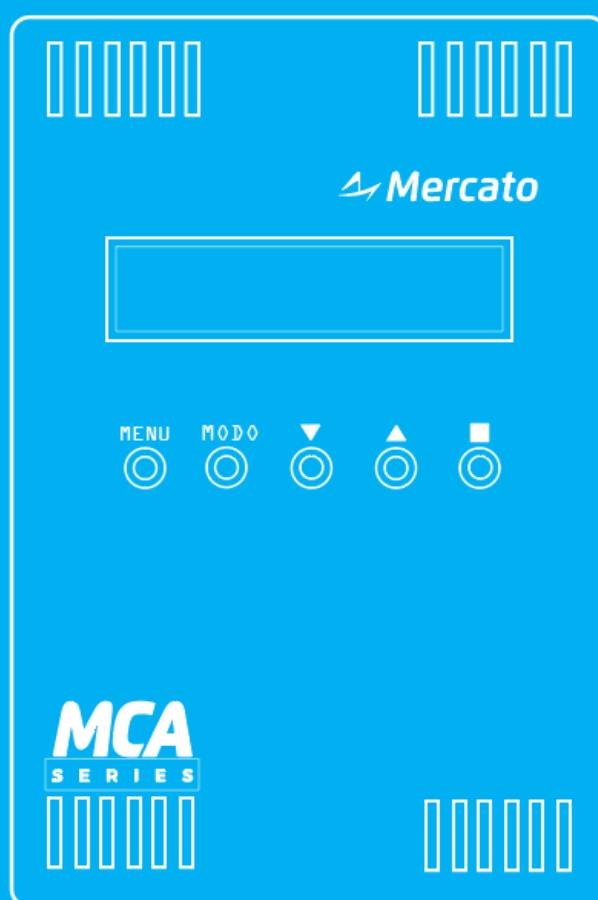


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S E R I E S



Instruction Manual



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This manual describes the on-off MCA-D model of the MCA Climate controller line.

1. CHARACTERISTICS

The MCA line includes controllers for temperature and humidity, which can be applied to different types of HVAC equipment.

Within the line, we have the MCA-D model, on-off temperature controllers.

MCA-D is available in the following models:

MCA-D-COM	Proportional controllers, with clock and communication in Modbus/RTU and BACnet MS/TP protocols.
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We can highlight the following characteristics:

- Three relay outputs.
- Interface with 16x2 characters, with backlighting and 5 operational keys.
- Allows visualization of machine state and setpoint adjustment.
- Local temperature sensor.
- Input for remote temperature sensor (NTC 10k)
- Adjustment blocks with password. What can be accessed by the user is configured freely.
- Power supply in 24 V_{AC}/V_{DC}.
- Wall mounting.
- Real time clock with operation schedule runs on standard CR2032 battery.
- RS485 communication port, with Modbus RTU and BACnet MS/TP.

2. INSTALLATION

CONNECTIONS

Table 2.1 identifies the purpose of each MCA connection point.

POINT	NAME	DESCRIPTION
1	VAC_B	24 V _{AC} power supply.
2	VAC_A	
3	D+	RS485 Communication.
4	D-	
5	COM	Common to analog outputs/inputs
6	DI/S2	Digital input/NTC 2
7	DI/S1	Digital input/NTC 1
8	DO1	Digital output 1
9	DO2	Digital output 2
10	DO/C	Common to digital outputs
11	DO3	Digital output 3

Table 2.1 - Connection Points

MAIN POWER SUPPLY

To operate properly, the MCA must be powered with 24V_{AC}. An independent transformer is recommended for each controller.

NOTE: Connections VAC_B and COM are internally connected. Attention to transformer and sensor wiring between equipments.

COMMUNICATION

The RS485 communication port is available in D+ and D- terminals.

The connection of the communications network must be daisy chained, avoiding "T" leads for better network operation. We recommend using a shielded and twisted cable in this network. The shield must be grounded on both sides of the cable.

