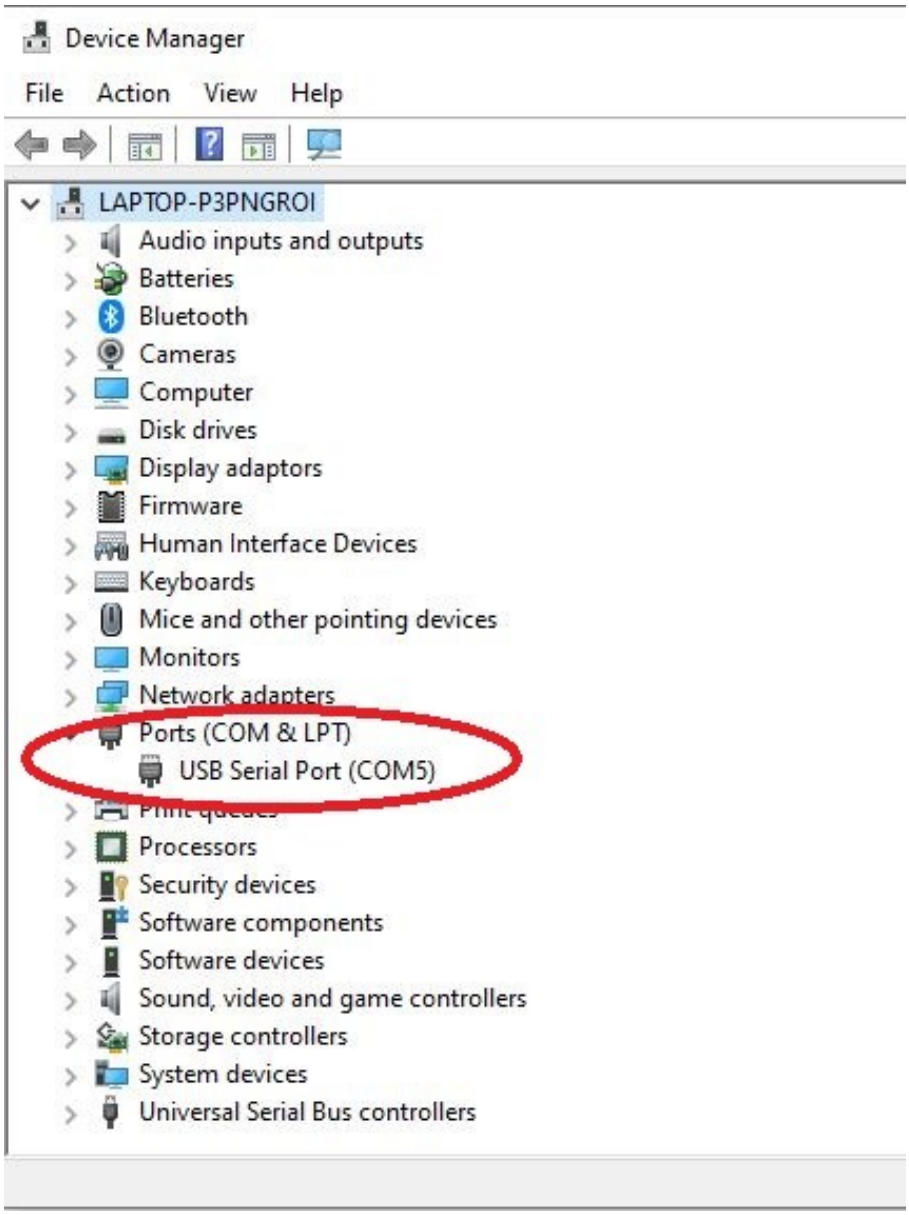

Figure 9. Device Manager Windows

Once the COM port has been selected, click the CONNECTED/DISCONNECTED toggle button, and verify if the Communications Status is OK.

As indicated in the previous section, the Modbus configuration parameters of the master can be selected through the dropdown menu: Tools → Modbus Connection Options. The changes of the Modbus connection parameters of the master must be done prior to clicking the connect toggle button.

By default, the communication parameters are:

- baud rate 115200;
- no parity bit;
- 1 stop bit.

5.3 Tabs

5.3.1 Info Tab

In this window, it is possible to read the main information about the actuator:

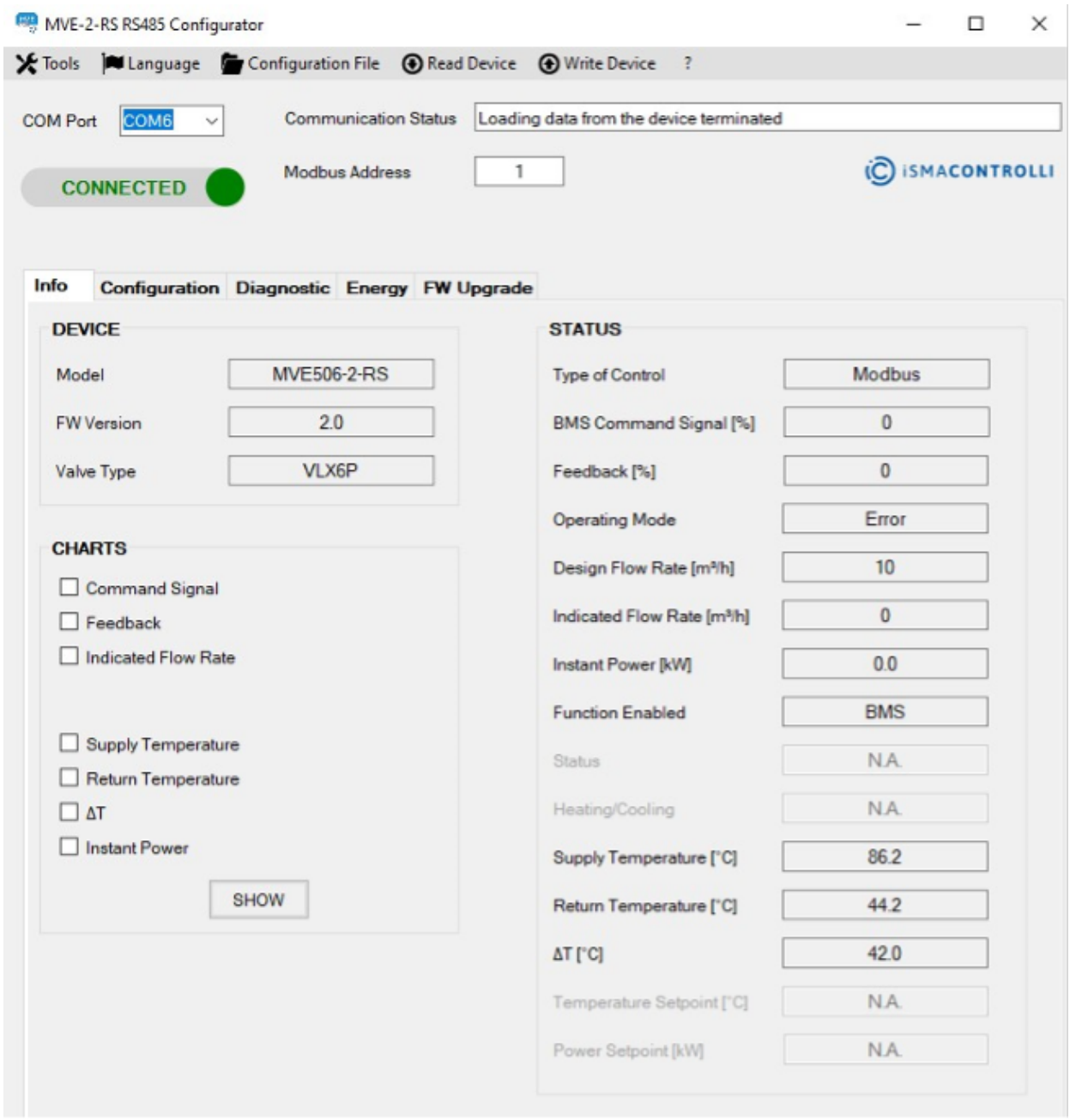

Figure 10. Info tab

- **Model:** represents the product part number. The alphanumeric code is composed as follows:

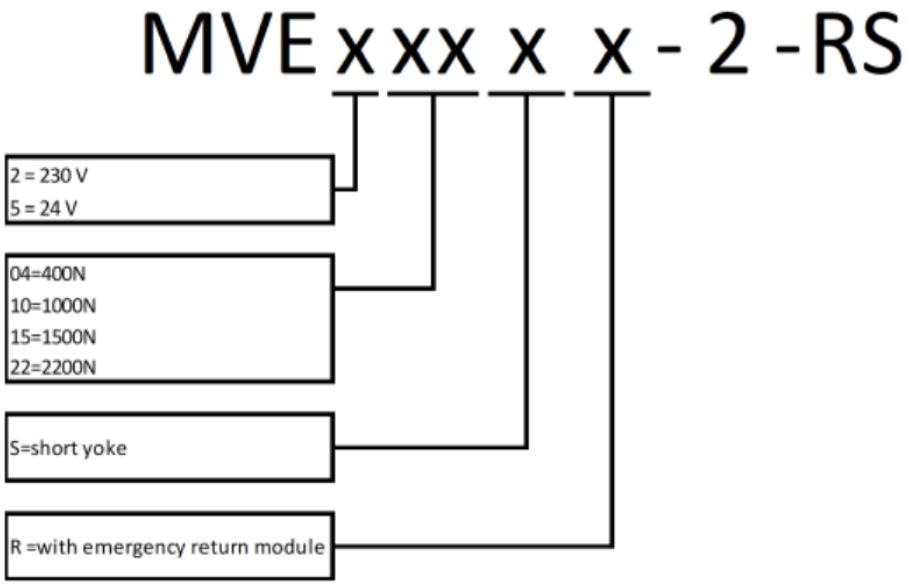

Figure 11. Example code

An example of the code is the following: MVE506-2-RS, which represents an MVE-2-RS model with 600 N of force, powered with 24 V AC Modbus/BACnet communication without emergency return.

The value cannot be changed in the Configuration Tool.

- **FW Version: :** identifies the current version of the firmware installed on the actuator;
- **Valve Type:** show the current valve connected to the actuator;
- **Type of Control:** shows the command type for the actuator (the default value is 0-10 V, selectable by DIP switch);
- **BMS Command Signal [%]:** shows the current Modbus command signal value (between 0-100%).

Note: It is a read-only value. The BMS command is set in the Configuration tab.

- **Feedback [%]:** allows to identify the position of the actuator in the 0-100% range of the stroke;
- **Operating Mode:** shows the operating status of the actuator, which can be one of the following:
  - **Normal:** the actuator is working following the command signal at its input; therefore, it is not in the initial positioning, calibration, emergency return, or manual override phases;
  - **Initial positioning:** the actuator is moving towards the initial position determined by the DIP 1 or, if the DIP switches are disabled, based on the action type value set in the Configuration tab;
  - **Calibration:** the actuator is calibrating the stroke;
  - **Error:** indicates that one or more errors have occurred; the details of the error are visible in the Errors section of the Diagnostics tab;
  - **Manual override:** shows that the manual command has been enabled; the actuator does not respond to the command signal until the manual override is disengaged and the initial positioning ends;

    - **Fail-safe:** shows that the actuator is in the emergency return phase due to the lack of power supply. This operative mode is available only for the emergency return models.
- **Design Flow Rate [m^3/h]:** this value (reading only) represents the maximum desired flow rate.
- **Indicated Flow Rate [m^3/h]:** this value (reading only) represents the flow rate calculated as a function of the valve position and the valve flow characteristic.
- **Instant Power [kW]:** represent the current power. It is showed only if the selected valve is a PICV and if the temperature sensors work properly.
- **Function enabled:** show which of the following function is enabled:
    - BMS;
    - Temperature Control;
    - ΔT limit;
    - Temp Limit;
    - Temp Limit;
    - Power Control;
    - Power Limit.
- **Status:** shows if the limit function is active or not in real time;
- **Heating/Cooling:** shows whether the heating or cooling control mode is active;
- **Supply Temperature [°C]:** represents the temperature value, in °C, detected by the supply temperature sensor (it is the sensor connected to the T1 input of the terminal block). It is a read-only value;

Note: If a value of 500.0 is displayed, it means that the supply sensor (T1) is disconnected or faulty, and the relative TEMPERATURE SENSORS group box is disabled (the group box is gray). In case functions, which require that temperature sensors are enabled, this error condition is also highlighted in the Diagnostics tab. In case a temperature sensor anomaly occurs, all the related functionalities are disabled.

- **Return Temperature [°C]:** represents the temperature value, in °C, detected by the sensor positioned at the valve outlet port (it is the sensor connected to the T2 input of the terminal block). It is a read-only value;

Note: If a value of 500.0 is displayed, it means that the return sensor (T2) is disconnected or faulty, and the relative TEMPERATURE SENSORS group box is disabled (the group box is gray). In case of functions which require that the temperature sensors are enabled, this error condition is also highlighted in the Diagnostics tab. In case a temperature sensor anomaly occurs, all the related functionalities are disabled.

- **ΔT [°C]:** shows a difference between the supply and return temperature value, in °C;

Note: If the temperature sensors have problems or are not connected, 500.0 is displayed.

- **Temperature Setpoint [°C]:** shows a setpoint configured for the temperature control enabled function;
- **Power Setpoint [kW]:** shows a setpoint configured for the power control enabled function;
- **CHARTS:** by checking the items listed in this section, it is possible to view the charts of the desired variables. The graphs are grouped into 2 types: the Control charts (command signal, feedback, indicated flow rate) and the Temperature and Power charts (supply temperature, return temperature, delta T, instant power). clicking the

CHARTS button, a window will appear with selected charts. The 2 types of variables are represented on 2 different graphic areas (see the figure below).

WARNING! The CHARTS functionality is NOT available in the MVE-2-RS USB Configuration Tool.

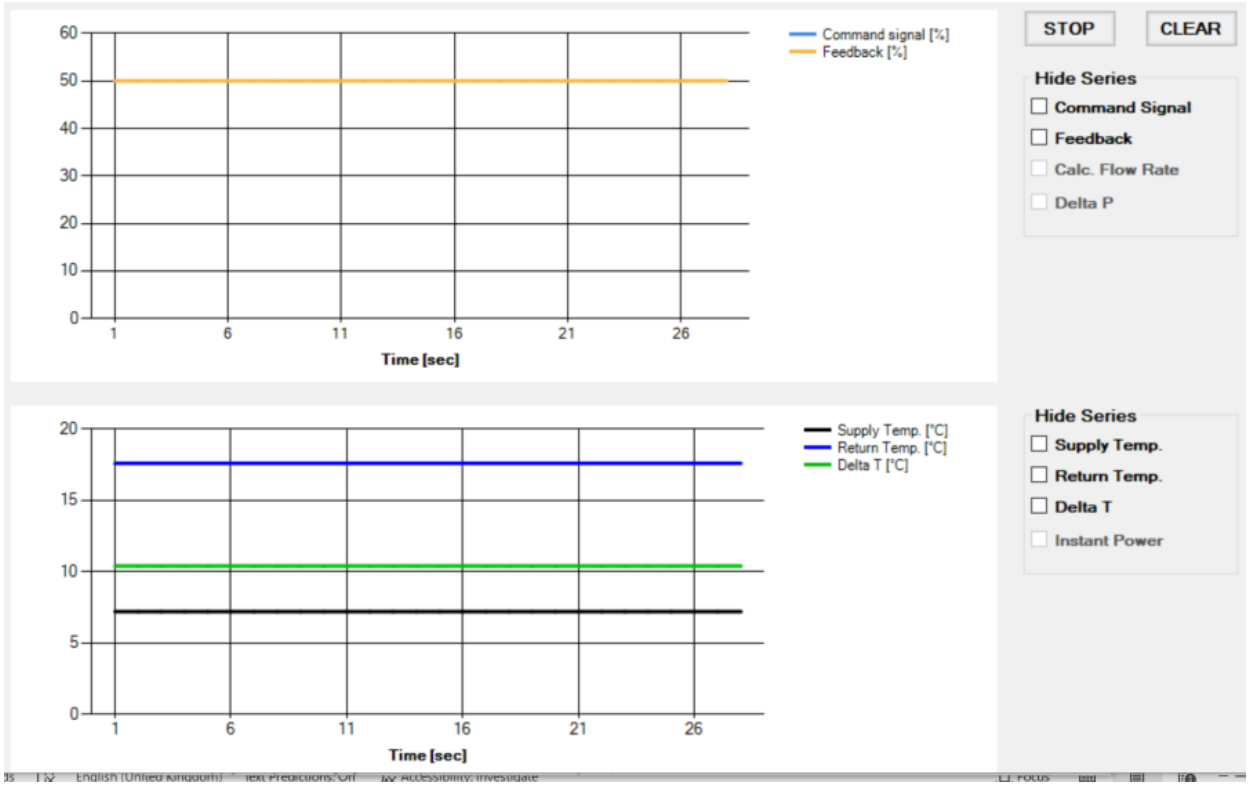

Figure 12. The charts window

The window shows the 2 areas for the 2 types of charts described above. The charts displayed are those selected in the Info tab, and they are updated every second starting from the opening of the window in the specific chart area.

It is possible to stop updating charts and display them by clicking the STOP button, and resume updating by clicking the START button (the same button, therefore, allows to stop or restart the display). When updating is resumed, the first data displayed will be the current one and not the one at the time of the stop (therefore, the data will be lost during the time the chart stops).

It is possible to hide one or more plotted graphs from the display by marking checkboxes in the Hide series section (the series is hidden, but the acquired data continues to be stored anyway).

It is again possible to show the previously hidden graphs by removing the check mark from the specific box; as mentioned, the graphs will show a temporal continuity in the data even if they were hidden.

The CLEAR button allows to delete the graphs from the display area.

After 90 minutes the charts are no longer updated because the maximum number of data that can be displayed has been reached. A pop-up message warns the user and asks if the data should be saved to a file (.csv); if the action is confirmed with the Yes button, a window is opened for saving the file, and, once the name of the file is indicated, the charts in the two areas are deleted. By clicking the No button, the data are not saved to the file,

and the charts will be deleted. By clicking, the START button, it is possible to restart the data display from the current instant.

