COMBIFLOW Multi Rotary Actuator

Modbus Integration Guide

Application

The COMBIFLOW Multi Rotary is a combined analogue and digital actuator designed to be used with the COMBIFLOW 6-way Pressure Independent Control Valve in 4-pipe applications.

The sizing flows can be programmed using BACnet or Modbus or by limiting the voltage or current signal to the actuator. The actuator can then be used for:

- Switching between cooling and heating.
- Flow modulation.
- Flow shut off.
- Error and status reporting.

When used as an analogue actuator, it communicates with the Building Management system (BMS) using a 0(2)-10 V or 0(4)-20 mA signal. When used as a digital actuator, it integrates with BACnet or Modbus systems, allowing simple configuration, feedback, flow and status indication.

This document describes how to integrate the actuators using Modbus RTU.

For actuator installation on the COMBIFLOW valve and electrical wiring, please refer to the COMBIFLOW Multi Rotary actuator Technote.

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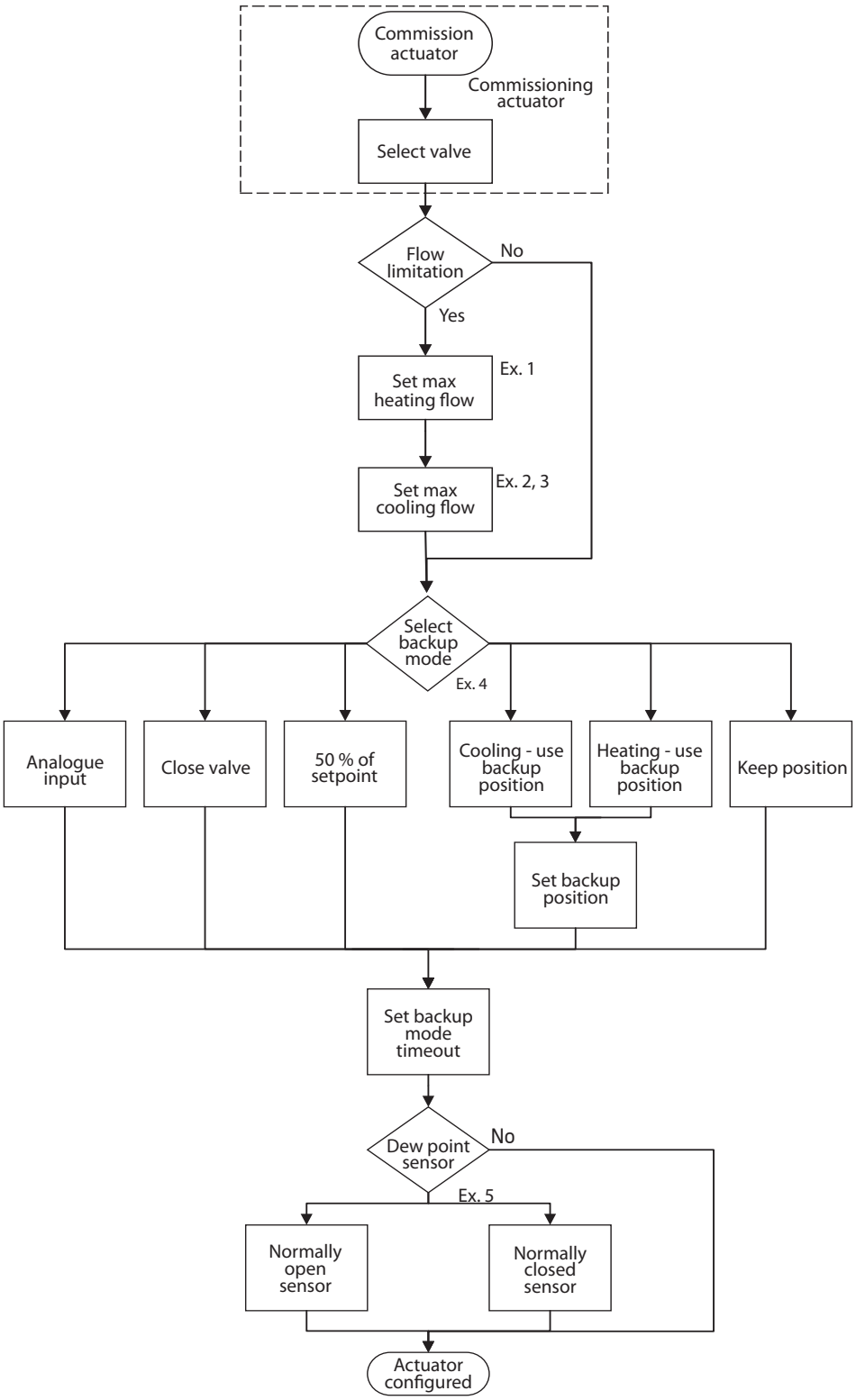
Overview