DIGITAL OUTPUTS

The MCA-D-COM has three digital outputs using relays with varistor protection. The maximum load they can switch is 127V_{AC}/0.5A.

Pay attention to the connection because all the outputs share the same common.

ENTRY FOR REMOTE SENSOR

The MCA has a NTC 10k input for the remote temperature sensor that can be used in place of the internal sensor.

3. OPERATION INTERFACE

MAIN SCREEN

The main screen shows the state of the controller and the temperature of the space.



Figure 3.1 - Main Screen.

The upper line presents the state of the machine:

- **OFF:** Machine is turned off.
- **Operating:** Machine in operation.
- **Delay:** Delay when activating equipment.

The lower line, on the left, shows the machine's active controls. The following characters are presented:

- F: Fan.
- C: Cooling
- H: Heating.

The lower line, on the right side, shows the temperature of the controlled environment.

OPERATION MODE SCREEN

On the main screen, when pressing the MODE key, we can access the configuration screen for the machine's operation mode.



Figure 3.2 – Operation mode screen.

The operation mode can be configured as:

- **AUTOMATIC**
Equipment operates automatically, respecting the operation schedule.
- **MANUAL ON**
The equipment is activated, regardless of the schedule's output.
- **MANUAL OFF**
The equipment is not operating, even during the schedule timing.

To alter the current mode, just press the MODE key again to cycle between modes. The UP and DOWN keys also alter the mode. To confirm the alteration, press the ENTER key. To cancel the alteration, press

the MENU key or wait a few seconds until the selected mode quits flashing.

TEMPERATURE SETPOINT

On the main screen, pressing the UP or DOWN keys, we can access the temperature setpoint adjustment screens.



Figure 3.3 – Setpoint Screen.

On this screen, the UP and DOWN keys change the values of both setpoints. The MCA adjusts the setpoint, maintaining a fixed difference between the two setpoints. This difference should be configured in the "Deadband" item. If the heating is not enabled, only the cooling setpoint is shown.

To confirm the setpoint value, press the ENTER key. To cancel the alteration, just press the MENU key or wait a few seconds until the values quit flashing.

The standard increment for the temperature setpoint adjustments is 0.5°C, but can be altered in the configurations if is desired.

MENU

On the main screen, the MENU key allows access to the MCA operations menu.

On this screen, the UP and DOWN keys navigate between the existing items. The ENTER key allows access to the selected item, and the MENU key cancels the operation, returning to the main screen.

OPERATION SCHEDULE

The operation schedule screen allows the equipment's operational schedule to be configured. The schedule allows the configuration of 4 different periods, which define the start time and the stop time and for what days of the week the period is valid.



Figure 3.4 - Configuration of scheduled timing.

The characters of the upper line show which days of the week the period will be valid (from Monday to Sunday). The "H" character means that the period is valid on holidays.

In the figure 3.4 example, the period 1 of the scheduled timing is configured to turn the machine on at 8:30am and turn off at 6:30pm, every week day.

The schedule is considered active if any of the periods are active, if the controller time is within the specified time for any of the periods.

The configuration of the scheduled timing with the start and end time equal to 00:00 schedules it to be on 24 hours a day.

On this screen, the UP and DOWN keys change the schedule periods (1 to 4). To begin editing, press the ENTER key. Each time the MODE key is pressed, it moves on to the editing of the next item. The UP and DOWN keys alter the item's value. To confirm the values, press the ENTER key. The alteration can be canceled with the use of the MENU key or by waiting for the selected field to stop flashing.

The schedule changed by this screen is the Modbus version. When device is configured in BACnet protocol, this Modbus schedule has no effect. In this case, you must edit schedule directly in BACnet protocol.

DATE AND TIME SCREEN

This screen allows the visualization and adjustment of the date and time of the controller.



Figure 3.5 – Date and time screen.

On this screen, the ENTER key begins the editing and the MODE key goes from one item on the screen to the next. The ABOVE and BELOW keys alter the item's value. The ENTER key records the altered value on the controller, while the MENU key cancels the alteration.

