Frese COMBIFLOW Modbus Rotary Actuator

Description

The Frese COMBIFLOW Modbus Rotary Actuator is designed to be used with the Frese COMBIFLOW 6-way Pressure Independent Control Valve.

The actuator is installed on the valve to switch between the heating and the cooling as well as for the flow setting, modulation and shut off.

Operation

The Frese COMBIFLOW Modbus Rotary Actuator uses Modbus communication protocol. It is programmed to achieve the sizing flows for heating and for cooling as well as to secure the shut off position.

Every actuator installed in the system is assigned with a unique address for the data transfer. The address is set using either the actuator's manual interface (push-button) or the Frese COMBIFLOW Modbus Programming Tool.

The sizing flows can be programmed using either the BMS master controller or the Frese COMBIFLOW Modbus Programming Tool. The shut off position must be programmed using the BMS master controller only.

Application

The Frese COMBIFLOW Modbus Rotary Actuator is used with the Frese COMBIFLOW 6-way Pressure Independent Control Valve for:

- Switching between the cooling and the heating
- Cooling and Heating flows setting
- Flow modulation
- Flow shut off
- Error and current status reporting

Benefits

- Easy setting of the sizing flow for heating and for cooling
- Assigning a unique address of the actuator without the risk of repeating the same value in different actuators
- Mass configuration for quick system commissioning
- Direct actuator operation monitoring and diagnostics

Features

- Communication: Modbus RTU (RS-485), galvanically separated
- Functions:
  - Setpoint 0.. 100%,
  - Actual value for position 0.. 100%,
  - Override control: open, close, min, max, stop,
  - Setpoint monitoring
  - Backup mode
- Supported baud rates:
  9.6, 19.2, 38.4, 57.6, 78.4, 115.2 kbaud
- Supported transmission formats:
  1-8-E-1, 1-8-N-1, 1-8-O-1, 1-8-N-2
- Termination:
  120 Ω electronically switchable
- Supported Modbus function codes:
  - 03 Read Holding Registers,
  - 04 Read Input Registers,
  - 06 Write Single Register,
  - 16 Write Multiple registers
    (max. 120 registers within one message)

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HMI (Human-Machine Interface)

Push-button operation		
Activity	**Push-button operation**	**Confirmation**
Display current address (in reverse order)	Press button < 1s	Current address is displayed
Enter Modbus address with push-button	Press button > 1s and < 5s	See description below
Enter push-button addressing mode (for use with Climatix™ controllers)	Press button > 5s and < 10s	LED shines orange (release button when red LED gets dark). Timeout after 1 min.
Reset to factory settings	Press button > 10s	LED flashes orange

LED colors and patterns		
Color	**Pattern**	**Description**
Green	Steady	Start-up
	1s on / 5s off	Fault free operation ("life pulse")
	Flashing	Bus traffic
Orange/green	1s orange / 1s green	Device is in override control
Orange	1s on / 1s off	Bus parameters not yet configured
Orange	1s on / 5s off	Backup mode entered
Red	Steady	Mechanical fault / device jammed
	1s on /5s off	Internal error
	0.1s on / 1s off	Invalid configuration, e.g. Min = Max

Resetting the device by push-button

The Frese COMBIFLOW Modbus Rotary actuator can be reset by push-button:

1. Press button for > 10s ➞ LED starts flashing orange
2. Release button while LED still flashes ➞ LED keeps flashing for 3s
3. If the button is pressed within these 3s, the reset is cancelled.
4. After those 3s ➞ LED shines red (reset), then green (start-up).

Push-button addressing

Display current address (digits in reverse order)

The Modbus address can be set without a separate tool by using the push-button and LED.

To display the current address, press button < 1s.

Colors		
1-digits: red	10-digits: green	100-digits: orange

Example for address 124:	
LED	
Note	The address is entered and shown in reverse order.