The flowchart below describes the complete actuator commissioning process. The guide starts by explaining the basic communication settings and valve selection process. Then, an application example is provided for each step of the flowchart and lastly, a complete object list is provided. Beside each step there is a reference such as Ex. 2.
This refers to an application example, so the example given is Application example 2 on page 5.
A basic commissioning can be done very quickly by jumping over the optional steps.



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Commissioning actuator

This basic setup prepares the valve and actuator to control the flow using algorithms.

Given that the Modbus-address has already been setup using the DIP-switches shown in the COMBIFLOW Multi Rotary Technote, these registers are needed to setup the Modbus communication. In registers where "**W**" is shown in the R/W column, values must be written into the registers. By default, the Modbus communication is 19200 8-E-1 baud, 8 databits, Even parity, and 1 stopbit.

To configure the communication settings, these registers must be setup (using 19200 8-E-1):

Name	Reg. adr. (Hex.)	Reg. adr. (Dec.)	Type	R/W	Values	Unit
MAC address*	0x701	1793	Uint16	R/W	1..247	--
RS-485 baud rate	0x601	1537	Uint16	R/W	0: 19200	--
					1: 9600	
					2: 19200	
					3: 38400	
					4: 57600	
					5: 76800	
					6: 115200	
RS-485 data format	0x602	1538	Uint16	R/W	0: 8E1	--
					1: 8N1	
					2: 8N2	
					3: 8O1	
ValveSelect	0x603	1539	Uint16	R/W	3: DN15LF	--
Reset**	0x700	1792	Uint16	W	2: Softreset	--

*** This register contains the current address of the actuator set by the HEX-switches. Changing this register overrides the HEX-switches.**

** Power cycling the device can also enable the new baudrate / data format.

Restore default settings:

To restore the default settings, turn the power off. Set the HEX-switches to FF and power the actuator on. Power off again, set the desired address and power on, then re-commission the actuator.

When the commissioning has been done, the examples on the following pages can be performed.

The valve used in this example is a COMBIFLOW DN15 LF. The complete range of COMBIFLOW valves are selectable (see Register 0x603/ValveSelect object in the object list).

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Application Example 1 · Flow setting and heating control

Example: Flow setting for cooling and heating, and control the valve in heating region.

Register 515: Preset value for the cooling side.
Register 519: Preset value for the heating side.
Register 514: Cooling flow setpoint 0-10000/0-100. 0-10000/0-100.
Register 518: Heating flow setpoint 0-10000/0-100. 0-10000/0-100.

Name	Reg. adr. (Hex.)	Reg. adr. (Dec.)	Type	R/W	Values	Unit
MaxCooling	0x203	515	Uint16	W	25 (Preset scale value 2.5)	--
MaxHeating	0x207	519	Uint16	W	10 (Preset scale value 1.0)	--
HeatingSet*	0x206	518	Uint16	W	0..10000	--

*** Please note:** Writing to the HeatingSet register automatically switches the actuator mode to Heating and resets CoolingSet to 0. The same applies vice versa. - Subsequently, be aware of the sequential order of writing to both registers HeatingSet and CoolingSet as the latest updated register enforces an automatic mode change accordingly.

Application Example 2 · Flow setting and cooling control

Example: Flow setting for cooling and heating, and control the valve in cooling region.

Register 515: Preset value for the cooling side.
Register 519: Preset value for the heating side.
Register 514: Cooling flow setpoint 0-10000/0-100. 0-10000/0-100.

Name	Reg. adr. (Hex.)	Reg. adr. (Dec.)	Type	R/W	Values	Unit
MaxCooling	0x203	515	Uint16	W	25 (Preset scale value 2.5)	--
MaxHeating	0x207	519	Uint16	W	10 (Preset scale value 1.0)	--
CoolingSet*	0x202	514	Uint16	W	0..10000	--

*** Please note:** Writing to the CoolingSet register automatically switches the actuator mode to Cooling and resets HeatingSet to 0. The same applies vice versa. - Subsequently, be aware of the sequential order of writing to both registers HeatingSet and CoolingSet as the latest updated register enforces an automatic mode change accordingly.