HOLIDAY SCREEN

The holiday screen allows up to 20 holidays to be configured, creating an exception for the operational schedule. On holidays, the schedule is only enabled if the period is enabled for the holiday, regardless of the day of the week.



Figure 3.6 – Holiday screen.

The UP and DOWN keys alter the holiday being viewed (1 to 20). To begin editing, press the ENTER key. The MODE key is used to alter between day and month. The ABOVE and BELOW keys alter the item's value. The alteration of the value can be saved on the controller, pressing the ENTER key again or canceled using the MENU key.

To deactivate a holiday, just configure to with a day and/or month equal to zero.

LOGIN SCREEN

Through the MCA configurations, it is possible to block the alteration of some parameters for a non-authorized user.

When the user doesn't have permission to alter a parameter and tried to do so, the blocking screen appears.



Figure 3.7 – Blocking screen.

To alter the parameter, you must login using the login screen.

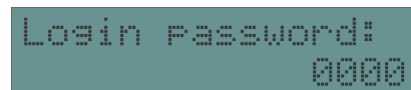


Figure 3.8 – Login screen.

The user should insert their 4 digit password to access the parameter.

The UP and DOWN keys alter the digit value and the MODE key moves it to the next digit. To confirm the value, press the ENTER key. If the password is correct, the main screen is presented. Note that in this case, there is the key in the upper right corner of the display, stating that the user has access.

The MCA closes the user's access after 1 minute without any key being pressed.

The standard access password is 1234. The password can be altered in the MCA configuration menu.

CONFIGURATION SCREEN

By accessing this menu item we can alter MCA configurations. To access the configurations, a password is required, other than the login password.



Figure 3.9 - Configuration access password.

The standard configuration access password is 1111 and may be altered after accessing the configuration menu.

In the configuration menu, use the UP and DOWN keys to navigate between the available configurations. To edit an item, the ENTER key should be pressed and the UP and DOWN keys are used to alter the

value of the item. The ENTER key confirms the new value. The MENU key cancels the edition of the items and allows for a return to the configuration menu.

The chapter 4 table has an explanation about all of the items available for configuration.

4. OPERATION LOGIC

INPUT/OUTPUT MAPPING

MCA have several internal logics that can be mapped to input/outputs. In configuration, the number of input/output must be selected to enable the function. Programming a zero value, disables the mapping of function.

ENABLING CONTROL

To activate, the MCA must be enabled. Enabling depends of the operation mode:

- **AUTOMATIC:**
In this mode, the enabling is controlled by the internal scheduled timing.
- **MANUAL ON:**
Adjusted manually to force the machine to turn on.
- **MANUAL OFF:**
Adjusted manually to force the machine to turn off.

It is also possible to control operations through the communication network, adjusting the mode of operation variable.

MCA can be configured for MANUAL enabling only. In this case, the AUTOMATIC option (controlled by the scheduled timing) is removed.

Device has two internal schedules: Modbus and BACnet. Active schedule depends on selected protocol.

FAN

The fan may be configured in the ACTIVATED or AUTOMATIC mode. In the ACTIVATED mode, the fan is always on when the controller is enabled for operation. In AUTOMATIC mode, the fan is only activated when there is a need for cooling or heating.

A delay for the fan deactivation at the end of the operation can be configured, allowing the cooling coil to dry.

You can use a digital input as the fan status function. With this function enabled, if fan output is on and input feedback is off, an alarm is generated.

TEMPERATURE CONTROL

The MCA uses a temperature control system based on two operation points.

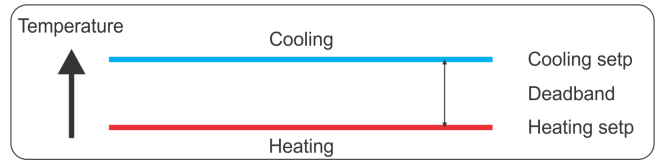


Figure 4.1 - Temperature Control.