5.3.2 Configuration Tab

In this window, it is possible to set the following actuator's configuration parameters:

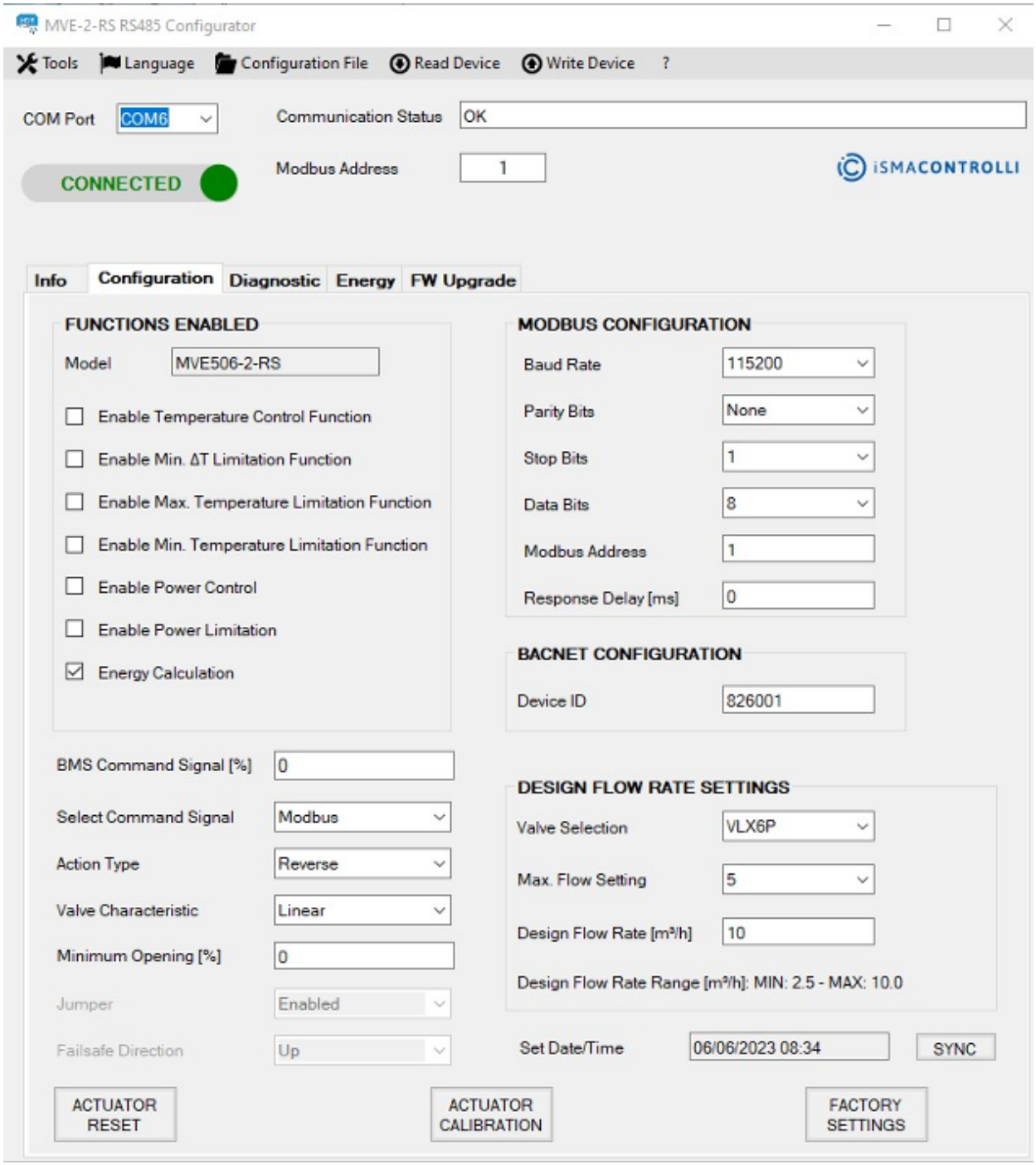

Figure 13. Configuration tab

- FUNCTIONS ENABLED: shows the available functions for the actuator model;

Figure 14. Selection of functions to enable

- ☐ **Temperature Control Function:** the function constantly overrides the control signal to maintain the set temperature or ΔT by closing or opening the valve;
- ☐ **Min. ΔT Limitation Function:** the actuator is controlled by the input signal (voltage or current control) or by the Modbus/BACnet command but, if the ΔT goes below the temperature limitation set (heating or cooling), the actuator overrides the command closing the valve;
- ☐ **Max. Temperature Limitation Function:** the actuator is controlled by the input signal (voltage or current control) or by the Modbus/BACnet command but, if the temperature exceeds the temperature limitation set (heating or cooling), the actuator:
  - opens the valve in cooling,
  - closes the valve in heating;
- ☐ **Min Temperature Limitation Function:** the actuator is controlled by the input signal (voltage or current control) or by the Modbus/BACnet command but, if the temperature goes below the temperature limitation set (heating or cooling), the actuator:
  - closes the valve in cooling,
  - opens the valve in heating;
- ☐ **Power Control:** the actuator calculates the thermal power transferred from the coil and control it. This function is enabled when the actuator is installed on a PICV valves (iC or custom) and both temperature sensors are installed on the MVE-2-RS.
- ☐ **Power Limitation:** the actuator limits the opening of the valve when the calculated power is greater than a Max Set value. This function is enabled when the actuator is installed on a PICV valves (iC or custom) and both temperature sensors are installed the MVE-2-RS.
- ☐ **Energy Calculation:** the actuator calculates the instantaneous thermal power and energy (heating\cooling) supplied by the controlled coil. This function is enabled when the actuator is installed on a PICV valves (iC or custom), both temperature sensors are connected to the MVE-2-RS and date and hour are synchronized.

- **BMS Command Signal [%]:** allows to set the Modbus/BACnet command for positioning the actuator between 0-100% (0.1% step). To send the command to the actuator, press the Enter key on the keyboard;
- **Select Command Signal:** allows to select the type of command signal for driving the actuator (by default set to 0-10 V, selected by DIP switches);
- **Action Type:** if Modbus/BACnet is enabled, this menu allows to select the action type of the actuator (direct or reverse). To write the selected value into the actuator, press the Enter key on the keyboard;
- **Valve Characteristic:** it is possible to select the characteristic of the valve: linear or equipercentage (EQP);

- **Minimum Opening [%]:** represents the minimum opening valve (expressed as a percentage) necessary to ensure a minimum of flow in the system;

Note: to save a specific value into the actuator, it is required to press Enter key on the keyboard. To save all data, it is possible to click the Write Device option.

- **Jumper:** allows to select if the emergency return direction is determined by the jumper on the emergency return board (enabled) or by the Modbus or by BACnet. This is enabled for the emergency models only;
- **Failsafe Direction:** allows to select the emergency return direction (up or down) if the Enable Jumper function is disabled. This is enabled for the emergency models only;
- **MODBUS CONFIGURATION:** allows to set the Modbus configuration parameters of the actuator, in particular:
- **Baud Rate:** 9600, 19200, 38400, 57600, 76800 and 115200;
- **Parity Bit:** sets the parity bit to none, odd, or even;
- **Stop Bits:** 1 or 2.

Note: The factory settings of the actuator are: baud rate 115200, no parity bit, and 1 stop bit.

- **Modbus Address:** allows to set the Modbus address of the actuator;

Note: To write the value in the actuator, press "Enter" on the keyboard after selecting the desired value.

- **BACNET CONFIGURATION:** allows to configurate/read the BACnet Device ID.
- **DESIGN FLOW RATE SETTING:**
- **Valve Selection:** allow to select the valve connected with the actuator. Selecting Custom PICV displays the SET X,Y button;

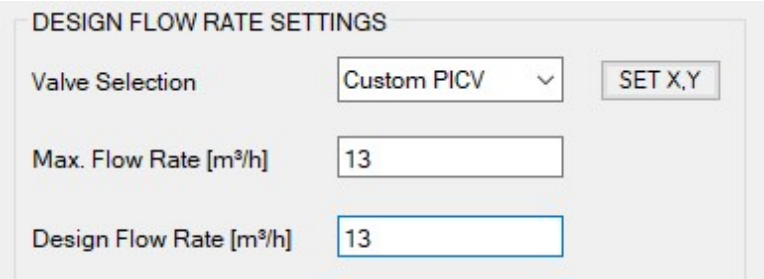

Figure 15. Custom PICV

Pressing the button opens a window in which it is possible to write down the flow rate (X) and position (Y) percentage values of the valve characteristic curve. When the window opens, a reading of the flow rate and position values is taken;

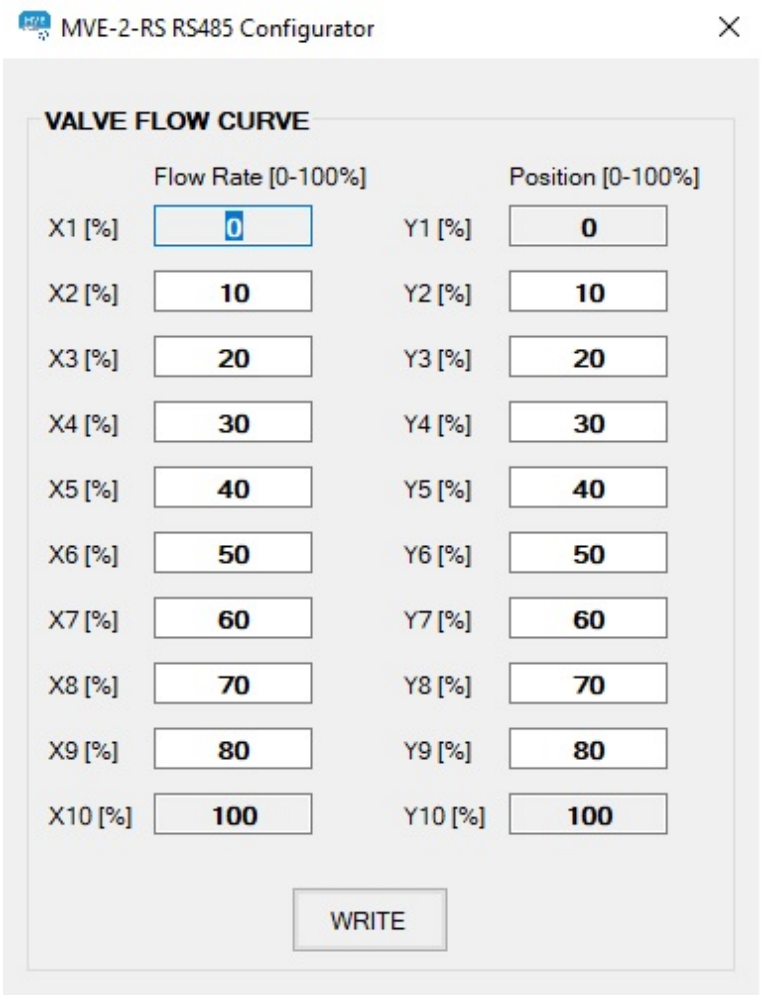

Figure 16. Flow rate and position

- Max Flow Setting: allow to select the maximum flow, in this case 5;
- Design Flow Rate [m^3/h]: show the maximum desired flow rate, in this case 10;
- Design Flow Rate Range [m^3/h]: show the range of design flow rate based on the max flow setting configurated, in this case 2.8-11.0;
- Set Date/Time: when the tab Configuration is selected, the textbox displays automatically the current date and time of the PC are saved in the actuator. At the same time, the clock error displayed in the Diagnostics tab disappears. Each time the actuator turns off (the error condition is indicated in the Diagnostics tab), the date and time must be synchronized.

Note: By clicking on the Actuator Date/Time label, the date and time inside the actuator is read and displayed in the textbox.

- Actuator Calibration: forces the calibration of the actuator stroke;
- Actuator Reset: performs a software reset of the actuator;
- Factory settings: restores factory values to the actuator reload. This action overwrites the configuration and data inside the actuator.

The variables in this window are read from the actuator and displayed when the Configuration tab is clicked from any tab or by clicking the Read Device item from the dropdown menu. It is also possible to invoke an instant reading of a textbox by clicking on the corresponding label.

5.3.3 Diagnostic Tab

In this window, it is possible to view the status of the actuator and the occurrence of any anomalies:

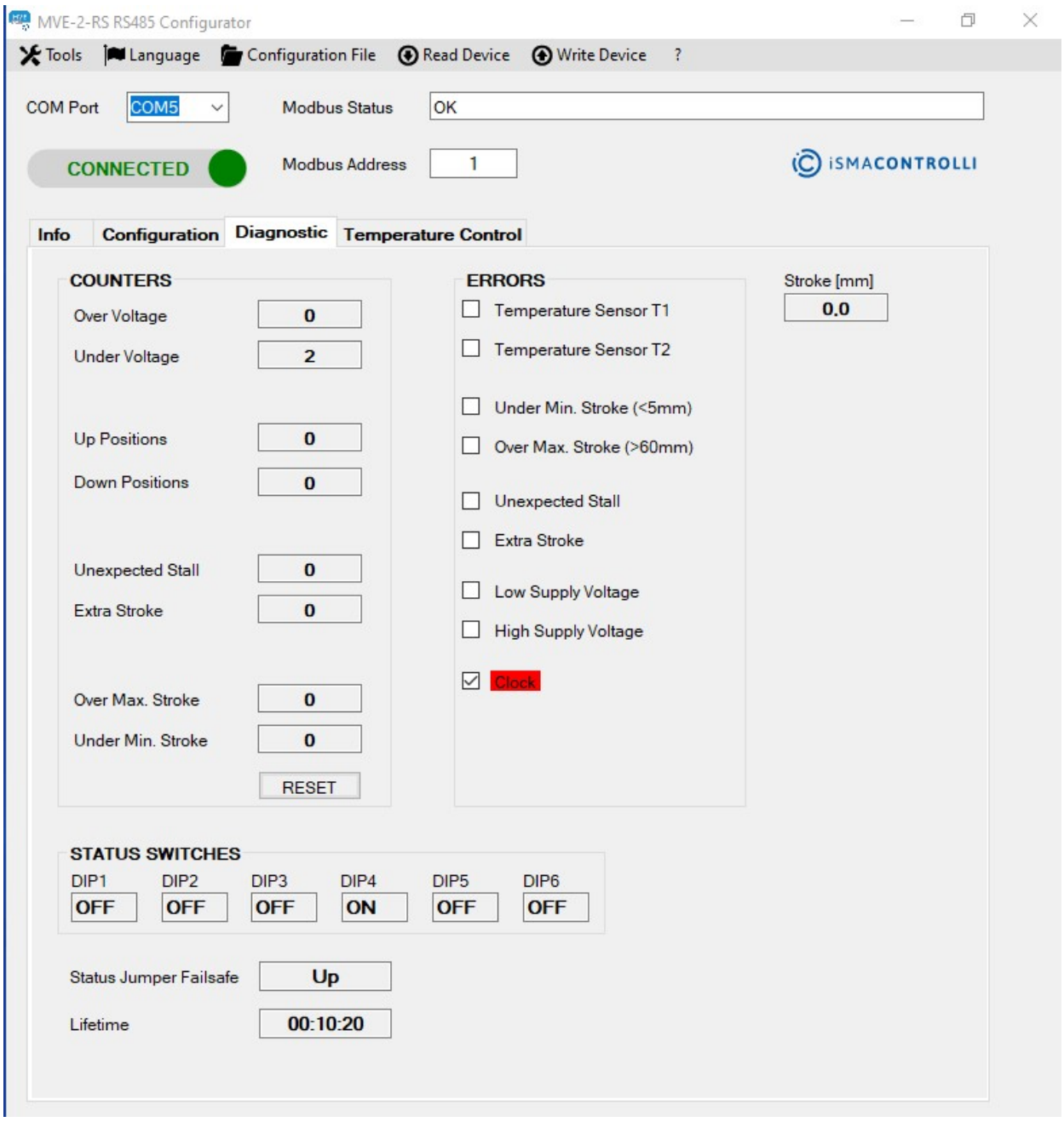

Figure 17. Diagnostic tab

- **Stroke [mm]:** shows the value of the actuator stroke calculated in mm during a calibration phase. It is a read-only value.

The COUNTERS section displays the number of events (mainly anomalies) that have occurred in the actuator. The events that can be logged are:

- **Over Voltage:** shows how many high voltage supply anomalies have occurred;
- **Under Voltage:** shows how many low voltage supply anomalies have occurred;
- **Up Positions:** identifies the number of times that the actuator has been fully retracted;
- **Down Positions:** identifies the number of times that the actuator has been fully extended;

- **Unexpected Stall:** identifies an unexpected stall anomaly; this value represents the number of times that a stall has occurred within the stroke;
- **Extra Stroke:** identifies an extra stroke anomaly; this value represents the number of times an extra stroke has occurred compared to the stroke calculated during the last calibration phase (out-of-range stroke);
- **Over Max. Stroke:** shows how many stroke anomalies calculated by the actuator in the calibration phase (stroke greater than 60 mm) have occurred;
- **Under Min. Stroke:** shows how many stroke anomalies calculated by the actuator in the calibration phase (stroke less than 5 mm) have occurred;
- **RESET:** allows to reset all the counters (Over Voltage, Under Voltage, Up Positions, Down Positions, Unexpected Stall, Extra Stroke, Over Max. Voltage, Under Min. Voltage).

The ERRORS section shows the detectable actuator errors:

- **Temperature Sensor T1:** the temperature sensor connected to the T1 terminal (supply temperature) has an anomaly (if temperature sensors are required for the enabled functions);
- **Temperature Sensor T2:** the temperature sensor connected to the terminal indicated with T2 (return temperature) has an anomaly (if temperature sensors are required for the enabled functions);
- **Under Min. Stroke (<5mm):** during the calibration phase, a stroke was calculated below the minimum allowed value;
- **Over Max. Stroke (>60mm):** during the calibration phase, a stroke above the maximum allowed value was calculated;
- **Unexpected Stall:** the actuator is in an unexpected stall condition in the stroke range;
- **Extra Stroke:** the actuator is in an extra stroke condition; therefore, the actuator is in a position beyond the calculated stroke;
- **Low Supply Voltage:** the power supply of the actuator is below the minimum allowed threshold (the performance of the actuator is not guaranteed);
- **High Supply Voltage:** the power supply of the actuator is above the maximum allowed threshold (the performance of the actuator is not guaranteed);
- **Clock:** indicates that the time and date have not been set in the actuator since the last time the actuator was switched on (it is necessary to enable the energy function and, consequently, to read the energy data). Synchronization is carried out in the Configuration tab as described in the specific paragraph.

Active errors are highlighted in red color.

The STATUS SWITCHES section allows to read the DIP switches configuration set on the actuator. The status of the switches is updated only after having engaged and disengaged manual override or after a reset command or after having power off/on the actuator.

- **Status Jumper Failsafe:** shows the jumper status (up or down) to indicate if the jumper on the emergency return board is inserted or not (it determines the fail-safe direction). The Status jumper fail-safe is applicable only if the Jumper is set on Enabled).
- **Lifetime:** shows how long the actuator has been switched on.

The variables present in this window are read when the “Diagnostic” tab is clicked from any tab or when the “Read Device” item from the dropdown menu is clicked.