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Application Example 3 · Flow setting, cooling control and read of flow estimation

Example: Flow setting for cooling and heating, controlling the valve in cooling region and reading the estimated flow.

Register 515: Preset value for the cooling side.
Register 519: Preset value for the heating side.
Register 514: Flow setpoint 0-10000.
Register 513: Estimated flow in the cooling region.

Name	Reg. adr. (Hex.)	Reg. adr. (Dec.)	Type	R/W	Values	Unit
MaxCooling	0x203	515	Uint16	W	25 (Preset scale value 2.5)	--
MaxHeating	0x207	519	Uint16	W	10 (Preset scale value 1.0)	--
CoolingSet*	0x202	514	Uint16	W	5000 (0: No flow .. 10000: Max preset)	--
CoolingFlow	0x201	513	Uint16	R	Example: 70 = 70 l/h**	l/h

*** Please note:** Writing to the CoolingSet register automatically switches the actuator mode to Cooling and resets HeatingSet to 0. The same applies vice versa. - Subsequently, be aware of the sequential order of writing to both registers HeatingSet and CoolingSet as the latest updated register enforces an automatic mode change accordingly.
** Estimated actual flow in the valve. In this example valve DN15 LF is selected. The actual flow can deviate from the estimated flow due to mechanical tolerances in actuator and valve.

Application Example 4 · Backup function

Example: Setting up backup function in case of communication loss.
In this example the valve will go to cooling position 5000 (range 0-10000, approximately the middle of the cooling region) if the bus communication is down for more than 1 hour (3600 s).

Register 522: BackupPosition.
Register 523: BackupTimeout in seconds.
Register 1536: Cooling with position set in Register 522.

Name	Reg. adr. (Hex.)	Reg. adr. (Dec.)	Type	R/W	Values	Unit
BackupPosition	0x20A	522	Uint16	W	5000 (0: No flow .. 10000: Max preset)	--
BackupTimeout	0x20B	523	Uint16	W	3600 (3600 sec / 1 hour)	Seconds
BackupMode	0x600	1536	Uint16	W	3: Cooling with BackupPosition	--

Application Example 5 · Dew point sensor

Example: Setting up the dew-point sensor.
When the dew point sensor is active, the actuator will close the valve.

Normally Open (N0) = Dew point active when Ain (Y1) is > 2V
Normally Closed (N1) = Dew point active when Ain (Y1) is < 2V
Register 1540: Select functionality of the dew-point sensor. When the dew-point sensor is active, the actuator will close the valve.

Name	Reg. adr. (Hex.)	Reg. adr. (Dec.)	Type	R/W	Values	Unit
DewPointSelect	0x604	1540	Uint16	W	1: DewPoint N0*	--

* In the example above the relay is connected between terminal 2 and 3.. When the relay is active (short circuit between pin 2 and 3 via the relay) the valve will be closed and there will be no flow as long as the relay is active

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Application Example 6 · Analogue input

Example: Reading analog input.

Register 0: Read the analogue input voltage present on Y1(when not used for dewpoint sensor).

Name	Reg. adr. (Hex.)	Reg. adr. (Dec.)	Type	R/W	Values	Unit
Ain (Y1)	0x0	0	Uint16	R	8300*	V*1000

* In the example above a 8,3 V signal is present at pin 3.

Application Example 7 · Status

Example: Reading the status bits.

Register 2048: Current status of the actuator.

Name	Reg. adr. (Hex.)	Reg. adr. (Dec.)	Type	R/W	Values	Unit
Status	0x800	2048	Uint16	R	00001000* = Dew-point sensor active*	--

* In the example above, the dew-point sensor is active, and the actuator has moved to the closed position.