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Set new address (digits in reverse order)

1. **Enter addressing mode**: press button > 1s until LED shines red, then release button (before LED gets dark).
2. **Enter digits**: press button n-times ➡ LED flashes per button press (feedback). Colors: 1-digits: red / 10-digits: green / 100-digits: orange
3. **Store digits**: press button until LED shines in color of following digits – release button
4. **Save address**: press button until LED shines red (confirmation) ➡ release button. An address can be stored at any time, i.e. after setting the 1-digits, or after setting the 1- and the 10-digits.
5. Entered address is repeated once for confirmation.

Note: If button is released before LED shines red, the address is discarded.

Examples

Set address "124":

1. Enter addressing mode
2. Set 1-digits: Press button 4-times ➡ LED flashes red per button press
3. Store 1-digits: press button until LED shines green – release button
4. Set 10-digits: Press button 2-times ➡ LED flashes green per button press
5. Store 10-digits: press button until LED shines orange – release button
6. Set 100-digits: Press button 1-times ➡ LED flashes orange per button press
7. Store address: press button until LED shines red – release button ➡ address is stored and displayed 1x for confirmation

Set address "50":

1. Enter addressig mode
2. Skip 1-digits: Hold button pressed until LED shines green – release button
3. Set 10-digits: Press button 5-times ➡ LED flashes green per button press
4. Store address (skip 100-digits): hold button pressed until LED shines red
   – release button
   ➡ address is stored and displayed 1x for confirmation

Set address "5":

1. Enter addressing mode
2. Set 1-digits: Press button 5-times ➡ LED flashes green per button press
3. Store address: press button until LED shines red

   ➡ address is stored and displayed 1x for confirmation

Modbus registers

Process Values					
Reg.	**Name**	**R/W**	**Unit**	**Scaling**	**Range/ enumeration**
1	Setpoint	RW	%	0.01	0..100
2	Override control	RW	--	--	0 = Off / 1 = Open / 2 = Close 3 = Stop / 4 = GoToMin / 5 = GoToMax
3	Actual position	R	%	0.01	0..100
256	Command	RW	--		0 = Ready / 1 = Adaption / 2 = Selftest 3 = ReInitDevice / 4 = RemoteFactoryReset

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Parameters

Reg.	Name	R/W	Unit	Scaling	Range/ enumeration
257	Opening Direction	RW	--	--	0 = CW / 1 = CCW
258	Adaptive Mode	RW	--	--	0 = Off / 1 = On
259	Operating Mode	RW	--	--	1 = POS
260	MinPosition	RW	%	0.01	0..100
261	MaxPosition	RW	%	0.01	0..100
262	Actuator Running Time	R	s	1	150
513	Backup Mode	RW	--	--	0 = Go to BackupPosition 1 = Keep last position 2 = Disabled
514	Backup Position	RW	%	0.01	0..100
515	Backup Timeout	RW	s	1	0..65535
516	Startup Setpoint	RW	%	0.01	0..100
764	Modbus Address	RW	--	--	1..247 / 255 = "unassigned"
765	Baudrate	RW	--	--	0 = auto / 1 = 9600 / 2 = 19200 3 = 38400 / 4 = 57600 / 5 = 76800 / 6 = 115200
766	Transmission Format	RW	--	--	0 = 1-8-E-1 / 1 = 1-8-O-1 2 = 1-8-N-1 / 3 = 1-8-N-2
767	Bus Termination	RW	--	--	0 = Off / 1 = On
768	Bus Conf. Command	RW	--	--	0 = Ready / 1 = Load / 2 = Discard
769	Status	R	--	--	See below

Device Information

Reg.	Name	R/W	Unit	Scaling
1281	Factory Index	R	--	--
1282-83	Factory Date	R	--	--
1284-85	Factory SeqNo	R	--	--
1409-16	TypeASN [Char_16..1]	R	--	--

Register 769 "Status"