5.3.4 Temperature Control Tab

In this window, it is possible to configure and check the parameters of the temperature loop function.

This function is enabled only if the actuator is installed on a PICV (iC or custom) and both temperature sensors are correctly installed.

To save the set values, press the "Enter" key on the keyboard.

The 2 sections in this tab are enabled/disabled (gray color) based on the enabled function in the Configuration tab.

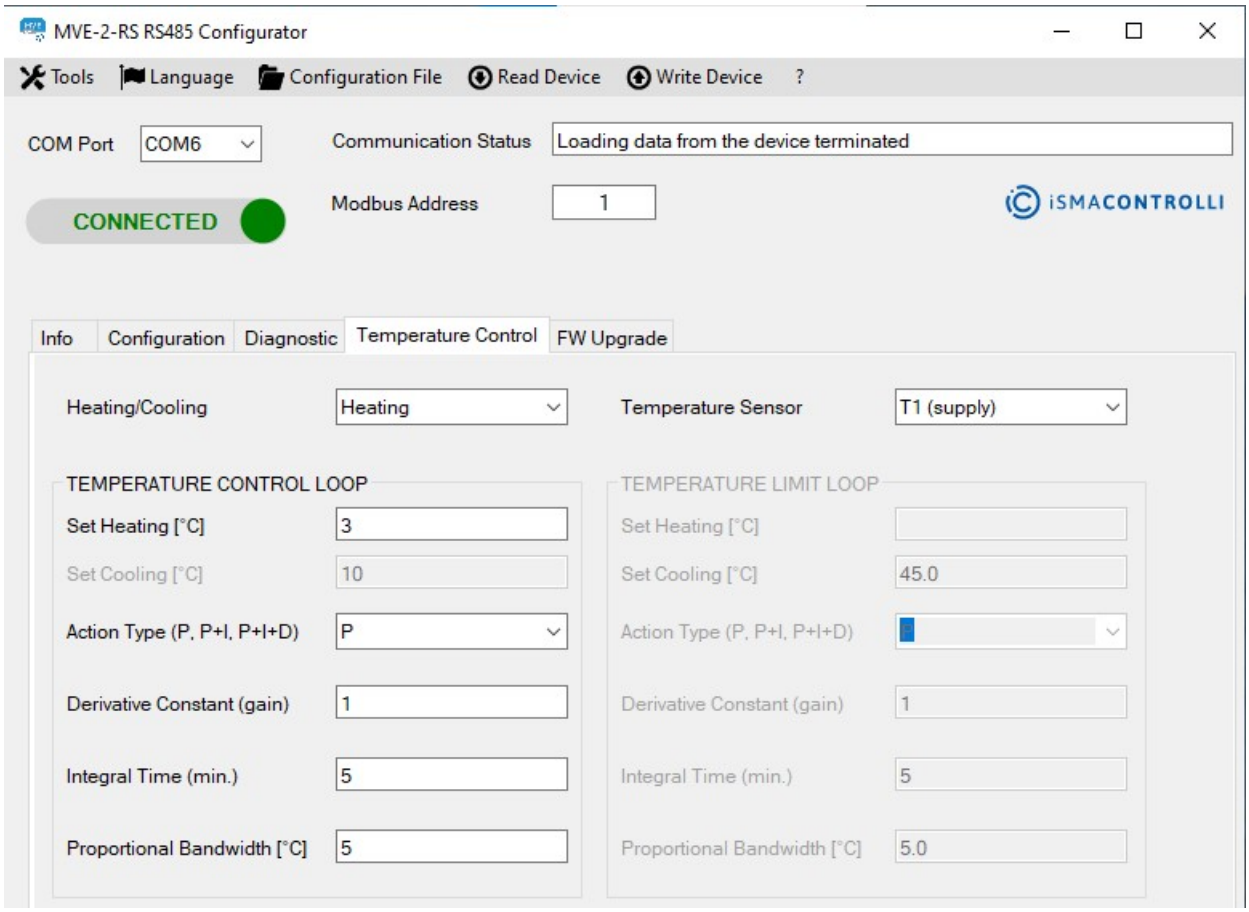

Figure 18. Temperature Control tab

- **Heating/Cooling/Automatic (ΔT):** sets a cooling or heating or automatic (based on ΔT) mode;
- **Temperature Sensor:** sets the temperature sensor (T1 supply, T2 return, or ΔT) to use in the selected temperature function.

The TEMPERATURE CONTROL /LIMIT LOOP section allows to set the parameters for the temperature control/limitations functions:

- **Set [°C]:** represents the temperature setpoint value;
- **Action Type (P, P+I, P+I+D):** represents the type of control of the system to be used to regulate the desiderate temperature. To write the selected value into the actuator, press the Enter key on the keyboard;
- **Derivative Constant (gain):** represents the contribution of the derivative action;
- **Integral Time (min):** defines the time within which the proportional action is proposed again;

- **Proportional Bandwidth ΔT [°C]:** represents the temperature error value (error = current temperature value - setpoint temperature), beyond which the valve will be fully open;

To save the desired value it is necessary to press the "Enter" key in the keyboard. To save all data press "Write Device".

Furthermore, it is possible to do an instantaneous read of the single information selecting on the specific label.

5.3.5 Power Control Tab

In this window, it is possible to configure and check the parameters of the Power Control function.

To save the set value of design power and max power limit, press the Enter key on the keyboard.

The 2 sections in this tab are enabled/disabled (gray color) based on the enabled function in the Configuration tab

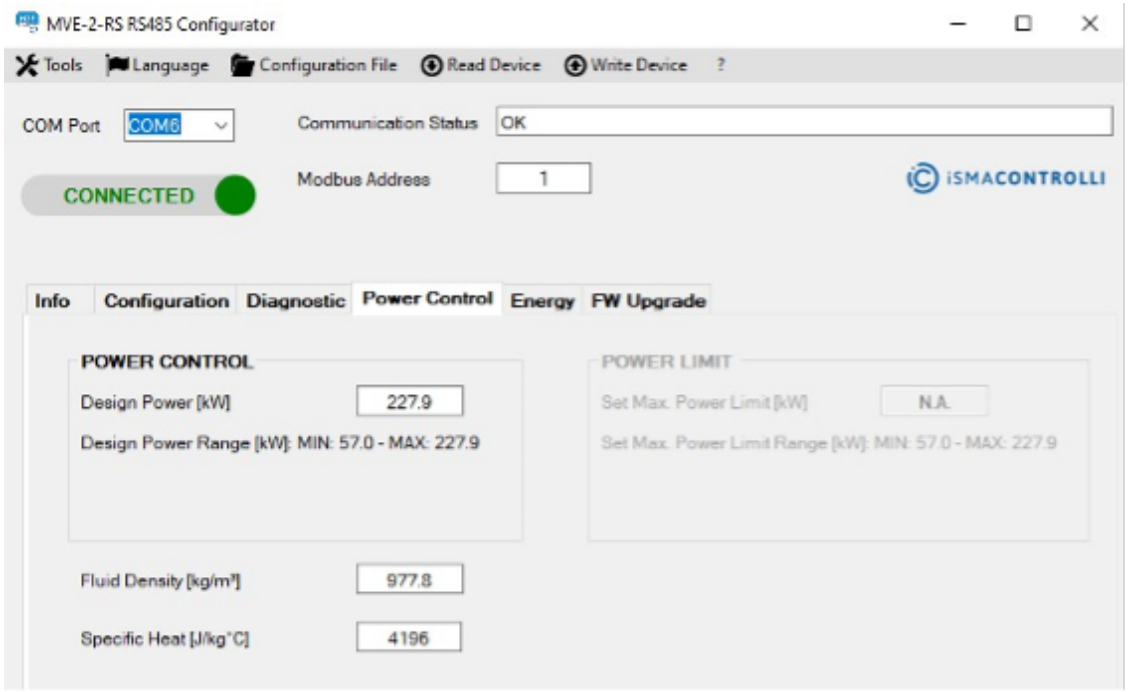

Figure 19. Power Control Tab

The POWER CONTROL section allows to set the information for the power control function, in particular:

- **Design power [kW]:** is the value of the power desired;
- **Design Power Range [kW]:** it represents the maximum and the minimum value the Design Power can assume for the type of valve selected (for VLX6P it is 57.0-227.9);

The POWER LIMIT SECTION allows to set the information about the power limit value that the actuator can't exceed, in particular:

- **Max. Power Limit [kW]:** is the maximum power limit desired;
- **Max. Power Limit Range [kW]:** it represents the maximum and the minimum value the Power can assume for the type of valve selected (for VLX6P it is 57.0-227.9);

Fluid density [Kg/m^3]: this value indicates the density of the fluid (default setting water 977.8 Kg/m^3);

Specific Heat [J/Kg °C]: this value indicates the specific heat of the fluid (default setting water 4196 J/Kg °C).

5.3.6 Energy Tab

In this window, it is possible to read the parameters of the Energy function and read the monthly consumption as histograms.

To save the set values, press the “Enter” key on the keyboard.

This function is enabled only if the actuator is installed on a PICV (iC or custom), both temperature sensors are correctly installed, and date and hour are synchronized.

The 2 sections in this tab are enabled/disabled (gray color) based on the enabled function in the Configuration tab.

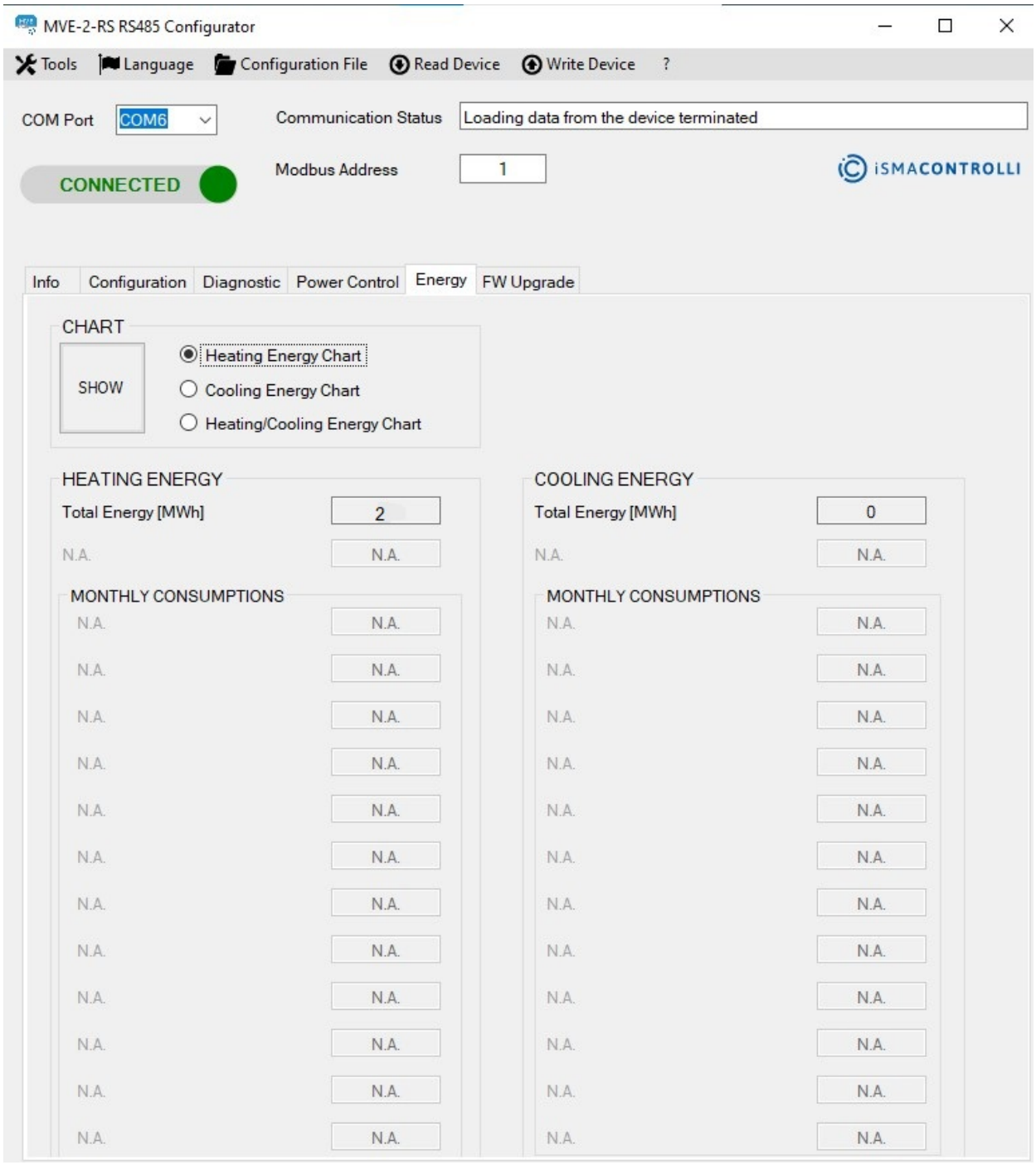

Figure 20. Energy Tab

The CHART section allows to observe the histogram about the energy in the 12 months of the year regarding:

- Heating Energy
- Cooling Energy
- Heating/Cooling Energy

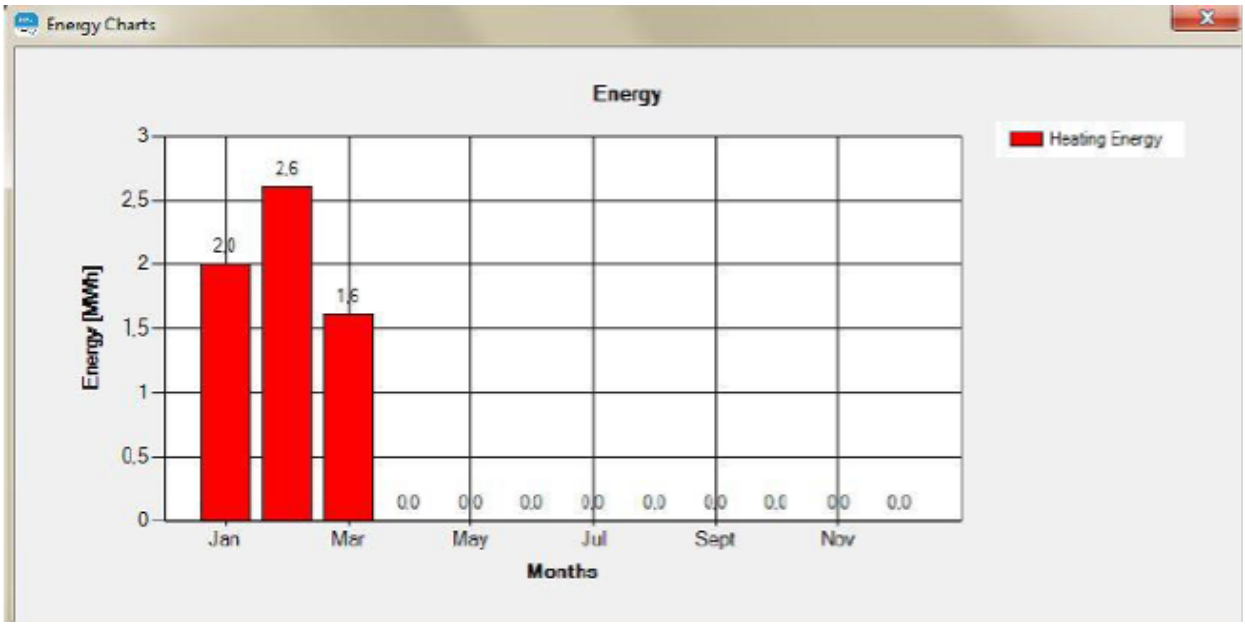

Figure 21. Window of the histogram chart of the energy

The HEATING and COOLING ENERGY section shows:

- **Total Energy [MWh]:** this value shows the total energy reading used until that moment;
- **Total Energy at 31/12/2023 [MWh]:** this value shows the total energy reading at the end of the year;
- **MONTHLY CONSUMPTION [MWh]:** in this section is reported the energy heating/ cooling consumption for each month. If for a month there are no registered value, or they haven't been calculated yet, then it will appear N/A.

The variables present in this window are read by the actuator and displayed when the "Energy" tab is pressed from any tab or by pressing the "Read Device" item from the drop-down menu.

5.3.7 FW Upgrade Tab

After the selection of this tab the following window is shown:

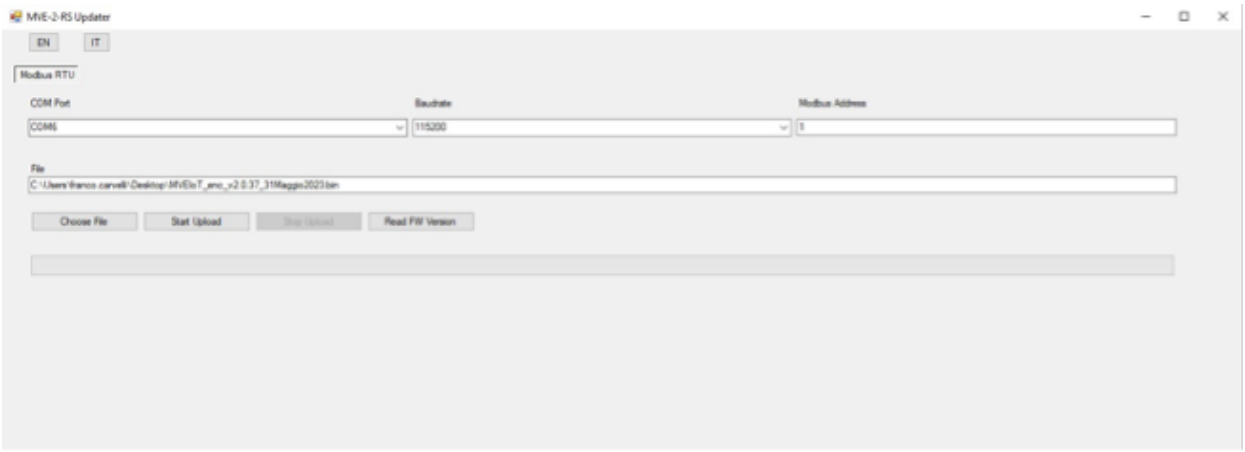

Figure 22. FW upgrade window

In this window, it is possible to upgrade the actuator's firmware.

- **COM Port:** displays all available COM port in the PC, it is necessary to select the one connected to the USB-RS485 converter;

- **Baudrate:** allow to set the desired Baudrate (default 115200) through a dropdown menu; the baudrate has to be configurated with the same value of the actuator;
- **Modbus Address:** allows to set the Modbus address of the actuator (default 1);
- **Choose File:** allow to select the file to download;
- **Start Upload:** start the download of the selected file;
- **Stop Upload:** in case of problem this button allow to stop the download, it can be selected only when the download starts;
- **Read FW Version:** Check the current FW version.