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Register List

Name	Description	Reg. adr. (Hex.)	Reg. adr. (Dec.)	Type	R/W	Values	Unit
Ain	Analog Input (Y1) 0-10 V	0x0	0	Uint16	R	0 - 10000	V*1000
Aout	Analog Output (U) 0-10 V	0x100	256	Uint16	R	0 - 10000	V*1000
Cooling	Current cooling position	0x200	512	Uint16	R	0 - 10000	--
CoolingFlow	Current cooling flow estimation (l/h)	0x201	513	Uint16	R	0 - Max flow of selected valve	l/h
*CoolingSet	Cooling setpoint	0x202	514	Uint16	R/W	0 - 10000	--
MaxCooling	Cooling preset 0-4.0	0x203	515	Uint16	R/W	0 - 40	--
Heating	Current heating position	0x204	516	Uint16	R	0 - 10000	--
HeatingFlow	Current heating flow estimation (l/h)	0x205	517	Uint16	R	0 - Max flow of selected valve	l/h
*HeatingSet	Heating setpoint	0x206	518	Uint16	R/W	0 - 10000	--
MaxHeating	Heating preset 0-4.0	0x207	519	Uint16	R/W	0 - 40	--
BackupPosition	Backup position for either cooling or heating	0x20A	522	Uint16	R/W	0 - 10000	--
BackupTimeout	Backup timeout in seconds	0x20B	523	Uint16	R/W	1 - 65535	Seconds
Firmware ver.	Current firmware version	0x218	536	Uint16	R	Current FW version	FW*100
BackupMode	Analog input value	0x600	1536	Uint16	R/W	0	--
	Closed position					1	
	50 % of setpoint					2	
	Cooling with BackupPosition					3	
	Heating with BackupPosition					4	
	Keep position					5	

*** Please note:** Writing to the CoolingSet register automatically switches the actuator mode to Cooling and resets HeatingSet to 0. The same applies vice versa. - Subsequently, be aware of the sequential order of writing to both registers HeatingSet and CoolingSet as the latest updated register enforces an automatic mode change accordingly.

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Register List

Name	Description	Reg. adr. (Hex.)	Reg. adr. (Dec.)	Type	R/W	Values	Unit
BaudRate	19200	0x601	1537	Uint16	R/W	0	--
	9600					1	
	19200					2	
	38400					3	
	57600					4	
	76800					5	
	115200					6	
DataFormat	8E1	0x602	1538	Uint16	R/W	0	--
	8N1					1	
	8N2					2	
	8O1					3	
ValveSelect	Generic	0x603	1539	Uint16	R/W	0	--
	DN20					1	
	DN15					2	
	DN15LF					3	
DewPointSelect	No sensor	0x604	1540	Uint16	R/W	0	--
	Dew point sensor NO (N0) (Normally Open)					1	
	Dew point sensor NC (N1) (Normally Closed)					2	
Reset	No change	0x700	1792	Uint16	R/W	0	--
	Reset to default values					1	
	Softreset					2	

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Register List

Name	Description	Reg. adr. (Hex.)	Reg. adr. (Dec.)	Type	R/W	Values	Unit
MAC address	RS-485 address of the actuator	0x701	1793	Uint16	R/W	1..247	--
Status	Obstruction (Jammed)	0x800	2048	Uint16	R	Bit 0	--
	Cooling					Bit 1	
	Heating					Bit 2	
	DewPoint sensor active					Bit 3	
	Reserved					Bit 4-7	

Please note: Information about Modbus-settting and flow can be found in the COMBIFLOW Multi Rotary Actuator Datasheet.

Software Update: Unified Setup of Heating & Cooling mode

For SW 2.08 or newer: New registers are included for unified setting of heating & cooling mode

Name	Description	Reg. adr. (Hex.)	Reg. adr. (Dec.)	Type	R/W	Values	Unit
FlowSet	Flowrate setting	0x219	537	Uint16	R/W	0 - 10000	V*1000

The flow setpoint FlowSet (Reg 537) sets the flow rate for both heating and cooling depending on the mode:
Heating flow setpoint if Mode **Reg 1541 = 1**
Cooling flow setpoint if Mode **Reg 1541 = 2**
thus obsoleting register 518 and 514.

Name	Description	Reg. adr. (Hex.)	Reg. adr. (Dec.)	Type	R/W	Values	Unit
Mode	Default (Reg 537 inactive)	0x605	1541	Uint16	R/W	0	--
	Heating mode					1	
	Cooling mode					2	

Parameter to change mode to Heating Mode (**Reg 1541 = 1**) or Cooling Mode (**Reg 1541 = 2**) with flow setpoint written to object **FlowSet (Reg 537)**.
Default Mode when parameter **Reg 1541 = 0**, while Reg 537 is inactive, and mode and flow are set via **HeatingSet (Reg 518)** and **CoolingSet (Reg 514)**, as with SW 2.07 or earlier SW versions explained in Application Examples 1-3 above.

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