The upper point is the cooling setpoint, and the lower is the heating setpoint. If the room temperature is above the upper point, cooling operates. If it is below if lower point, heating operates. In the intermediate range, called the deadband, the system does not operate.

The minimum value of the deadband can be adjusted in configurations. The default value is 2°C. The controller does not allow adjustments of cooling and heating setpoints that make the deadband be less than the programmed value.

In the ON-OFF control mode, the MCA does a simple control with hysteresis. If the space temperature goes above the setpoint plus the hysteresis, the valve is activated. When the temperature returns to below the setpoint, the valve is deactivated. The hysteresis is programmed in the MCA configurations.

REMOTE TEMPERATURE SENSOR

The MCA has a analog input for connecting a remote temperature sensor. In the MCA configurations, you can select the calculation mode for the space temperature: LOCAL, REMOTE, AVERAGE, MINIMUM or MAXIMUM.

MODBUS COMMUNICATION

The MCA controller supports the Modbus RTU slave protocol at port RS485. The address and baudrate configuration is done using the configuration menu.

The following functions are supported:

Func-tion	Description
03	Read holding registers
04	Read input registers
06	Write single register
16	Write multiple registers
43	Read device info

There is no distinction made between the registers read by functions 03 and 04.

BACNET COMMUNICATION

MCA also supports communication of BACnet MS/TP protocol on port RS485.

To work properly, the following parameters must be programmed:

- **BACnetID:**
It is a unique number that identified the equipment upon installation. It must be different in all the BACnet equipment of the system.
- **MSTP MAC:**
It is the address of the equipment within the sub-network that it belongs to. It should be unique only in this sub-network.

- **Max mast:**
Configures the largest existing address in the sub-network that the controller belongs to. Allows the limitation of the search function for new equipment on the network, increasing performance.

DATE/TIME ADJUST

The controller's date/time can be adjusted by interface or by communication. In BACnet protocol, you must use TimeSync service. In Modbus protocol, current date/time are available in registers 500 to 505. To adjust clock, you must write new date/time in registers 600 to 605. To apply the new clock, you must write value 12345 to register 606.

5. CONFIGURATIONS

Group	Item	Value Range	Description
Communication	Protocol		Selects the communication protocol
	485 baudrate		Selects the baudrate of port RS485
	Bacnet MSTP Mac	0 .. 127	Address of the equipment in the MS/TP network
	Bacnet Max Mast	0 .. 127	Largest address in MS/TP network
	Bacnet DeviceID	0 .. 4194302	Global address of the equipment in the BACnet network
	APDU retries	0 .. 10	Communication attempts.
	APDU timeout	100 .. 10000	Communication timeout (master mode)
	Modbus Address	1 .. 255	Address of the equipment in the Modbus network
I/O Config	Delay Tx	0 .. 100	Delay before transmitting the Modbus frame.
	DI/Sx type		Type of input x
	Sx offset		Offset for NTCx sensor
	Int S Offset		Offset for NTC internal sensor
	Dix polarity		Polarity of DIx input
Interface	Dox polarity		Polarity of digital output x
	Block mode adj		Block for MODE adjustment (login required)
	Block Sched adj		Block for scheduled timing adjustment
	Block clock adj		Block for clock/holiday adjustment
	Block setp adj		Block for setpoint adjustment
	Config password		Password for access to configurations
Input maps	Login password		User login password (to adjust blocked items)
	Ext NTC input		Input number for external NTC functioning.
Output maps	FAN STATUS input		Input number for fan STATUS.
	FAN Output		Output for fan control
	CWV Output ON-OFF		Output for cold water valve (ON-OFF)
Temp control	HWV Output ON-OFF		Output for hot water valve (ON-OFF)
	Cool enabled		Enables cooling control?
	Heat enabled		Enables heating control?
	Space temp mode		Space temperature measurement mode.
	Deadband		Minimum difference between cooling/heating setpoints.
	Cool Hysteresis		Hysteresis of cooling ON-OFF control
	Heat Hysteresis		Hysteresis of heating ON-OFF control
	Min cool setp		Minimum cooling setpoint value
	Max heat setp		Maximum heating setpoint value.
Fan	Setp resolution		Setpoint increment (for adjustment via display)
	Fan mode		Fan operation mode
General	Fan alarm time		Alarm time (via STATUS monitoring)
	Enabling type		Type of controller enabling.
	Max failures		Number of failures for operation blocking (zero to disable blocking).
	Failure time		time to restart control after a failure.