6 MVE-2-RS USB Configurator User Interface

The MVE-2-RS USB Configuration Tool allows to read and write only the configuration data of the actuator.

In the **USB Configuration Tool is not possible**, for example, **to set a command signal to move the actuator, or view the graphs of the real-time actuator position**. **All other functionalities are same as in the Modbus Configuration tool previously described.**

This Configuration Tool offer the offline mode (simulator), which allows to interact with the user interface even if the actuator and USB cable are not connected.

When the USB cable is connected between the PC and the actuator, the motor is disabled, and, therefore, if the actuator was moving before the connection, it stops immediately. It resumes the movement towards the previously calculated position once the cable is disconnected.

MVE-2-RS USB Configuration Tool is opened in an offline mode. The offline mode allows to interact with the user interface even if the actuator is not connected. In this mode, it is possible to simulate all configuration tool operations except the Load File, because this operation requires the actuator connected via USB.

To switch to the Configuration Tool mode, it is enough to click on the OFFLINE check box to remove the mark.

At the start, if the cable is already connected or has been connected after opening the Configuration Tool, it will be automatically recognized by the PC and showed in the Device Manager window of Windows under “Human Interface Device” (HID) identified by the device description.

6.1 General functionality

This chapter describes the user interface of the USB Configuration Tool.

Opening the application, the following user interface will be displayed:

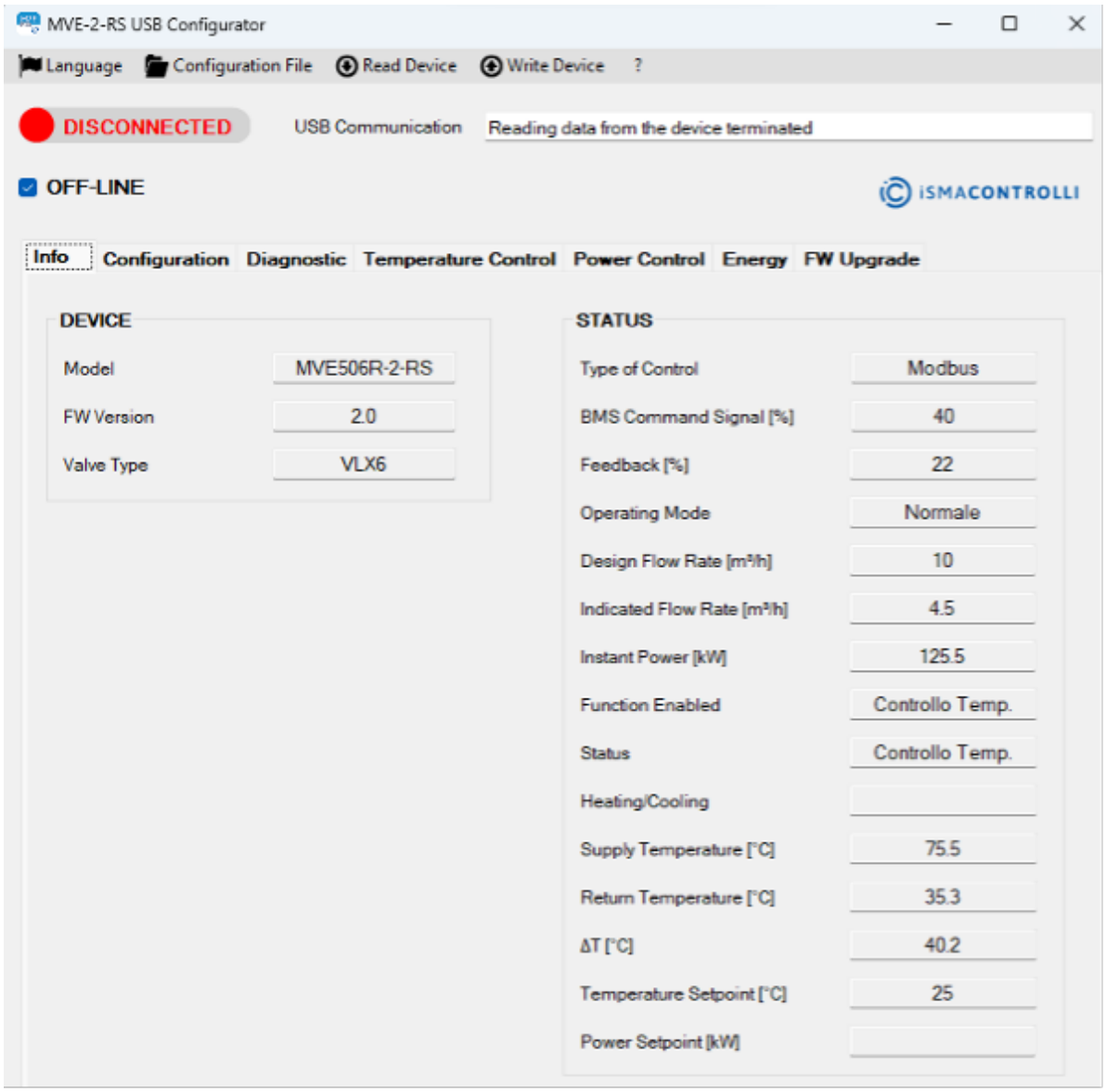

Figure 23. User interface at the startup

The user interface allows the following functionalities:

- Reading the main characteristics of the actuator (Info tab);
- Configuring the actuator (Configuration tab);
- Checking the actuator's status and its anomalies (Diagnostic tab);
- Set and read the parameters for temperature control function (Temperature Control Tab);
- Set and read the parameters for power control function (Power Control tab);
- Set and read the parameters for energy function (Energy tab);
- Download the FW (FW Upgrade tab);
- Selecting the language (Italian or English).

When any tab is selected, all parameters shown in the page will be refreshed.

To write a parameter inside a textbox in a tab, different from the info tab, it is required to press Enter after a new value is entered or after selecting an item from a dropdown menu.

6.2 FW Upgrade Tab

After the selection of this tab the following window is shown:

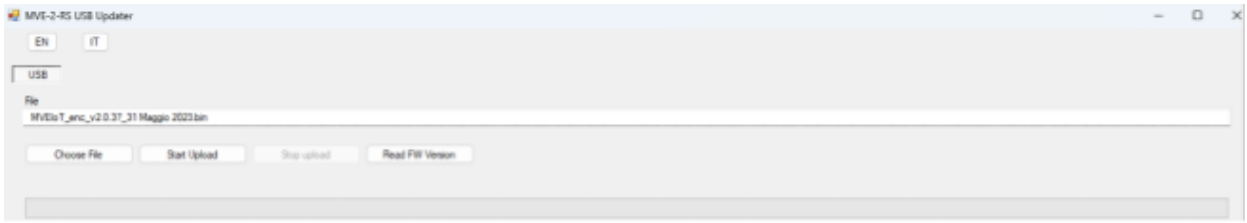

Figure 24. FW Upgrade tab

In this window, it is possible to upgrade the actuator's firmware.

The USB box show if the USB cable is connected or not, showing “USB connected / disconnected”.

- **Choose File:** allow to select the file to download;
- **Start Upload:** start the download of the selected file;
- **Stop Upload:** In case of problem this button allows to stop the download, it can be selected only when the download starts;
- **Read FW Version:** Check the current FW version.

7 Description of the Configuration Parameter

7.1 Configuration Area

7.1.1 Version and module type

This register shows the firmware version (Most Significant Byte) and the device ID of the actuator (Least Significant Byte).

Modbus register: 40001

7.1.2 Module Address

Defines the Modbus address of the device from 1 to 255.

Modbus register: 30002

BACnet object: Network port, object ID: 0, properties: MAC address.

7.1.3 Counter of Received Frames (LSW)

This register contains the least significant word of the counter of received frames from the last powering-up or module reset.

Modbus register: 30004

7.1.4 Counter of Received Frames (MSW)

This register contains the most significant word of the counter of received frames from the last powering-up or module reset.

Modbus register: 30005

7.1.5 Counter of Frames with Error (LSW)

This register contains the least significant word of the counter of frames with error from the last powering-up or module reset.

Modbus register: 30006

7.1.6 Counter of Frames with Error (MSW)

This register contains the most significant word of the counter of frames with error from the last powering-up or module reset.

Modbus register: 30007

7.1.7 Counter of Sent Frames (LSW)

This register contains the least significant word of the counter of sent frames from the last powering-up or module reset.

Modbus register: 30008

7.1.8 Counter of Sent Frames (MSW)

This register contains the most significant word of the counter of sent frames from the last powering-up or module reset.

Modbus register: 30009

7.1.9 Up Time (LSW)

This register contains the least significant word of the uptime counter from the last powering-up or module reset.

Modbus register: 30012

BACnet object: type Analog value, object ID: 0, properties: Present value.

7.1.10 Up Time (MSW)

This register contains the most significant word of the uptime counter from the last powering-up or module reset.

Modbus register: 30013

BACnet object: type Analog value, object ID: 0, properties: Present value.

7.1.11 Source of last device reset

This register shows the source of the last reset, according to the table below:

Addr. value	Source of the last reset
1	Power-on reset (POR)
2	Brown-out detector (BOD12)
4	Brown-out detector (BOD33)
16	Ext. reset (EXT)
32	Watchdog (WDT)
64	System reset (SYST)

Table 3. Selection for source of the last reset

Modbus register: 30014

7.1.12 BACnet device ID

This register contains the least important two bytes of the BACnet ID value.

Modbus register: 40134

7.1.13 BACnet Device ID

This register contains the most important two bytes of the BACnet ID value.

Modbus register: 40135

7.1.14 Baud Rate

It defines the possibility to set the modbus protocol baud rate according to the following possibilities:

Addr. 1 (value)	Modbus Baud rate
1	960
2	1920
3	3840
4	5760
5	7680
6	11520 (default)

Table 4. Selection of the Baud rate

Modbus register: 40136

BACnet object: Network port, object ID: 0, properties: link speed.

7.1.15 Stop Bits

Defines the number of stop bits in the Modbus communication parameters according to the following possibilities:

Addr.136 (value)	Number of stop bits
1	1
2	2

Table 5. Stop bits configuration for Modbus communication

Modbus register: 40137

7.1.16 Data Bits

Defines the number of stop bits in the Modbus communication parameters according to the following possibilities:

Addr.137 (value)	Data bits
8	Data has 8 bits

Table 6. Data bits configuration for Modbus communication

Modbus register: 40138

7.1.17 Parity Bit

Defines the value of parity bit in the Modbus communication parameters according to the following possibilities:

Addr.138 (value)	Parity bit
0	None (default)
1	Odd
2	Even

Table 7. Pairty bit configuration for Modbus communication

Modbus register: 40139

7.1.18 Response delay

This register shows the delay (in ms) before sending the response to the master. The default value is 0.

Modbus register: 40140

7.1.19 Auxiliary register

This auxiliary register is used for detecting the first device activation, 0x5555=device activated (it's a read-only register).

Modbus register: 30190

7.1.20 Device version designation

Defines the device version according to the table below:

Bit number	Device description	
	Addr. value	Model
1 2 3 4	129	MVE504-2-RS
	131	MVE506-2-RS
	133	MVE510-2-RS
	135	MVE515-2-RS
	137	MVE522-2-RS
	139	MVE204-2-RS
	141	MVE206-2-RS
	143	MVE210-2-RS
	145	MVE215-2-RS
	147	MVE222-2-RS
	161	MVE504R-2-RS

Bit number	Device description	
	Addr. value	Model
	163	MVE506R-2-RS
	165	MVE510R-2-RS
	167	MVE515R-2-RS
	193	MVE504S-2-RS
	195	MVE506S-2-RS
	197	MVE510S-2-RS
	199	MVE515S-2-RS
	201	MVE522S-2-RS
	203	MVE204S-2-RS
	205	MVE206S-2-RS
	207	MVE210S-2-RS
	209	MVE215S-2-RS
	211	MVE222S-2-RS
	225	MVE504SR-2-RS
	227	MVE506SR-2-RS
	229	MVE510SR-2-RS
	231	MVE515SR-2-RS
5		Emergency return (1 available, 0 not available)
6		Yoke (1 Short, 0 Long)
7		Temperature sensors (1 available 0 not available)

Table 8. Selection for actuator model

7.1.21 Hardware version

Define the Hardware version of the selected actuator model (to know the hardware version, the register value must be divided by 10, e.g 12_{10} = 1.2).

Modbus register: 30302

7.1.22 Bootloader version

Define the Bootloader version of the selected actuator model (to know the bootloader version, the most significant byte must be divided by 10, the least significant byte represents the sub-version. Example: $A08_{16}$ ➔ $A_{16} = 10_{10} = 1.0$ and $08_{16} = 8$ ➔ 1.0.8).

Modbus register: 30303

7.1.23 Firmware version (extended)

Define the Firmware version of the selected actuator model (to know the extended firmware version, the most significant byte must be divided by 10, the least significant byte represents the sub-version. Example: 1401_{16} ➔ $14_{16} = 20_{10} = 2.0$ and $01_{16} = 1$ ➔ 2.0.1).

Modbus register: 30304

7.1.24 Serial number 1

This value is set by production.

Modbus register: 30305

7.1.25 Serial number 2

This value is set by production.

Modbus register: 30306

7.1.26 Serial number 3

This value is set by production.

Modbus register: 30307

7.1.27 Serial number 4

This value is set by production.

Modbus register: 30308

7.1.28 Maximum flow setting

Define the caliber position according to the following values:

Addr.1004 (value)	Max. flow setting
0	1
1	1,25
2	1,5
3	1,75

Addr.1004 (value)	Max. flow setting
4	2
5	2,25
6	2,5
7	2,75
8	3
9	3,25
10	3,5
11	3,75
12	4
13	4,25
14	4,5
15	4,75
16	5

Table 9. Selection for Max flow setting

Modbus register: 41005

BACnet object: multi state value, object ID: 9, properties: present value.

7.1.29 Type of Control

Defines the type of actuator command signal (selectable via Modbus/BACnet only if dip switches are disabled):

Addr.1005 (value)	Type of Control
0	Modbus (the command of the actuator is set via the Modbus command into the range 0-100%). Dipswitches are disabled.
1	0 - 10 V (the Modbus connection can be present to configure and monitor the system). Dipswitches are disabled.
2	2 - 10 V (the Modbus connection can be present to configure and monitor the system). Dipswitches are disabled.
3	0 - 5 V (the Modbus connection can be present to configure and monitor the system). Dipswitches are disabled.
4	5 - 10 V (the Modbus connection can be present to configure and monitor the system). Dipswitches are disabled.

Addr.1005 (value)	Type of Control
5	2 - 6 V (the Modbus connection can be present to configure and monitor the system). Dipswitches are disabled.
6	6 - 10 V (the Modbus connection can be present to configure and monitor the system). Dipswitches are disabled.
7	Indicates that the command signal is selected from dip switches (default value).

Table 10. Type of control

The 4-20mA command can only be set via dip switches.

Modbus register: 41006

BACnet object: multi state value, object ID: 0, properties: present value.

7.1.30 Command signal action and setting of the emergency return direction

Defines the action type of the command signal (direct or reverse action) and the direction of the actuator in case of emergency return (function present only for models with emergency return).

Addr.1006 (value)	Configuration of the actuator action and Failsafe direction
bit0	Direct action (bit0=1); reverse (bit0=0)
bit1	Failsafe DOWN (bit1=1); Failsafe UP (bit1=0)

Table 11. Selection of the action and failsafe direction of the actuator (if dip switches are disabled) via Modbus

Modbus register: 41007

BACnet object:

Bit	Object type	Object ID	Properties
Type of action	Binary value	0	Present value
Emergency return	Binary value	1	Present value

Table 12. Selection of the action and failsafe direction of the actuator (if dip switches are disabled) via BACne.t

7.1.31 Forced Calibration of the stroke

Defines the possibility of performing forced calibration of the stroke (by writing the bit0 to 1). At the end of the calibration the bit is automatically reset.

Modbus register: 41008

BACnet object: binary value, object ID: 2, properties: present value.

7.1.32 Enable Jumper for emergency return

Defines the enabling of the jumper for selecting the direction in case of emergency return according to the following table:

Addr.1008 (value)	Enabling
0	Jumper Enabled
1	Jumper Disabled

Table 13. Enabling of the jumper of the emergency return board

Modbus register: 41009

BACnet object: binary value, object ID: 3, properties: present value.

7.1.33 Changeover setting

This register defines the temperature loop action according to the following table:

Addr.1009 (value)	Changeover
0	Heating (default)
1	Cooling
2	Automatic (according ΔT)

Table 14. Changeover setting

Modbus register: 41010

BACnet object: binary value, object ID: 1, properties: present value.

7.1.34 Temperature Probe Selection

This register defines the temperature sensor to use in the loops according to the following table:

Addr.1010 (value)	Temperature probe selection
0	Supply temperature (T1) (default)
1	Return temperature (T2)
2	ΔT

Table 15. Temperature probe selection

Modbus register: 41011

BACnet object: multi state value, object ID: 2, properties: present value.

7.1.35 Valve characteristic configuration

This register allows to set the valve movement: linear (0) or equipercentage (EQP) (1).

Modbus register: 41013

BACnet object: multi state value, object ID: 3, properties: present value.

7.1.36 Functions enable

Defines the enabling of the MVE-2-RS system operating loops according to the following table:

Addr.1013 (bit)	Functions enable
bit 0	BMS control
bit 1	Enable temperature control function
bit 2	Enable min. ΔT limitation function
bit3	Enable max. temperature limitation function
bit4	Enable min. temperature limitation function
bit5	Enable power control function
bit6	Enable power limit function
bit7	Enable energy function

Table 16. Functions enable via Modbus

Modbus register: 41014

BACnet object:

Value	BACnet name	BACnet object type	BACnet object ID	BACnet object property
1	BMS control	Multi state value	4	Present value
2	Temperature control function			
3	Min. ΔT limitation function			
4	Max. temperature limitation function			
5	Min. temperature limitation function			
6	Power control function			
7	Power limit function			
-	Energy function	Binary value	14	Present value

Table 17. Functions enable via BACnet

7.1.37 Functions status

Defines the status of the MVE-2-RS system operating loops according to the following table:

Addr.1014 (bit)	Functions enable
bit 0	BMS control
bit 1	Temperature control function activated
bit 2	Min. ΔT limitation function activated
bit 3	Max. temperature limitation function activated
bit 4	Min. temperature limitation function activated
bit 5	Power control function activated

Table 18. Functions status

Modbus register: 31015

BACnet object: multi state value, object ID: 5, properties: present value.