6. BACNET OBJECTS

Name	Type	Instance	Description
MCA-D-COM	Device	DeviceID	Description of the equipment
Alarms	Notification	1	Object for alarm distribution
Configs	File	0	Configuration file
NTC_1	AnalogInput	1	NTC 1 sensor
NTC_2	AnalogInput	2	NTC 2 sensor
NTC_INT	AnalogInput	3	Internal temperature sensor
Operation mode	AnalogValue	1	Current operation mode (auto, manual off, manual on)
Space temperature	AnalogValue	2	Space temperature calculated
Cooling setpoint	AnalogValue	3	Cooling control setpoint
Heating setpoint	AnalogValue	4	Heating control setpoint
DI_1	BinaryInput	1	Digital input 1
DI_2	BinaryInput	2	Digital input 2
DO_1	BinaryOutput	1	Digital output 1
DO_2	BinaryOutput	2	Digital output 2
DO_3	BinaryOutput	3	Digital output 3
Enabled	BinaryValue	1	Control enabled for operation
Fan	BinaryValue	2	Fan State
Fan Status	BinaryValue	3	Fan input status
Unblock comand	BinaryValue	4	Write 1 to unblock controller if there are excess failures
CWV ON-OFF	BinaryValue	5	State of cold water valve ON-OFF
HWV ON-OFF	BinaryValue	6	State of hot water valve ON-OFF
Control State	MultistateValue	1	Shows the current control state
Operation schedule	Schedule	1	Schedule that controls enable of equipment.

7. MODBUS TABLE

Table 7.1 shows the addresses and the meanings of each available registry.

FLOAT or DWORD registries are available in 2 consecutive 16bit registries, where the more significant part is made available in the first address.