7.1.38 Minimum Opening Valve (%)

This register contains the minimum opening valve value (expressed as a percentage) when the limit loops are active.

Modbus register: 41016

BACnet object: analog value, object ID: 1, properties: present value.

7.1.39 DIP Switches & Push Button & Jumper status

Defines the status of the dip switches, the push button (used for the forced calibration of the stroke) and the jumper (used to define the direction of the emergency return) according to the following table:

Addr.1016 (bit)	DIP Switch & Push Button & Jumper Status
bit 0	Direct action (OFF ➔ bit0 = 0). Reverse action (ON ➔ bit0 = 1)
bit 1	0-10V (OFF ➔ bit1 = 0). BUS (ON ➔ bit1 = 1)
bit 2	Normal (OFF ➔ bit2 = 0). Default setting (ON ➔ bit2 = 1).
bit 3	Modbus (OFF ➔ bit3 = 0). BACnet (ON ➔ bit3 = 1).
bit 4	Not used
bit 5	Voltage control (OFF ➔ bit5 = 0). Current control 4-20mA (ON ➔ bit5 = 1).

Addr.1016 (bit)	DIP Switch & Push Button & Jumper Status
bit 6	Push Button status (for calibration). Pressed (bit6 = 1), Released (bit6 = 0)
bit 7	Jumper status. Bit7 = 1 (failsafe DOWN). Bit7 = 0 (failsafe UP).

Table 19. Information about the status of dip switches, push button and the jumper on the emergency return board

Modbus register: 31017

BACnet object: analog value, object ID: 2, properties: present value.

7.1.40 Valve Type

Define the valve type according to the following table:

Addr.1017 (value)	Valve type
0	Generic valve
5	VLX6P
6	VLX8P
12	Custom PICV valve

Table 20. Selection for valve type

Modbus register: 41018

BACnet object: multi state value, object ID: 6, properties: present value.

7.1.41 Valve Stroke (mm)

This register contains the calculated valve stroke value. The value stored in the register is multiplied by 100. A value of 500 corresponds to a stroke of 5mm.

Modbus register: 41019

BACnet object: analog value, object ID: 3, properties: present value (read only).

7.1.42 Actuator reset

Through this register it is possible to perform a forced reset of the system by forcing its value to 1. After few seconds automatically this value is set to 0.

Modbus register: 41034

7.1.43 Restore Factory Setting

This register allows to restore the default setting and EEPROM memory setting 1.

Writing the value to 1 will reset the memory area to the default values.

Modbus register: 41187

7.2 DIAGNOSTIC

7.2.1 Over voltage Events

The system over voltage events is stored in this address, that is:

- 24V + 20%
- 230V + 20%

Default value is 0 and will start from 1 with the first error event.

If the value of the register reaches the maximum limit (65534 = 0xFFFE) this value will remain in memory.

Modbus register: 41020

BACnet object: analog value, object ID: 4, properties: present value.

7.2.2 Under voltage Events

The system under voltage events is stored in this address, that is:

- 24V – 20%
- 230V – 20%

Default value is 0 and will start from 1 with the first error event.

If the value of the register reaches the maximum limit (65534 = 0xFFFE) this value will remain in memory.

Modbus register: 41021

BACnet object: analog value, object ID: 5, properties: present value.

7.2.3 Number of full opening events

This address stores the valve full opening events. The default value is 0 and will start from 1 which corresponds to 10 total valve opening (in order to avoid continuous writing on the memory that could damage the component). If the value of the Register reaches the maximum limit (65534 = 0xFFFE) this value will remain in memory.

Modbus register: 41022

BACnet object: analog value, object ID: 6, properties: present value.

7.2.4 Number of full closing events

This address stores the valve full closing events. The default value is 0 and will start from 1 which corresponds to 10 total valve opening (in order to avoid continuous writing on the memory that could damage the component). If the value of the register reaches the maximum limit (65534 = 0xFFFE) this value will remain in memory.

Modbus register: 41023

BACnet object: analog value, object ID: 7, properties: present value.

7.2.5 Unexpected stall events within the stroke

Unexpected stall events within the valve stroke are stored in this address. The default value is 0 and will start from 1 which corresponds to 1 unexpected stall event. If the value of the register reaches the maximum limit (65534 = 0xFFFE) this value will remain in memory.

Modbus register: 41024

BACnet object: analog value, object ID: 8, properties: present value.

7.2.6 Unexpected stall events outside the stroke

This address stores unexpected stall events outside the stroke valve (extra stroke). The default value is 0 and will start from 1 which corresponds to 1 unexpected stall event. If the value of the register reaches the maximum limit (65534 = 0xFFFE) this value will remain in memory.

Modbus register: 41025

BACnet object: analog value, object ID: 9, properties: present value.

7.2.7 Stroke calculation events greater than 60mm

This address stores the calculation events of the stroke greater than 5mm (during the calibration phase). The default value is 0 and will start from 1 which corresponds to 1 calculation event of the stroke less than 5mm. If the value of the Register reaches the maximum limit (65534 = 0xFFFE) this value will remain in memory.

Modbus register: 41026

BACnet object: analog value, object ID: 10, properties: present value.

7.2.8 Stroke calculation events less than 5mm

This address stores the calculation events of the stroke less than 5mm (during the calibration phase). The default value is 0 and will start from 1 which corresponds to 1 calculation event of the stroke less than 5mm. If the value of the Register reaches the maximum limit (65534 = 0xFFFE) this value will remain in memory.

Modbus register: 41027

BACnet object: analog value, object ID: 11, properties: present value.

7.2.9 Operating states

The operating states of the system are stored in this address according to the following table:

Addr.1027 (bit)	Operating states
bit 0	Normal Running (bit0 = 1). In this state the system works normally.
bit 1	Initial positioning (bit1 = 1). After switching-on or after using the manual override, the actuator performs the initial positioning in the direction defined by the action type (direct or reverse).

Addr.1027 (bit)	Operating states
bit 2	**Stroke calibration (bit2 = 1).** In this operating state, the actuator is calculating the valve stroke.
bit 3	**Fail Safe Phase (bit3 = 1).** In this operating state, the actuator is performing an emergency return.
bit 4	**Manual override Phase (bit4 = 1).** In this operating state, the manual override is active.

Table 21. Operating mode of the actuator via Modbus

Modbus register: 31028

BACnet object:

Value	BACnet object type	BACnet object ID	BACnet object properties
1	Multi state value	7	Present value
2			
3			
4			
5			
-	Binary value	4	Present value

Table 22. Operating mode of the actuator via BACnet.

7.2.10 Type of error

The types of errors are stored in this address according to the following table:

Addr.1028 (bit)	Errors
bit 0	Supply temperature sensor error (T1). This error (bit0 = 1) indicates an out-of-scale value of the supply temperature sensor (if provided).
bit 1	Return temperature sensor error (T2). This error (bit1 = 1) indicates an out-of-scale value of the return temperature sensor (if provided).
bit 2	reserved
bit 3	reserved
bit 4	Calculation error of the valve stroke less than 5 mm. This error (bit4 = 1) indicates that the stroke value calculated by the calibration phase is less than 5mm.
bit 5	Calculation error of the valve stroke greater than 60 mm. This error (bit5 = 1) indicates that the stroke value calculated by the calibration phase is greater than 60mm.

Addr.1028 (bit)	Errors
bit 6	Unexpected stall error within the calculated stroke. This error (bit6 = 1) indicates an unexpected stall within the calculated stroke.
bit 7	Unexpected stall error outside the calculated stroke. This error (bit7 = 1) indicates an unexpected stall outside the calculated stroke.
bit 8	Low voltage error. This error (bit8 = 1) indicates that the value of the supply voltage is below 20% of the nominal value.
bit 9	High voltage error. This error (bit9 = 1) indicates that the value of the supply voltage is above 20% of the nominal value.
bit 10	Clock error. This error (bit10 = 1) indicates that the time and date values have not been initialized from the BMS. It's set to 0 by the firmware once the time and date have been set.

Table 23. List of the error type of the actuator

Modbus register: 31029

BACnet object:

Bit number	BACnet object type	BACnet object ID	BACnet object properties
0	Binary value	5	Present value
1		6	
4		7	
5		8	
6		9	
7		10	
8		11	
9		12	
10		13	

Table 24. List of the error type of the actuator via BACnet.

7.3 INPUT/OUTPUT

7.3.1 Command Signal from the BMS (0 – 100%)

This register contains the value of the BMS command in the range 0-100%.

The value contained in the register is multiplied by 10 (0-1000).

Modbus register: 41035

BACnet object: analog value, object ID: 12, properties: present value.

7.3.2 Feedback

This register contains the value of the valve position (feedback) in the range 0-100%.

The value contained in the register is multiplied by 10.

Modbus register: 31038

BACnet object: analog value, object ID: 13, properties: present value.

7.4 FLOW RATE

7.4.1 Max Flow Rate

Define the nominal flow rate according to the following table:

Addr.1004 (value)	Flow rate	
	VLX6P	VLX8P
0	1,1	2,2
1	1,512	2,85
2	1,925	3,5
3	2,337	4,15
4	2,75	4,8
5	3,262	5,2
6	3,775	5,7
7	4,287	6,1
8	4,8	6,5
9	5,4	7,125
10	5,9	7,75
11	6,45	8,375
12	7	9
13	7,75	9,875
14	8,5	10,75
15	9,25	11,265
16	11	13,5

Table 25. Selection for Max flow rate

Modbus register: 41044

BACnet object: analog value, object ID: 14, properties: present value.

7.4.2 Design flow rate

Define the design flow rate that has to be between the 25% of Qnom and Qnom.

BACnet object: analog value, object ID: 15, properties: present value.

Modbus register: 41045

7.4.3 Flow rate SP X1

This register is used only if the actuator is assembled with a custom valve and set the first value of the flow rate at 0 (fixed value). This parameter with the following ones allows to build the custom valve characteristic curve.

Modbus register: 41080

BACnet object: analog value, object ID: 16, properties: present value.

7.4.4 Valve position Y1

This register is used only if the actuator is assembled with a custom valve and set the first value of the valve position at 0 (fixed value). This parameter with the following ones allows to build the custom valve characteristic curve.

Modbus register: 41081

BACnet object: analog value, object ID: 17, properties: present value.

7.4.5 Flow rate SP X2

This register is used only if the actuator is assembled with a custom valve and allow to set the second value of the flow rate (in percent) multiplied by ten. This parameter with the other ones allows to build the custom valve characteristic curve.

Modbus register: 41082

BACnet object: analog value, object ID: 18, properties: present value.

7.4.6 Valve position Y2

This register is used only if the actuator is assembled with a custom valve and allow to set the second value of the valve position (in percent) multiplied by ten. This parameter with the other ones allows to build the custom valve characteristic curve.

Modbus register: 41083

BACnet object: analog value, object ID: 19, properties: present value.

7.4.7 Flow rate SP X3

This register is used only if the actuator is assembled with a custom valve and allow to set the third value of the flow rate (in percent) multiplied by ten. This parameter with the other ones allows to build the custom valve characteristic curve.

Modbus register: 41084

BACnet object: analog value, object ID: 20, properties: present value.

7.4.8 Valve position Y3

This register is used only if the actuator is assembled with a custom valve and allow to set the third value of the valve position (in percent) multiplied by ten. This parameter with the other ones allows to build the custom valve characteristic curve.

Modbus register: 41085

BACnet object: analog value, object ID: 21, properties: present value.

7.4.9 Flow rate SP X4

This register is used only if the actuator is assembled with a custom valve and allow to set the fourth value of the flow rate (in percent) multiplied by ten. This parameter with the other ones allows to build the custom valve characteristic curve.

Modbus register: 41086

BACnet object: analog value, object ID: 22, properties: present value.

7.4.10 Valve position Y4

This register is used only if the actuator is assembled with a custom valve and allow to set the fourth value of the valve position (in percent) multiplied by ten. This parameter with the other ones allows to build the custom valve characteristic curve.

Modbus register: 41087

BACnet object: analog value, object ID: 23, properties: present value.

7.4.11 Flow rate SP X5

This register is used only if the actuator is assembled with a custom valve and allow to set the fifth value of the flow rate (in percent) multiplied by ten. This parameter with the other ones allows to build the custom valve characteristic curve.

Modbus register: 41088

BACnet object: analog value, object ID: 24, properties: present value.

7.4.12 Valve position Y5

This register is used only if the actuator is assembled with a custom valve and allow to set the fifth value of the valve position (in percent) multiplied by ten. This parameter with the other ones allows to build the custom valve characteristic curve.

Modbus register: 41089

BACnet object: analog value, object ID: 25, properties: present value.

7.4.13 Flow rate SP X6

This register is used only if the actuator is assembled with a custom valve and allow to set the sixth value of the flow rate (in percent) multiplied by ten. This parameter with the other ones allows to build the custom valve characteristic curve.

Modbus register: 41090

BACnet object: analog value, object ID: 26, properties: present value.

7.4.14 Valve position Y6

This register is used only if the actuator is assembled with a custom valve and allow to set the sixth value of the valve position (in percent) multiplied by ten. This parameter with the other ones allows to build the custom valve characteristic curve.

Modbus register: 41091

BACnet object: analog value, object ID: 27, properties: present value.

7.4.15 Flow rate SP X7

This register is used only if the actuator is assembled with a custom valve and allow to set the seventh value of the flow rate (in percent) multiplied by ten. This parameter with the other ones allows to build the custom valve characteristic curve.

Modbus register: 41092

BACnet object: analog value, object ID: 28, properties: present value.

7.4.16 Valve position Y7

This register is used only if the actuator is assembled with a custom valve and allow to set the seventh value of the valve position (in percent) multiplied by ten. This parameter with the other ones allows to build the custom valve characteristic curve.

Modbus register: 41093

BACnet object: analog value, object ID: 29, properties: present value.

7.4.17 Flow rate SP X8

This register is used only if the actuator is assembled with a custom valve and allow to set the eighth value of the flow rate (in percent) multiplied by ten. This parameter with the other ones allows to build the custom valve characteristic curve.

Modbus register: 41094

BACnet object: analog value, object ID: 30, properties: present value.

7.4.18 Valve position Y8

This register is used only if the actuator is assembled with a custom valve and allow to set the eighth value of the valve position (in percent) multiplied by ten. This parameter with the other ones allows to build the custom valve characteristic curve.

Modbus register: 41095

BACnet object: analog value, object ID: 31, properties: present value.

7.4.19 Flow rate SP X9

This register is used only if the actuator is assembled with a custom valve and allow to set the nineth value of the flow rate (in percent) multiplied by ten. This parameter with the other ones allows to build the custom valve characteristic curve.

Modbus register: 41096

BACnet object: analog value, object ID: 32, properties: present value.

7.4.20 Valve position Y9

This register is used only if the actuator is assembled with a custom valve and allow to set the nineth value of the valve position (in percent) multiplied by ten. This parameter with the other ones allows to build the custom valve characteristic curve.

Modbus register: 41097

BACnet object: analog value, object ID: 33, properties: present value.

7.4.21 Flow rate SP X10

This register is used only if the actuator is assembled with a custom valve its value of the flow rate is set to the 10 (that multiplied by 10 is 100) . This parameter with the other ones allows to build the custom valve characteristic curve.

Modbus register: 41098

BACnet object: analog value, object ID: 34, properties: present value.

7.4.22 Valve position Y10

This register is used only if the actuator is assembled with a custom valve its value is set to the 10 (that multiplied by 10 is 100). This parameter with the other ones allows to build the custom valve characteristic curve.

Modbus register: 41099

BACnet object: analog value, object ID: 35, properties: present value.

7.4.23 Indicated flow rate

This register calculates the indicated flow rate as m^3/h (the value is multiplied by 100).

Modbus register: 31100

BACnet object: analog value, object ID: 36, properties: present value.

7.5 SETPOINTS

7.5.1 Setpoint ΔT Control Heating (°C)

This register contains the value of the setpoint for heating ΔT control loop.

The value contained in the register is multiplied by 10.

Modbus register: 41101

BACnet object: analog value, object ID: 37, properties: present value.

7.5.2 Setpoint ΔT Control Cooling (°C)

This register contains the value of the setpoint for cooling ΔT control loop.
The value contained in the register is multiplied by 10.
Modbus register: 41102
BACnet object: analog value, object ID: 38, properties: present value.

7.5.3 Setpoint Supply Temperature Control Heating (°C)

This register contains the value of the setpoint for heating supply temperature loop.
The value contained in the register is multiplied by 10.
Modbus register: 41103
BACnet object: analog value, object ID: 39, properties: present value.

7.5.4 Setpoint Supply Temperature Control Cooling (°C)

This register contains the value of the setpoint for cooling supply temperature loop.
The value contained in the register is multiplied by 10.
Modbus register: 41104
BACnet object: analog value, object ID: 40, properties: present value.

7.5.5 Setpoint Return Temperature Control Heating (°C)

This register contains the value of the setpoint for heating return temperature loop.
The value contained in the register is multiplied by 10.
Modbus register: 41105
BACnet object: analog value, object ID: 41, properties: present value.

7.5.6 Setpoint Return Temperature Control Cooling (°C)

This register contains the value of the setpoint for cooling return temperature loop.
The value contained in the register is multiplied by 10.
Modbus register: 41106
BACnet object: analog value, object ID: 42, properties: present value.

7.5.7 Setpoint Minimum ΔT Heating (°C)

This register contains the value of the setpoint for heating ΔT limitation loop.
The value contained in the register is multiplied by 10.
Modbus register: 41107
BACnet object: analog value, object ID: 43, properties: present value.

7.5.8 Setpoint Minimum ΔT Cooling (°C)

This register contains the value of the setpoint for cooling ΔT limitation loop.

The value contained in the register is multiplied by 10.

Modbus register: 41108

BACnet object: analog value, object ID: 44, properties: present value.

7.5.9 Setpoint Max. Supply Temperature Heating (°C)

This register contains the value of the setpoint for heating supply temperature limitation loop.

The value contained in the register is multiplied by 10.

Modbus register: 41109

BACnet object: analog value, object ID: 45, properties: present value.

7.5.10 Setpoint Min. Supply Temperature Cooling (°C)

This register contains the value of the setpoint for cooling supply temperature limitation loop.

The value contained in the register is multiplied by 10.

Modbus register: 41110

BACnet object: analog value, object ID: 46, properties: present value.

7.5.11 Setpoint Max. Return Temperature Heating (°C)

This register contains the value of the setpoint for heating return temperature limitation loop.

The value contained in the register is multiplied by 10.

Modbus register: 41111

BACnet object: analog value, object ID: 47, properties: present value.

7.5.12 Setpoint Min. Return Temperature Cooling (°C)

This register contains the value of the setpoint for cooling return temperature limitation loop.

The value contained in the register is multiplied by 10.

Modbus register: 41112

BACnet object: analog value, object ID: 48, properties: present value.

7.6 POWER LIMIT/CONTROL

7.6.1 Design Power

This register allows to set the maximum power control, this value is multiplied by 10 (kW).

Modbus register: 41113

BACnet object: analog value, object ID: 49, properties: present value.

7.6.2 Set Max Power Limit

This register allows to set the maximum power limit, this value is multiplied by 10 (kW).

Modbus register: 41114

BACnet object: analog value, object ID: 50, properties: present value.

7.7 TEMPERATURE SENSORS

7.7.1 Supply Temperature (°C)

This register contains the supply temperature value. The value stored in the register is multiplied by 10.

If the sensor is disconnected or faulty, the stored value is 5000.

Modbus register: 31115

BACnet object: analog input, object ID: 0, properties: present value.

7.7.2 Return Temperature (°C)

This register contains the return temperature value.

The value stored in the register is multiplied by 10.

If the sensor is disconnected or faulty, the stored value is 5000.

Modbus register: 31116

BACnet object: analog input, object ID: 1, properties: present value.

7.7.3 ΔT(°C)

This register contains the value of the difference between the supply and return temperatures (ΔT).

The value stored in the register is multiplied by 10.

If the supply and/or return temperature sensor is disconnected or faulty, the stored value is 5000.

Modbus register: 31117

BACnet object: analog value, object ID: 51, properties: present value.

7.8 ENERGY HEATING/COOLING

7.8.1 Instant power

This register calculates the instant power (kW*10).

Modbus register: 31120

BACnet object: analog value, object ID: 52, properties: present value.

7.8.2 Heating energy LSR

This register contains the least significant data of the total calculated heating energy (kWh*10).

Modbus register: 31121

BACnet object: analog value, object ID: 53, properties: present value.

7.8.3 Heating energy MSR

This register contains the most significant data of the total calculated heating energy (kWh*10).

Modbus register: 31122

BACnet object: analog value, object ID: 53, properties: present value.

7.8.4 Cooling energy LSR

This register contains the least significant data of the total calculated cooling energy (kWh*10).

Modbus register: 31123

BACnet object: analog value, object ID: 54, properties: present value.

7.8.5 Cooling energy MSR

This register contains the most significant data of the total calculated cooling energy (kWh*10).

Modbus register: 31124

BACnet object: analog value, object ID: 54, properties: present value.

7.8.6 Heating energy at 31/12 LSR

This register allows to read for the least significant data of the total heating energy (kWh*10) at the end of the year.

Modbus register: 31139

BACnet object: analog value, object ID: 55, properties: present value.

7.8.7 Heating energy at 31/12 MSR

This register allows to read for the most significant data of the total heating energy (kWh*10) at the end of the year.

Modbus register: 31140

BACnet object: analog value, object ID: 55, properties: present value.

7.8.8 Heating energy value 1

This register contains the energy (heating) consumption (MWh*10) for the month of January.

Modbus register: 31141

BACnet object: analog value, object ID: 56, properties: present value.

7.8.9 Heating energy value 2

This register contains the energy (heating) consumption (MWh*10) for the month of February.

Modbus register: 31142

BACnet object: analog value, object ID: 57, properties: present value.

7.8.10 Heating energy value 3

This register contains the energy (heating) consumption (MWh*10) for the month of March.

Modbus register: 31143

BACnet object: analog value, object ID: 58, properties: present value.

7.8.11 Heating energy value 4

This register contains the energy (heating) consumption (MWh*10) for the month of April.

Modbus register: 31144

BACnet object: analog value, object ID: 59, properties: present value.

7.8.12 Heating energy value 5

This register contains the energy (heating) consumption (MWh*10) for the month of May.

Modbus register: 31145

BACnet object: analog value, object ID: 60, properties: present value.

7.8.13 Heating energy value 6

This register contains the energy (heating) consumption (MWh*10) for the month of June.

Modbus register: 31146

BACnet object: analog value, object ID: 61, properties: present value.

7.8.14 Heating energy value 7

This register contains the energy (heating) consumption (MWh*10) for the month of July.

Modbus register: 31147

BACnet object: analog value, object ID: 62, properties: present value.

7.8.15 Heating energy value 8

This register contains the energy (heating) consumption (MWh*10) for the month of August.

Modbus register: 31148

BACnet object: analog value, object ID: 63, properties: present value.

7.8.16 Heating energy value 9

This register contains the energy (heating) consumption (MWh*10) the month of September.

Modbus register: 31149

BACnet object: analog value, object ID: 64, properties: present value.

7.8.17 Heating energy value 10

This register contains the energy (heating) consumption (MWh*10) for the month of October.

Modbus register: 31150

BACnet object: analog value, object ID: 65, properties: present value.

7.8.18 Heating energy value 11

This register contains the energy (heating) consumption (MWh*10) for the month of November.

Modbus register: 31151

BACnet object: analog value, object ID: 66, properties: present value.

7.8.19 Heating energy value 12

This register contains the energy (heating) consumption (MWh*10) for the month of December.

Modbus register: 31152

BACnet object: analog value, object ID: 67, properties: present value.

7.8.20 Cooling energy at 31/12 LSR

This register allows to read the least significant data of the total cooling energy (kWh*10) at the end of the year.

Modbus register: 31153

BACnet object: analog value, object ID: 68, properties: present value.

7.8.21 Cooling energy at 31/12 MSR

This register contains the most significant data of the total cooling energy (kWh*10) at the end of the year.

Modbus register: 31154

BACnet object: analog value, object ID: 68, properties: present value.

7.8.22 Cooling energy value 1

This register contains the energy (cooling) consumption (MWh*10) for the month of January.

Modbus register: 31155

BACnet object: analog value, object ID: 69, properties: present value.

7.8.23 Cooling energy value 2

This register contains the energy (cooling) consumption (MWh*10) for the month of February.

Modbus register: 31156

BACnet object: analog value, object ID: 70, properties: present value.

7.8.24 Cooling energy value 3

This register contains the energy (cooling) consumption (MWh*10) for the month of March.

Modbus register: 31157

BACnet object: analog value, object ID: 71, properties: present value.

7.8.25 Cooling energy value 4

This register contains the energy (cooling) consumption (MWh*10) for the month of April.

Modbus register: 31158

BACnet object: analog value, object ID: 72, properties: present value.

7.8.26 Cooling energy value 5

This register contains the energy (cooling) consumption (MWh*10) for the month of May.

Modbus register: 31159

BACnet object: analog value, object ID: 73, properties: present value.

7.8.27 Cooling energy value 6

This register contains the energy (cooling) consumption (MWh*10) for the month of June.

Modbus register: 31160

BACnet object: analog value, object ID: 74, properties: present value.

7.8.28 Cooling energy value 7

This register contains the energy (cooling) consumption (MWh*10) for the month of July.

Modbus register: 31161

BACnet object: analog value, object ID: 75, properties: present value.

7.8.29 Cooling energy value 8

This register contains the energy (cooling) consumption (MWh*10) for the month of August.

Modbus register: 31162

BACnet object: analog value, object ID: 76, properties: present value.

7.8.30 Cooling energy value 9

This register contains the energy (cooling) consumption (MWh*10) for the month of September.

Modbus register: 31163

BACnet object: analog value, object ID: 77, properties: present value.

7.8.31 Cooling energy value 10

This register contains the energy (cooling) consumption (MWh*10) for the month of October.

Modbus register: 31164

BACnet object: analog value, object ID: 78, properties: present value.

7.8.32 Cooling energy value 11

This register contains the energy (cooling) consumption (MWh*10) for the month of November.

Modbus register: 31165

BACnet object: analog value, object ID: 79, properties: present value.

7.8.33 Cooling energy value 12

This register contains the energy (cooling) consumption (MWh*10) for the month of December.

Modbus register: 31166

BACnet object: analog value, object ID: 80, properties: present value.

7.9 CLOCK FUNCTION

7.9.1 Clock Minutes

This database register contains the value of the minutes received during the time synchronization phase.

Modbus register: 41182

BACnet object:

Analog value object		Device object	
Object ID	Property	Object ID	Property
81	Present value	1	Local time

Table 26. Clock Minutes object in BACnet

7.9.2 Clock Hours

This register contains the value of the hours received during the time synchronization phase.

Modbus register: 41183

BACnet object:

Analog value object		Device object	
Object ID	Property	Object ID	Property
82	Present value	1	Local time

Table 27. Clock Hours object in BACnet

7.9.3 Clock Day

This register contains the value of the day received during the time synchronization phase.

Modbus register: 41184

BACnet object:

Analog value object		Device object	
Object ID	Property	Object ID	Property
83	Present value	1	Local date

Table 28. Clock Day object in BACnet

7.9.4 Clock Month

This register contains the value of the month received during the time synchronization phase.

Modbus register: 41185

BACnet object:

Analog value object		Device object	
Object ID	Property	Object ID	Property
84	Present value	1	Local date

Table 29. Clock Month object in BACnet

7.9.5 Clock Year

This register contains the value of the year received during the time synchronization phase.

Registers from address 1181 to address 1185 contain the values that store the date and time of the actuator once they have been synchronized (only necessary in the case of energy calculation).

The actuator doesn't have a "buffer" battery so that every time it is turned-off or reset the date and time are lost, a new synchronization will therefore be required. If the date and time are not synchronized the default date/time is: 01/01/2000 00:00.

Modbus register: 41186

BACnet object:

Analog value object		Device object	
Object ID	Property	Object ID	Property
85	Present value	1	Local date

Table 30. Clock Year object in BACnet

7.10 LOOP OUTPUTS

7.10.1 Loop Output BMS (%)

This register contains the percentage output value of the BMS loop.

The value inside the register is multiplied by 10.

Modbus register: 31193

7.10.2 Loop Output flow rate control

This register contains the percentage output value of the output flow rate control loop.

The value inside the register is multiplied by 10.

Modbus register: 31194

7.10.3 Loop Output power

This register contains the percentage output value of the power loop.

The value inside the register is multiplied by 10.

Modbus register: 31196

7.10.4 Loop Output power limit

This register contains the percentage output value of the power limit loop.

The value inside the register is multiplied by 10.

Modbus register: 31197

7.10.5 Loop Output Temperature Control (%)

This register contains the percentage output value of the Temperature control loop.

If one or both of the temperature sensors are disconnected or faulty, the stored value is 5000.

The value inside the register is multiplied by 10.

Modbus register: 31198

7.10.6 Loop Output Temperature Limitations (%)

This register contains the percentage output value of the Temperature limit loop.

If one or both of the temperature sensors are disconnected or faulty, the stored value is 5000.

The value inside the register is multiplied by 10.

Modbus register: 31199

7.10.7 Operating loop output (%)

This register contains the percentage out value of the operating loop resulting from the actually enabled functions.

The value inside the register is multiplied by 10.

Modbus register: 31200

7.11 POWER

7.11.1 Max. power

This register allows to set the valve nominal power (kW*10).

Modbus register: 41207

BACnet object: analog value, object ID: 86, properties: present value.

7.11.2 Media density

This register allows to set the density of the fluid, the default value is for water at 20°C (997.8 Kg/m^3). The value is multiplied by 10, so in the register is: 9978.

Modbus register: 41208

BACnet object: analog value, object ID: 87, properties: present value.

7.11.3 Media specific heat

This database register allows to set the specific heat of the fluid, the default value is for water at 20°C (4196 J/Kg °C). The value is multiplied by 10, so in the register is: 41960.

Modbus register: 41209

BACnet object: analog value, object ID: 88, properties: present value.

7.11.4 Custom nominal power ΔT 20K

This register contains the valve nominal power at 20°C (kW*10).

Modbus register: 31213

7.12 LOOP PARAMETERS

7.12.1 Action Type

This database register contains the type of loop action that can be:

Addr.1230 (value)	Action type
0	Proportional (**P**)
1	Proportional Integral (**PI**)
2	Proportional Integral Derivative (**PID**)

Table 31. Selection of the action type

Modbus register: 41231

BACnet object: multi state value, object ID: 8, properties: present value.

7.12.2 Derivative Time

This register contains the derivative time of the derivative action expressed as "gain" from 1 to 1000 (default value is 1).

Modbus register: 41232

BACnet object: analog value, object ID: 89, properties: present value.

7.12.3 Integral Time (min)

This register contains the integral time of the integral action expressed in minutes.

Modbus register: 41233

BACnet object: analog value, object ID: 90, properties: present value.

7.12.4 Proportional Bandwidth (°C)

This register contains the proportional band of the ΔT heating loop. The value stored in the register is multiplied by 10.

Modbus register: 41234

BACnet object: analog value, object ID: 91, properties: present value.

7.12.5 Month timestamp of 31st December

This register allows to read the year end month total energy, it is set to December.

Modbus register: 31241

BACnet object: analog value, object ID: 92, properties: present value.

7.12.6 Year timestamp of 31st December

This register allows to read the year of the last reading recorded on 31 December.

Modbus register: 31242

BACnet object: analog value, object ID: 93, properties: present value.

7.12.7 Month timestamp of value 1

This register contains the month in which the actuator has registered the energy consumption, it is set to January.

Modbus register: 31243

BACnet object: analog value, object ID: 94, properties: present value.

7.12.8 Year timestamp of value 1

This register contains the year in which the actuator has registered the energy consumption in January.

Modbus register: 31244

BACnet object: analog value, object ID: 95, properties: present value.

7.12.9 Month timestamp of value 2

This register contains the month in which the actuator has registered the energy consumption, it is set to February.

Modbus register: 31245

BACnet object: analog value, object ID: 96, properties: present value.

7.12.10 Year timestamp of value 2

This register contains the year in which the actuator has registered the energy consumption in February.

Modbus register: 31246

BACnet object: analog value, object ID: 97, properties: present value.

7.12.11 Month timestamp of value 3

This register contains the month in which the actuator has registered the energy consumption, it is set to March.

Modbus register: 31247

BACnet object: analog value, object ID: 98, properties: present value.

7.12.12 Year timestamp of value 3

This register contains the year in which the actuator has registered the energy consumption in March.

Modbus register: 31248

BACnet object: analog value, object ID: 99, properties: present value.

7.12.13 Month timestamp of value 4

This register contains the month in which the actuator has registered the energy consumption, it is set to April.

Modbus register: 31249

BACnet object: analog value, object ID: 100, properties: present value.

7.12.14 Year timestamp of value 4

This register contains the year in which the actuator has registered the energy consumption in April.

Modbus register: 31250

BACnet object: analog value, object ID: 101, properties: present value.

7.12.15 Month timestamp of value 5

This register contains the month in which the actuator has registered the energy consumption, it is set to May.

Modbus register: 31251

BACnet object: analog value, object ID: 102, properties: present value.

7.12.16 Year timestamp of value 5

This register contains the year in which the actuator has registered the energy consumption in May.

Modbus register: 31252

BACnet object: analog value, object ID: 103, properties: present value.

7.12.17 Month timestamp of value 6

This register contains the month in which the actuator has registered the energy consumption, it is set to June.

Modbus register: 31253

BACnet object: analog value, object ID: 104, properties: present value.

7.12.18 Year timestamp of value 6

This register contains the year in which the actuator has registered the energy consumption in June.

Modbus register: 31254

BACnet object: analog value, object ID: 105, properties: present value.

7.12.19 Month timestamp of value 7

This register contains the month in which the actuator has registered the energy consumption, it is set to July.

Modbus register: 31255

BACnet object: analog value, object ID: 106, properties: present value.

7.12.20 Year timestamp of value 7

This register contains the year in which the actuator has registered the energy consumption in July.

Modbus register: 31256

BACnet object: analog value, object ID: 107, properties: present value.

7.12.21 Month timestamp of value 8

This register contains the month in which the actuator has registered the energy consumption, it is set to August.

Modbus register: 31257

BACnet object: analog value, object ID: 108, properties: present value.

7.12.22 Year timestamp of value 8

This register contains the year in which the actuator has registered the energy consumption in August.

Modbus register: 31258

BACnet object: analog value, object ID: 109, properties: present value.

7.12.23 Month timestamp of value 9

This register contains the month in which the actuator has registered the energy consumption, it is set to September.

Modbus register: 31259

BACnet object: analog value, object ID: 110, properties: present value.

7.12.24 Year timestamp of value 9

This register contains the year in which the actuator has registered the energy consumption in September.

Modbus register: 31260

BACnet object: analog value, object ID: 111, properties: present value.

7.12.25 Month timestamp of value 10

This register contains the month in which the actuator has registered the energy consumption, it is set to October.

Modbus register: 31261

BACnet object: analog value, object ID: 112, properties: present value.

7.12.26 Year timestamp of value 10

This register contains the year in which the actuator has registered the energy consumption in October.

Modbus register: 31262

BACnet object: analog value, object ID: 113, properties: present value.

7.12.27 Month timestamp of value 11

This register contains the month in which the actuator has registered the energy consumption, it is set to November.

Modbus register: 31263

BACnet object: analog value, object ID: 114, properties: present value.

7.12.28 Year timestamp of value 11

This register contains the year in which the actuator has registered the energy consumption in November.

Modbus register: 31264

BACnet object: analog value, object ID: 115, properties: present value.

7.12.29 Month timestamp of value 12

This register contains the month in which the actuator has registered the energy consumption, it is set to December.

Modbus register: 31265

BACnet object: analog value, object ID: 116, properties: present value.

7.12.30 Year timestamp of value 12

This register contains the year in which the actuator has registered the energy consumption in December.

Modbus register: 31266

BACnet object: analog value, object ID: 117, properties: present value.