Address	Name	Type	Write	Description
0/1	ST	FLOAT	-	Space temperature
2	FAN	UINT16	-	Fan State
3	STATUS_FAN	UINT16	-	Fan return
4	STATE	UINT16	-	Current control state (0=off, 1=starting, 2=operating, 3=failure, 4=blocked, 6=deactivating, 7=delay)
9	CWV_ONOFF	UINT16	-	State of CWV On-Off
10	HWV_ONOFF	UINT16	-	State of HWV On-Off
11/12	ALARMS	UINT32	-	Active alarms (see table 7.2)
100/101	COOL_SP	FLOAT	Y	Cooling setpoint
102/103	HEAT_SP	FLOAT	Y	Heating setpoint
150	MODE	UINT16	Y	Operation mode (0=manual off, 1=manual on, 2=automatic)
200	SCH.PER1.DAYS	UINT16	Y	Scheduled timing: Period 1: days of the week
201	SCH.PER1.INIH	UINT16	Y	Scheduled timing: Period 1: start hour
202	SCH.PER1.INIM	UINT16	Y	Scheduled timing: Period 1: start minute
203	SCH.PER1.ENDH	UINT16	Y	Scheduled timing: Period 1: end hour
204	SCH.PER1.END M	UINT16	Y	Scheduled timing: Period 1: end minute
205	SCH.PER2.DAYS	UINT16	Y	Scheduled timing: Period 2: days of the week
206	SCH.PER2.INIH	UINT16	Y	Scheduled timing: Period 2: start hour
207	SCH.PER2.INIM	UINT16	Y	Scheduled timing: Period 2: start minute
208	SCH.PER2.ENDH	UINT16	Y	Scheduled timing: Period 2: end hour
209	SCH.PER2.END M	UINT16	Y	Scheduled timing: Period 2: end minute
210	SCH.PER3.DAYS	UINT16	Y	Scheduled timing: Period 3: days of the week
211	SCH.PER3.INIH	UINT16	Y	Scheduled timing: Period 3: start hour
212	SCH.PER3.INIM	UINT16	Y	Scheduled timing: Period 3: start minute
213	SCH.PER3.ENDH	UINT16	Y	Scheduled timing: Period 3: end hour
214	SCH.PER3.END M	UINT16	Y	Scheduled timing: Period 3: end minute
215	SCH.PER4.DAYS	UINT16	Y	Scheduled timing: Period 4: days of the week
216	SCH.PER4.INIH	UINT16	Y	Scheduled timing: Period 4: start hour
217	SCH.PER4.INIM	UINT16	Y	Scheduled timing: Period 4: start minute
218	SCH.PER4.ENDH	UINT16	Y	Scheduled timing: Period 4: end hour
219	SCH.PER4.END M	UINT16	Y	Scheduled timing: Period 4: end minute
500	DAYS	UINT16	Y	Clock: day
501	MONTH	UINT16	Y	Clock: month
502	YEAR	UINT16	Y	Clock: year
503	HOURL	UINT16	Y	Clock: hour
504	MIN	UINT16	Y	Clock: minute
505	SEC	UINT16	Y	Clock: second
600	DAY_ADJ	UINT16	Y	Clock adjustment: day
601	MONTH_ADJ	UINT16	Y	Clock adjustment: month
602	YEAR_ADJ	UINT16	Y	Clock adjustment: year
603	HOURL_ADJ	UINT16	Y	Clock adjustment: hour
604	MIN_ADJ	UINT16	Y	Clock adjustment: minute
605	SEC_ADJ	UINT16	Y	Clock adjustment: second
606	CLOCK_WRITE	UINT16	Y	Clock adjustment: write 12345 to save values
650	HOL01_DAY	UINT16	S	Holiday 1 day
651	HOL01_MONTH	UINT16	S	Holiday 1 month
...	...	...	...	...
688	HOL20_DIA	UINT16	S	Holiday 20 date

689	HOL20_MES	UINT16.	S	Holiday 20 month
1000	UNBLOCK	UINT16	S	Write 1 to unblock controller if there are excess errors
2000	DI1	UINT16.	-	Digital input 1
2001	DI2	UINT16.	-	Digital input 2
2002/3	NTC1	FLOAT	-	NTC 1 input
2004	NTC1_STATUS	UINT16.	-	0 if valid
2005/6	NTC2	FLOAT	-	NTC2 input
2007	NTC2_STATUS	UINT16.	-	0 if valid
2100	DO1	UINT16.	-	Digital output state
2101	DO2	UINT16.	-	Digital output 2 state
2102	DO3	UINT16	-	Digital output 3 state
65001	VERSION	UINT16	-	Firmware version (1.23 = 123).

BIT	ALARM
0	NTC 1
1	NTC 2
2	Clock
3	No temperature measurement
4	Fan error
5	Filter is dirty

Table 7.2 - Alarms (registries 11/12)

8. TECHNICAL SPECIFICATIONS

Power supply	24 V _{AC} ± 20%.
Consumption	5VA maximum.
Digital outputs	relays, maximum 127V _{AC} , 0.5A. Protection with varistor.
Analog outputs	Voltage 0/2-10V, maximum load impedance 1k ohm.
NTC Input	NTC 10k, type II or type III curves
RS485 communication port	EIA-485 not isolated. Max 115200 bps.
Operational temperature	0 to 60 °C. Max humidity 95% non-condensable.
Weight	200 grams.
Mounting	Wall mount
External dimensions	120 x 81 x 25 mm

REVISION CONTROL

Revision C

- Note about Modbus and BACnet schedules.

Revision B

- Note about internal connection between VAC_B and COM.

Revision A

- Initial version.

MCA-D-COM – SERVICE MANUAL
Revision C - 20220523

At the discretion of the factory and, in view of the improvement of the product, the characteristics herein may be changed without prior notice.

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