8 List of Modbus Registers and BACnet Object

Modbus Address	Decimal Address	Hex Address	Register Name	Access	Description	Persistence	Group
40001	0	0x0	VERSION AND MODULE TYPE	Read/ write	LSB – type (device ID), MSB - FW version / 10	YES	Common registers
30002	1	0x1	MODULE ADDRESS	Read/ write	Modbus address setting via Modbus from 1 to 255	YES	
30004	3	0x3	COUNTER OF RECEIVED FRAMES (32-Bit)	Read-only	Default state is 0. Counting the received Modbus frames from the last powering up or module reset.	YES	
30005	4	0x4					
30006	5	0x5	COUNTER OF FRAMES WITH ERROR (32-Bit)	Read-only	Default state is 0. Counting the incorrect received Modbus frames from the last powering up or module reset.	YES	
30007	6	0x6					
30008	7	0x7	COUNTER OF SENT FRAMES (32-Bit)	Read-only	Default state is 0. Counting the sent Modbus frames from the last powering up or module reset.	YES	
30009	8	0x8					
30012	11	0xB	UP TIME	Read-only	This 32-bit register contains module counting time in seconds from the last powering up or module reset	NO	
30013	12	0xC					
30014	13	0xD	SOURCE OF LAST DEVICE RESET	Read-only	Select the source of the last reset 1: power-on reset (POR) 2: brown-out detector (BOD12) 4: brown-out detector (BOD33) 16: ext. reset pin 32: watchdog (WDT)	YES	

Modbus Address	Decimal Address	Hex Address	Register Name	Access	Description	Persistence	Group
					64: system reset (SYST)		
40134	133	0x85	BACNET_DEVICE ID	Read/ write	Device BACnet ID	YES	
40135	134	0x86					
40136	135	0x87	BAUD RATE	Read/ write	Transmission speed is defined by the user calculated using the formula: baud rate = register value x 10. The default value is 115200 bps.	YES	
40137	136	0x88	STOP Bits	Read/ write	Supported values are 1 and 2. The default value is 1.	YES	
40138	137	0x89	DATA Bits	Read/ write	Supported value is only 8.	YES	
40139	138	0x8A	PARITY Bit	Read/ write	Parity bit. The default value is 0 (no parity). Allowed values: 0 (default): none, 1: odd, 2: even	YES	
40140	139	0x8B	RESPONSE DELAY	Read/ write	Delay in ms before sending the response. The default value is 0.	YES	
30190	190	0xBE	-	Read-only	Auxiliary register (used for detecting first device activation, 0x5555=device activated)	YES	
30301	300	0x12C	DEVICE VERSION DESIGNATION	Read-only	Select the device version designation Bit 5: Emergency return (0 not available, 1 available) Bit 6: Long/short yoke (0 Long, 1 Short)	YES	Configuration

Modbus Address	Decimal Address	Hex Address	Register Name	Access	Description	Persistence	Group
					Bit 7: Temp sensor (0 not available, 1 available)		
30302	301	0x12D	HARDWARE VERSION	Read-only	Hardware version	YES	
30303	302	0x12E	BOOTLOADER VERSION	Read-only	Bootloader version	YES	
30304	303	0x12F	FIRMWARE VERSION	Read-only	Firmware version	YES	
30305	304	0x130	SERIAL NUMBER 1	Read-only	It's configured in production	YES	
30306	305	0x131	SERIAL NUMBER 2	Read-only	It's configured in production	YES	
30307	306	0x132	SERIAL NUMBER 3	Read-only	It's configured in production	YES	
30308	307	0x133	SERIAL NUMBER 4	Read-only	It's configured in production	YES	
41005	1004	0x3EC	MAXIMUM FLOW SETTING	Read/ write	Select the caliber position: 0: Max flow setting 1 1: Max flow setting 1,25 2: Max flow setting 1,5 3: Max flow setting 1,75 4: Max flow setting 2 5: Max flow setting 2,25 6: Max flow setting 2,5 7: Max flow setting 2,75 8: Max flow setting 3 9: Max flow setting 3,25 10: Max flow setting 3,5	YES	

Modbus Address	Decimal Address	Hex Address	Register Name	Access	Description	Persistence	Group
					11: Max flow setting 3,75 12: Max flow setting 4 13: Max flow setting 4,25 14: Max flow setting 4,5 15: Max flow setting 4,75 16: Max flow setting 5		
41006	1005	0x3ED	TYPE OF CONTROL	Read/ write	Select the actuator type of control: 0: Modbus (DIP switch disabled) 1: 10 V (DIP switch disabled) 2: 2-10 V (DIP switch disabled) 3: 0 5 V (DIP switch disabled) 4: 5-10 V (DIP switch disabled) 5: 2-6 V (DIP switch disabled) 6: 6-10 V (DIP switch disabled) 7 (default): selected by DIP switch	YES	
41007	1006	0x3EE	DIRECT/ REVERSE & FAILSAFE DIRECTION SETTING	Read/ write	Select the actuator's action (direct or reverse) and fail-safe direction: Bit 0: direct action (1-default); reverse action (0) Bit 1: fail-safe DOWN (1); fail-safe UP (0-default)	YES	
41008	1007	0x3EF	FORCE CALIBRATION	Read/ write	Force calibration (valve stroke learning); 1 - force calibration (automatic reset of value after calibration)	NO	

Modbus Address	Decimal Address	Hex Address	Register Name	Access	Description	Persistence	Group
41009	1008	0x3F0	JUMPER ENABLE (ER board)	Read/ write	Fail-safe jumper enable setting: 0 (default) - jumper enabled, 1 - jumper disabled	YES	
41010	1009	0x3F1	CHANGEOVER SETTING	Read/ write	Temperature loops action selection: 0 (default): heating 1: cooling 2: automatic (according ΔT)	YES	
41011	1010	0x3F2	TEMPERATURE PROBE SELECTION	Read/ write	Temperature probe selection: 0 (default): supply temperature (T1) 1: return temperature (T2) 2: ΔT	YES	
41013	1012	0x3F4	VALVE CHARACTERISTIC CONFIGURATION	Read/ write	Select type of movement of the valve: Linear-0, EQP-1	YES	
41014	1013	0x3F5	FUNCTIONS ENABLE	Read/ write	Actuator function setting (bit0 = 1-BMS - default): Bit 0: BMS Bit 1: enable temperature control function Bit 2: enable min. ΔT limitation function Bit 3: enable function max. temperature limitation function Bit 4: enable function min. temperature limitation function Bit 5: enable power control function Bit 6: enable power limit function	YES	

Modbus Address	Decimal Address	Hex Address	Register Name	Access	Description	Persistence	Group
					Bit 7: enable energy function		
31015	1014	0x3F6	FUNCTIONS STATUS	Read-only	Actuator function setting: Bit 0: BMS control Bit 1: function temperature control activated (1-active) Bit 2: function temperature min. ΔT limit activated Bit 3: function temperature max. limit activated Bit 4: function temperature min. limit activated Bit 5: function power control activated Bit 6: function power limit activated	NO	
41016	1015	0x3F7	% MINIMUM OPENING VALVE	Read/ write	Set minimum opening valve when the temperature loops and limits are active.	YES	
31017	1016	0x3F8	DIP SWITCH & PUSH BUTTON & JUMPER STATUS	Read-only	DIP switches and jumper status: Bit 0: DIP1 status: "Direct Action" (OFF) – "Reverse Action" (ON) Bit 1: DIP2 status: "0-10V" (OFF) - "BUS" (ON) Bit 2: DIP3 status: "Normal" (OFF) – "Default setting" (ON) Bit 3: DIP4 status: "Modbus" (OFF) - "BACnet" (ON) Bit 5: DIP6 status: "Voltage control" (OFF)- "curr. control (4-20 mA)" (ON)	NO	

Modbus Address	Decimal Address	Hex Address	Register Name	Access	Description	Persistence	Group
					Bit 6: Push button: status: "Active" (Pressed) - Not Active (Released) Bit 7: Jumper status: "Fail-safe Down" (Jumper Insert) -" Fail-safe UP"		
41018	1017	0x3F9	VALVE TYPE	Read/ write	Select valve model 0: Generic valve 5: VLX6P 6: VLX8P 12: Custom PICV valve	YES	
41019	1018	0x3FA	VALVE STROKE (mm*100)	Read/ write	Valve stroke (mm*100) - after calibration phase	YES	
41020	1019	0x3FB	OVERVOLTAGE EVENTS (24 V AC > 20%) (230 V > 10%)	Read/ write	Overvoltage events (24 V AC > 20%) (230 V > 20%)	YES	Diagnostic
41021	1020	0x3FC	UNDERVOLTAGE EVENTS (V AC < 20%) (230 V < 10%)	Read/ write	Undervoltage events (V AC < 20%) (230 V < 20%)	YES	
41022	1021	0x3FD	FULLY OPEN EVENTS	Read/ write	Fully opened events	YES	
41023	1022	0x3FE	FULLY CLOSE EVENTS	Read/ write	Fully closes events	YES	
41024	1023	0x3FF	UNEXPECTED STALL CONDITION EVENTS (within calculated stroke)	Read/ write	Unexpected stall condition events (within calculated stroke)	YES	
41025	1024	0x400	UNEXPECTED STALL CONDITION EVENTS (outside calculated stroke)	Read/ write	Unexpected stall condition events (outside calculated stroke)	YES	

Modbus Address	Decimal Address	Hex Address	Register Name	Access	Description	Persistence	Group
41026	1025	0x401	VALVE STROKE ERROR > max. (60 mm)	Read/ write	Valve stroke error > max. (60 mm)	YES	
41027	1026	0x402	VALVE STROKE ERROR < min. (5 mm)	Read/ write	Valve stroke error < min. (5 mm)	YES	
31028	1027	0x403	ACTUATOR OPERATING MODE	Read-only	Actuator operating mode (0 - not active) (1- active): Bit 0: Normal Running Bit 1: Initial Positioning Bit 2: Stroke calibration Bit 3: Fail Safe Phase Bit 4: Manual Override Phase Bit 5: Error Phase	NO	
31029	1028	0x404	ERROR TYPE	Read-only	Error type: (0- no error) (1- error): Bit 0: T1 temperature sensor error (out of range) Bit 1: T2 temperature sensor error (out of range) Bit 4: valve stroke < 5 mm Bit 5: valve stroke > 60 mm Bit 6: unexpected stall condition events (within calculated stroke) Bit 7: unexpected stall condition events (outside calculated stroke Bit 8: undervoltage error Bit 9: overvoltage error Bit 10: clock error	YES	

Modbus Address	Decimal Address	Hex Address	Register Name	Access	Description	Persistence	Group
41034	1033	0x409	ACTUATOR RESET	Read/ write	Force actuator reset (1)	NO	Configuration
41035	1034	0x40A	BMS COMMAND	Read/ write	BMS command (0-100%)*10	NO	Input/ Output
31038	1037	0x40D	FEEDBACK	Read-only	Valve position (0-100%)*10	NO	
41044	1043	0x413	MAX FLOW RATE	Read/ write	Select Nominal flow rate (m^3/h) 0: VLX6P (2,1)-VLX8P (3,2) 1: VLX6P (2,5)-VLX8P (3,9) 2: VLX6P (2,9)-VLX8P (4,5) 3: VLX6P (3,3)-VLX8P (5,2) 4: VLX6P (3,8)-VLX8P (5,8) 5: VLX6P (4,3)-VLX8P (6,3) 6: VLX6P (4,8)-VLX8P (6,7) 7: VLX6P (5,3)-VLX8P (7,1) 8: VLX6P (5,8)-VLX8P (7,5) 9: VLX6P (6,4)-VLX8P (8,1) 10: VLX6P (6,9)-VLX8P (8,8) 11: VLX6P (7,5)-VLX8P (9,4) 12: VLX6P (8)-VLX8P (10) 13: VLX6P (8,8)-VLX8P (10,9) 14: VLX6P (9,5)-VLX8P (11,8) 15: VLX6P (10,3)-VLX8P (12,3) 16: VLX6P (11)-VLX8P (13,5)	YES	Flow rate
41045	1044	0x414	DESIGN FLOW RATE	Read/ write	Design flow rate must be between ¼ of Qnom and Qnom (*10)	YES	

Modbus Address	Decimal Address	Hex Address	Register Name	Access	Description	Persistence	Group
41080	1079	0x437	FLOW RATE SP X1	Read/ write	Flow rate X1 (custom valve)*10	YES	
41081	1080	0x438	VALVE POSITION Y1	Read/ write	Valve Position Y1 (custom valve)*10	YES	
41082	1081	0x439	FLOW RATE SP X2	Read/ write	Flow rate X2 (custom valve)*10	YES	
41083	1082	0x43A	VALVE POSITION Y2	Read/ write	Valve position Y2 (custom valve)*10	YES	
41084	1083	0x43B	FLOW RATE SP X3	Read/ write	Flow rate X3 (custom valve)*10	YES	
41085	1084	0x43C	VALVE POSITION Y3	Read/ write	Valve position Y3 (custom valve)*10	YES	
41086	1085	0x43D	FLOW RATE SP X4	Read/ write	Flow rate X4 (custom valve)*10	YES	
41087	1086	0x43E	VALVE POSITION Y4	Read/ write	Valve position Y4 (custom valve)*10	YES	
41088	1087	0x43F	FLOW RATE SP X5	Read/ write	Flow rate X5 (custom valve)*10	YES	
41089	1088	0x440	VALVE POSITION Y5	Read/ write	Valve position Y5 (custom valve)*10	YES	
41090	1089	0x441	FLOW RATE SP X6	Read/ write	Flow rate X6 (custom valve)*10	YES	
41091	1090	0x442	VALVE POSITION Y6	Read/ write	Valve position Y6 (custom valve)*10	YES	
41092	1091	0x443	FLOW RATE SP X7	Read/ write	Flow rate X7 (custom valve)*10	YES	
41093	1092	0x444	VALVE POSITION Y7	Read/ write	Valve position Y7 (custom valve)*10	YES	
41094	1093	0x445	FLOW RATE SP X8	Read/ write	Flow rate X8 (custom valve)*10	YES	
41095	1094	0x446	VALVE POSITION Y8	Read/ write	Valve position Y8 (custom valve)*10	YES	
41096	1095	0x447	FLOW RATE SP X9	Read/ write	Flow rate X9 (custom valve)*10	YES	

Modbus Address	Decimal Address	Hex Address	Register Name	Access	Description	Persistence	Group
41097	1096	0x448	VALVE POSITION Y9	Read/ write	Valve position Y9 (custom valve)*10	YES	
41098	1097	0x449	FLOW RATE SP X10	Read/ write	Flow rate X10 (custom valve)*10	YES	
41099	1098	0x44A	VALVE POSITION Y10	Read/ write	Valve position Y10 (custom valve)*10	YES	
31100	1099	0x44B	INDICATED FLOW RATE	Read-only	Calculated flow rate (m^3/h)*100	YES	
41101	1100	0x44C	SETPOINT ΔT CONTROL HEATING	Read/ write	Set heating ΔT control (°C*10)	YES	Setpoints
41102	1101	0x44D	SETPOINT ΔT CONTROL COOLING	Read/ write	Set cooling ΔT control (°C*10)	YES	
41103	1102	0x44E	SETPOINT SUPPLY TEMPERATURE CONTROL HEATING	Read/ write	Set heating supply temperature (°C*10)	YES	
41104	1103	0x44F	SETPOINT SUPPLY TEMPERATURE CONTROL COOLING	Read/ write	Set cooling supply temperature (°C*10)	YES	
41105	1104	0x450	SETPOINT RETURN TEMPERATURE CONTROL HEATING	Read/ write	Set heating return temperature (°C*10)	YES	
41106	1105	0x451	SETPOINT RETURN TEMPERATURE CONTROL COOLING	Read/ write	Set cooling return temperature (°C*10)	YES	
41107	1106	0x452	SETPOINT MINIMUM ΔT HEATING	Read/ write	Set heating ΔT limitation (°C*10)	YES	
41108	1107	0x453	SETPOINT MINIMUM ΔT COOLING	Read/ write	Set cooling ΔT limitation (°C*10)	YES	

Modbus Address	Decimal Address	Hex Address	Register Name	Access	Description	Persistence	Group
41109	1108	0x454	SETPOINT MAX. SUPPLY TEMPERATURE HEATING	Read/ write	Set heating supply temperature limit (°C*10)	YES	
41110	1109	0x455	SETPOINT MIN. SUPPLY TEMPERATURE COOLING	Read/ write	Set cooling supply temperature limit (°C*10)	YES	
41111	1110	0x456	SETPOINT MAX. RETURN TEMPERATURE HEATING	Read/ write	Set heating return temperature limit (°C*10)	YES	
41112	1111	0x457	SETPOINT MIN. RETURN TEMPERATURE COOLING	Read/ write	Set cooling return temperature limit (°C*10)	YES	
41113	1112	0x458	DESIGN POWER	Read/ write	Set maximum power (control) (kW*10)	YES	Power control/limit
41114	1113	0x459	SET MAX. POWER LIMIT	Read/ write	Set max power (limit) (kW*10)	YES	
31115	1114	0x45A	SUPPLY TEMPERATURE VALUE	Read-only	Supply temperature value (°C*10)	NO	Temperature Sensors
31116	1115	0x45B	RETURN TEMPERATURE VALUE	Read-only	Return temperature value (°C*10)	NO	
31117	1116	0x45C	ΔT VALUE (S1 – S2)	Read-only	ΔT value (T1 – T2) (°C*10)	NO	
31120	1119	0x45F	INSTANT POWER	Read-only	Instant power (kW*10)	YES	Energy Heating/ Cooling
31121	1120	0x460	HEATING ENERGY LSR	Read-only	Total heating energy (kWh*10)	YES	
31122	1121	0x461	HEATING ENERGY MSR	Read-only	YES		
31123	1122	0x462	COOLING ENERGY LSR	Read-only	Total cooling energy (kWh*10)	YES	
31124	1123	0x463	COOLING ENERGY MSR	Read-only	YES		

Modbus Address	Decimal Address	Hex Address	Register Name	Access	Description	Persistence	Group
31139	1138	0x472	HEATING ENERGY AT 31/12 LSR	Read-only	Energy (Heating) at the end of the year (kWh*10)	YES	
31140	1139	0x473	HEATING ENERGY AT 31/12 MSR	Read-only	YES		
31141	1140	0x474	HEATING ENERGY AT VALUE 1	Read-only	Energy (Heating) value 1 (MWh*10)	YES	
31142	1141	0x475	HEATING ENERGY AT VALUE 2	Read-only	Energy (Heating) value 2 (MWh*10)	YES	
31143	1142	0x476	HEATING ENERGY AT VALUE 3	Read-only	Energy (Heating) value 3 (MWh*10)	YES	
31144	1143	0x477	HEATING ENERGY AT VALUE 4	Read-only	Energy (Heating) value 4 (MWh*10)	YES	
31145	1144	0x478	HEATING ENERGY AT VALUE 5	Read-only	Energy (Heating) value 5 (MWh*10)	YES	
31146	1145	0x479	HEATING ENERGY AT VALUE 6	Read-only	Energy (Heating) value 6 (MWh*10)	YES	
31147	1146	0x47A	HEATING ENERGY AT VALUE 7	Read-only	Energy (Heating) value 7 (MWh*10)	YES	
31148	1147	0x47B	HEATING ENERGY AT VALUE 8	Read-only	Energy (Heating) value 8 (MWh*10)	YES	
31149	1148	0x47C	HEATING ENERGY AT VALUE 9	Read-only	Energy (Heating) value 9 (MWh*10)	YES	
31150	1149	0x47D	HEATING ENERGY AT VALUE 10	Read-only	Energy (Heating) value 10 (MWh*10)	YES	
31151	1150	0x47E	HEATING ENERGY AT VALUE 11	Read-only	Energy (Heating) value 11 (MWh*10)	YES	

Modbus Address	Decimal Address	Hex Address	Register Name	Access	Description	Persistence	Group
31152	1151	0x47F	HEATING ENERGY AT VALUE 12	Read-only	Energy (Heating) value 12 (MWh*10)	YES	
31153	1152	0x480	COOLING ENERGY AT 31/12 LSR	Read-only	Energy (Cooling) at the end of the year (kWh*10)	YES	
31154	1153	0x481	COOLING ENERGY AT 31/12 MSR	Read-only	YES		
31155	1154	0x482	COOLING ENERGY VALUE 1	Read-only	Energy (Cooling) value 1 (MWh*10)	YES	
31156	1155	0x483	COOLING ENERGY VALUE 2	Read-only	Energy (Cooling) value 2 (MWh*10)	YES	
31157	1156	0x484	COOLING ENERGY VALUE 3	Read-only	Energy (Cooling) value 3 (MWh*10)	YES	
31158	1157	0x485	COOLING ENERGY VALUE 4	Read-only	Energy (Cooling) value 4 (MWh*10)	YES	
31159	1158	0x486	COOLING ENERGY VALUE 5	Read-only	Energy (Cooling) value 5 (MWh*10)	YES	
31160	1159	0x487	COOLING ENERGY VALUE 6	Read-only	Energy (Cooling) value 6 (MWh*10)	YES	
31161	1160	0x488	COOLING ENERGY VALUE 7	Read-only	Energy (Cooling) value 7 (MWh*10)	YES	
31162	1161	0x489	COOLING ENERGY VALUE 8	Read-only	Energy (Cooling) value 8 (MWh*10)	YES	
31163	1162	0x48A	COOLING ENERGY VALUE 9	Read-only	Energy (Cooling) value 9 (MWh*10)	YES	
31164	1163	0x48B	COOLING ENERGY VALUE 10	Read-only	Energy (Cooling) value 10 (MWh*10)	YES	

Modbus Address	Decimal Address	Hex Address	Register Name	Access	Description	Persistence	Group
31165	1164	0x48C	COOLING ENERGY VALUE 11	Read-only	Energy (Cooling) value 11 (MWh*10)	YES	
31166	1165	0x48D	COOLING ENERGY VALUE 12	Read-only	Energy (Cooling) value 12 (MWh*10)	YES	
41182	1181	0x49D	CLOCK MINUTES	Read/ write	Clock minutes	YES	Clock function
41183	1182	0x49E	CLOCK HOURS	Read/ write	Clock hours	YES	
41184	1183	0x49F	CLOCK DAY	Read/ write	Clock day	YES	
41185	1184	0x4A0	CLOCK MONTH	Read/ write	Clock month	YES	
41186	1185	0x4A1	CLOCK YEAR	Read/ write	Clock year	YES	
41187	1186	0x4A2	RESTORE FACTORY SETTING	Read/ write	Set 1 to load default setting to the device and to EEPROM MEMORY	NO	Configuration
31193	1192	0x4A8	OUT LOOP BMS	Read-only	Output loop BMS (*10)	NO	Loop outputs
31194	1193	0x4A9	OUT LOOP FLOW RATE CONTROL	Read-only	Output loop flow rate control (*10)	NO	
31196	1195	0x4AB	OUT LOOP POWER	Read-only	Output loop power (*10)	NO	
31197	1196	0x4AC	OUT LOOP POWER LIMIT	Read-only	Output loop power limit (*10)	NO	
31198	1197	0x4D	OUT LOOP T CONTROL	Read-only	Output loop T control (*10)	NO	
31199	1198	0x4AE	OUT LOOP T LIMITS	Read-only	Output loop T limits (*10)	NO	
31200	1199	0x4AF	OUT LOOP "ACTIVE"	Read-only	Output loop "active" (*10)	NO	

Modbus Address	Decimal Address	Hex Address	Register Name	Access	Description	Persistence	Group
41207	1206	0x4B6	MAX. POWER	Read/ write	Valve nominal power (kW)*10	YES	Power
41208	1207	0x4B7	MEDIA DENSITY	Read/ write	Media density (*10): default value is for water at 20°C (Kg/m^3)	YES	
41209	1208	0x4B8	MEDIA SPECIFIC HEAT	Read/ write	Media specific heat (*10): default value is for water (J/Kg°C)	YES	
31213	1212	0x4BC	CUSTOM NOMINAL POWER ΔT 20K	Read-only	Valve nominal power at 20°C (kW) (max.val)	YES	
41231	1230	0x4CE	LOOP TYPE P, P+I, P+I+D	Read/ write	Loop type P, P+I, P+I+D	YES	Loop parameters
41232	1231	0x4CF	DERIVATIVE TIME (gain)	Read/ write	Derivative time (gain)	YES	
41233	1232	0x4D0	INTEGRAL TIME (min.)	Read/ write	Integral time (min.)	YES	
41234	1233	0x4D1	PROPORTIONAL BANDWIDTH ΔT (°C*10)	Read/ write	Proportional bandwidth ΔT (°C*10)	YES	
31241	1240	0x4D8	MONTH TIMESTAMP OF 31ST DECEMBER	Read-only	Month timestamp for energy at 31st December	YES	
31242	1241	0x4D9	YEAR TIMESTAMP OF 31ST DECEMBER	Read-only	Year timestamp for energy at 31st December	YES	
31243	1242	0x4DA	MONTH TIMESTAMP OF VALUE 1	Read-only	Month timestamp for value 1	YES	
31244	1243	0x4DB	YEAR TIMESTAMP OF VALUE 1	Read-only	Year timestamp for value 1	YES	
31245	1244	0x4DC	MONTH TIMESTAMP OF VALUE 2	Read-only	Month timestamp for value 2	YES	

Modbus Address	Decimal Address	Hex Address	Register Name	Access	Description	Persistence	Group
31246	1245	0x4DD	YEAR TIMESTAMP OF VALUE 2	Read-only	Year timestamp for value 2	YES	
31247	1246	0x4DE	MONTH TIMESTAMP OF VALUE 3	Read-only	Month timestamp for value 3	YES	
31248	1247	0x4DF	YEAR TIMESTAMP OF VALUE 3	Read-only	Year timestamp for value 3	YES	
31249	1248	0x4E0	MONTH TIMESTAMP OF VALUE 4	Read-only	Month timestamp for value 4	YES	
31250	1249	0x4E1	YEAR TIMESTAMP OF VALUE 4	Read-only	Year timestamp for value 4	YES	
31251	1250	0x4E2	MONTH TIMESTAMP OF VALUE 5	Read-only	Month timestamp for value 5	YES	
31252	1251	0x4E3	YEAR TIMESTAMP OF VALUE 5	Read-only	Year timestamp for value 5	YES	
31253	1252	0x4E4	MONTH TIMESTAMP OF VALUE 6	Read-only	Month timestamp for value 6	YES	
31254	1253	0x4E5	YEAR TIMESTAMP OF VALUE 6	Read-only	Month timestamp for value 6	YES	
31255	1254	0x4E6	MONTH TIMESTAMP OF VALUE 7	Read-only	Year timestamp for value 7	YES	
31256	1255	0x4E7	YEAR TIMESTAMP OF VALUE 7	Read-only	Month timestamp for value 7	YES	
31257	1256	0x4E8	MONTH TIMESTAMP OF VALUE 8	Read-only	Year timestamp for value 8	YES	
31258	1257	0x4E9	YEAR TIMESTAMP OF VALUE 8	Read-only	Month timestamp for value 8	YES	

Modbus Address	Decimal Address	Hex Address	Register Name	Access	Description	Persistence	Group
31259	1258	0x4EA	MONTH TIMESTAMP OF VALUE 9	Read-only	Year timestamp for value 9	YES	
31260	1259	0x4EB	YEAR TIMESTAMP OF VALUE 9	Read-only	Month timestamp for value 9	YES	
31261	1260	0x4EC	MONTH TIMESTAMP OF VALUE 10	Read-only	Year timestamp for value 10	YES	
31262	1261	0x4ED	YEAR TIMESTAMP OF VALUE 10	Read-only	Month timestamp for value 10	YES	
31263	1262	0x4EE	MONTH TIMESTAMP OF VALUE 11	Read-only	Year timestamp for value 11	YES	
31264	1263	0x4EF	YEAR TIMESTAMP OF VALUE 11	Read-only	Month timestamp for value 11	YES	
31265	1264	0x4F0	MONTH TIMESTAMP OF VALUE 12	Read-only	Year timestamp for value 12	YES	
31266	1265	0x4F1	YEAR TIMESTAMP OF VALUE 12	Read-only	Month timestamp for value 12	YES	

Table 32. List of registers

BACnet ID	Object properties	Object type	Object name	Access
0	MAC address	Network port	Module address	Read only
0	Present value	Analog value	Up time	Read only
0	Link speed	Network port	Baud rate	Read/ write
9	Present value	Multi state value	Maximum flow setting	Read/ write
0	Present value	Multi state value	Type of control	Read/ write

BACnet ID	Object properties	Object type	Object name	Access
0	Present value	Binary value	Direct/reverse setting	Read/ write
1			failsafe direction setting	
2	Present value	Binary value	Force calibration	Read/ write
3	Present value	Multi state value	Valve characteristics configuration	Read/ write
4	Present value	Multi state value	Functions enable: BMS	Read/ write
			Temperature control	
			Temperature ΔT limit	
			Temperature max limit	
			Temperature min limit	
			Power control	
			Power limit	
14	Present value	Binary value	Energy calculation	Read/ write
5	Present value	Multi state value	functions status	Read only
1	Present value	Analog value	% minimum opening valve	Read/ write
2	Present value	Analog value	Dip switch & push button & jumper status	Read only
6	Present value	Multi state value	Valve type	Read/ write
3	Present value	Analog value	Valve stroke (mm*100)	Read only
4	Present value	Analog value	Overvoltage events (24 v ac > 20%) (230 v > 10%)	Read only
5	Present value	Analog value	Undervoltage events (v ac < 20%) (230 v < 10%)	Read only
6	Present value	Analog value	Fully open events	Read only
7	Present value	Analog value	Fully close events	Read only

BACnet ID	Object properties	Object type	Object name	Access
8	Present value	Analog value	Unexpected stall condition events (within calculated stroke)	Read only
9	Present value	Analog value	Unexpected stall condition events (outside calculated stroke)	Read only
10	Present value	Analog value	Valve stroke error > max. (60 mm)	Read only
11	Present value	Analog value	Valve stroke error < min. (5 mm)	Read only
7	Present value	Multi state value	Actuator operating mode: Normal running	Read only
			Initial positioning	
			Stroke calibration	
			Fail safe	
			Manual override	
4	Present value	Binary value	Error	Read only
5	Present value	Binary value	Error type: Temperature sensor 1 error	Read only
6			Temperature sensor 2 error	
7			Calibrated stroke < 5mm	
8			Calibrated stroke > 60mm	
9			Unexpected stall (inside stroke)	
10			Unexpected stall (outside stroke)	
11			Undervoltage	
12			Overvoltage	
13			Clock error	
12	Present value	Analog value	BMS command	Read/ write
13	Present value	Analog value	Feedback	Read only
14	Present value	Analog value	Max flow rate	Read/ write

BACnet ID	Object properties	Object type	Object name	Access
15	Present value	Analog value	Design flow rate	Read/ write
16	Present value	Analog value	Flow rate sp x1	
17	Present value	Analog value	Valve position y1	Read/ write
18	Present value	Analog value	Flow rate sp x2	Read/ write
19	Present value	Analog value	Valve position y2	Read/ write
20	Present value	Analog value	Flow rate sp x3	Read/ write
21	Present value	Analog value	Valve position y3	Read/ write
22	Present value	Analog value	Flow rate sp x4	Read/ write
23	Present value	Analog value	Valve position y4	Read/ write
24	Present value	Analog value	Flow rate sp x5	Read/ write
25	Present value	Analog value	Valve position y5	Read/ write
26	Present value	Analog value	Flow rate sp x6	Read/ write
27	Present value	Analog value	Valve position y6	Read/ write
28	Present value	Analog value	Flow rate sp x7	Read/ write
29	Present value	Analog value	Valve position y7	Read/ write
30	Present value	Analog value	Flow rate sp x8	Read/ write
31	Present value	Analog value	Valve position y8	Read/ write
32	Present value	Analog value	Flow rate sp x9	Read/ write

BACnet ID	Object properties	Object type	Object name	Access
33	Present value	Analog value	Valve position y9	Read/ write
34	Present value	Analog value	Flow rate sp x10	Read/ write
35	Present value	Analog value	Valve position y10	Read/ write
36	Present value	Analog value	Indicated flow rate	Read/ write
37	Present value	Analog value	Setpoint ΔT control heating	Read/ write
38	Present value	Analog value	Setpoint ΔT control cooling	Read/ write
39	Present value	Analog value	Setpoint supply temperature control heating	Read/ write
40	Present value	Analog value	Setpoint supply temperature control cooling	Read/ write
41	Present value	Analog value	Setpoint return temperature control heating	Read/ write
42	Present value	Analog value	Setpoint return temperature control cooling	Read/ write
43	Present value	Analog value	Setpoint minimum ΔT heating	Read/ write
44	Present value	Analog value	Setpoint minimum ΔT cooling	Read/ write
45	Present value	Analog value	Setpoint max. supply temperature heating	Read/ write
46	Present value	Analog value	Setpoint min. supply temperature cooling	Read/ write
47	Present value	Analog value	Setpoint max. return temperature heating	Read/ write
48	Present value	Analog value	Setpoint min. return temperature cooling	Read/ write
49	Present value	Analog value	Design power	Read/ write
50	Present value	Analog value	Set max. power limit	Read/ write

BACnet ID	Object properties	Object type	Object name	Access
0	Present value	Analog input	Supply temperature value	Read only
1	Present value	Analog input	Return temperature value	Read only
51	Present value	Analog value	ΔT value (s1 – s2)	Read only
52	Present value	Analog value	Instant power	Read only
53	Present value	Analog value	Heating energy lsr	Read only
53	Present value	Analog value	Heating energy msr	Read only
54	Present value	Analog value	Cooling energy lsr	Read only
54	Present value	Analog value	Cooling energy msr	Read only
55	Present value	Analog value	Heating energy at 31/12 lsr	Read only
55	Present value	Analog value	Heating energy at 31/12 msr	Read only
56	Present value	Analog value	Heating energy at value 1	Read only
57	Present value	Analog value	Heating energy at value 2	Read only
58	Present value	Analog value	Heating energy at value 3	Read only
59	Present value	Analog value	Heating energy at value 4	Read only
60	Present value	Analog value	Heating energy at value 5	Read only
61	Present value	Analog value	Heating energy at value 6	Read only
62	Present value	Analog value	Heating energy at value 7	Read only
63	Present value	Analog value	Heating energy at value 8	Read only

BACnet ID	Object properties	Object type	Object name	Access
64	Present value	Analog value	Heating energy at value 9	Read only
65	Present value	Analog value	Heating energy at value 10	Read only
66	Present value	Analog value	Heating energy at value 11	Read only
67	Present value	Analog value	Heating energy at value 12	Read only
68	Present value	Analog value	Cooling energy at 31/12 lsr	Read only
70	Present value	Analog value	Cooling energy at 31/12 msr	Read only
69	Present value	Analog value	Cooling energy value 1	Read only
70	Present value	Analog value	Cooling energy value 2	Read only
71	Present value	Analog value	Cooling energy value 3	Read only
72	Present value	Analog value	Cooling energy value 4	Read only
73	Present value	Analog value	Cooling energy value 5	Read only
74	Present value	Analog value	Cooling energy value 6	Read only
75	Present value	Analog value	Cooling energy value 7	Read only
76	Present value	Analog value	Cooling energy value 8	Read only
77	Present value	Analog value	Cooling energy value 9	Read only
78	Present value	Analog value	Cooling energy value 10	Read only
79	Present value	Analog value	Cooling energy value 11	Read only
80	Present value	Analog value	Cooling energy value 12	Read only

BACnet ID	Object properties	Object type	Object name	Access
81	Present value	Analog value	Clock minutes	Read/ write
1	Local time	Device		
82	Present value	Analog value	Clock hours	Read/ write
1	Local time	Device		
83	Present value	Analog value	Clock day	Read/ write
1	Local date	Device		
84	Present value	Analog value	Clock month	Read/ write
1	Local date	Device		
85	Present value	Analog value	Clock year	Read/ write
1	Local date	Device		
86	Present value	Analog value	Max. power	Read/ write
87	Present value	Analog value	Media density	Read/ write
88	Present value	Analog value	Media specific heat	Read/ write
8	Present value	Multi state value	Loop type P, P+I, P+I+D	Read/ write
89	Present value	Analog value	Derivative time (gain)	Read/ write
90	Present value	Analog value	Integral time (min.)	Read/ write
91	Present value	Analog value	Proportional bandwidth Δt (°c*10)	Read/ write
92	Present value	Analog value	Month timestamp of 31st December	Read only
93	Present value	Analog value	Year timestamp of 31st December	Read only
94	Present value	Analog value	Month timestamp of value 1	Read only
95	Present value	Analog value	Year timestamp of value 1	Read only

BACnet ID	Object properties	Object type	Object name	Access
96	Present value	Analog value	Month timestamp of value 2	Read only
97	Present value	Analog value	Year timestamp of value 2	Read only
98	Present value	Analog value	Month timestamp of value 3	Read only
99	Present value	Analog value	Year timestamp of value 3	Read only
100	Present value	Analog value	Month timestamp of value 4	Read only
101	Present value	Analog value	Year timestamp of value 4	Read only
102	Present value	Analog value	Month timestamp of value 5	Read only
103	Present value	Analog value	Year timestamp of value 5	Read only
104	Present value	Analog value	Month timestamp of value 6	Read only
105	Present value	Analog value	Year timestamp of value 6	Read only
106	Present value	Analog value	Month timestamp of value 7	Read only
107	Present value	Analog value	Year timestamp of value 7	Read only
108	Present value	Analog value	Month timestamp of value 8	Read only
109	Present value	Analog value	Year timestamp of value 8	Read only
110	Present value	Analog value	Month timestamp of value 9	Read only
111	Present value	Analog value	Year timestamp of value 9	Read only
112	Present value	Analog value	Month timestamp of value 10	Read only
113	Present value	Analog value	Year timestamp of value 10	Read only

BACnet ID	Object properties	Object type	Object name	Access
114	Present value	Analog value	Month timestamp of value 11	Read only
115	Present value	Analog value	Year timestamp of value 11	Read only
116	Present value	Analog value	Month timestamp of value 12	Read only
117	Present value	Analog value	Year Timestamp of Value 12	Read only

Table 33. List of BACnet object