Status

Bit 00	1 = Local Override	Bit 06	1 = Adaption done
Bit 01	1 = Backup mode active	Bit 07	1 = Adaption in progress
Bit 02	1 = reserved	Bit 08	1 = Adaption error
Bit 03	1 = reserved	Bit 09	1 = Selftest failed
Bit 04	1 = Device jammed	Bit 10	1 = Selftest passed
Bit 05	1 = Nom. lifetime exceeded	Bit 11	1 = Invalid configuration

Supported function codes

Function codes

03 (0x03)	Read Holding Registers
04 (0x04)	Read Input Registers
06 (0x06)	Write Single Register
16 (0x10)	Write Multiple Registers (Limitation: Max. 120 registers within one message)

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Commissioning

Parameterization

The following parameters must be checked or set prior to commissioning:

Parameter	Range	Description	Factory setting
Opening direction	CW (R) / CCW (L)	Opening direction of rotary actuator	CW (R)

Commissioning workflow 1: Full or partial configuration by tool

The following parameters must be checked or set prior to commissioning:

- Connect the Frese COMBIFLOW Modbus Programming tool, 48-5399, to the Frese COMBIFLOW Modbus Rotary actuator and navigate to the bus configuration menu
- Set bus parameters as desired
- Optionally make changes on actuator parameters.

Note: *With the Frese COMBIFLOW Modbus Programming tool, 48-5399, all parameters can be set using the mass configuration function. The bus parameters are included in the mass configuration function. It can be selected that the address is automatically incremented with each programmed actuator.*

Commissioning workflow 2: Configuration over bus (fully or partially)

The devices can be configured over bus if the pre-commissioning settings allow for a connection between the Modbus master / programming tool and peripheral devices (i.e. nonconflicting addresses and matching baudrate / transmission format).

- Full configuration over bus: If the address is unique per segment when powered up, the device can be accessed by the Modbus master (or programming tool) and the address and other parameters can then be set to the definitive values.

- Partial configuration over bus: If the address is not unique per segment when powered up, each device must get a nonconflicting address before connecting it to the bus (e.g. using the push-button addressing method). After addressing all devices, the remaining configuration can be done over the bus using the default settings for baudrate (auto-baud) and transmission mode for the Modbus master.

- Overwriting the bus configuration over bus uses a timeout. If „1 = Load" is not written into Reg 768 within 30 seconds, all values are discarded.

Closing position

The Frese COMBIFLOW 6-way valve is closed in the middle position (no flow from heating nor from cooling to the terminal unit). The Frese COMBIFLOW Modbus Rotary Actuator calculates its middle position based on the flow setting values. Because of this the middle position of the valve equals the middle position of the actuator only when the maximum flow for heating (100%) and the maximum flow for cooling (0%) has been provided.

Consequently, if the flow for cooling (Min. position in %) is much greater than the flow for heating (Max. position in %), or the opposite, the middle position calculated by the actuator would move away from the middle position required by the valve to close completely.

In order to be able to close the valve regardless of the flow setting values the master BMS controller must be programmed to lock the closing position of the actuator. The following formula should be used for this:

$$\text{Closing position} = \frac{50 - \text{Min. position \%}}{\text{Max. position \%} - \text{Min. position \%}} * 100$$

Note:

When setting the flows for heating and for cooling using either the Frese COMBIFLOW Modbus Programming Tool or the BMS master controller the closing position must always be programmed in the BMS master controller.

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Example: Table shows bus configuration registers before and after changing them over bus.

Reg.	Name	Pre-commissioning	New value (ex.)
764	MacAddress	46	12
765	Baudrate	0 = auto	1 = 9600
766	Transmission Mode	0 = 1-8-E-1	3 = 1-8-N-2
767	Termination	0 = off	0 = Off
768	BusConfigCmd	0 = Ready	1 = Load

Technical data

Power Supply

Operating voltage		AC 24 V ± 20 % (SELV) or AC 24 V class 2 (US)
Frequency		50/60 Hz
Power consumption	at 50 Hz	
	Actuator holds	1 VA / 0.5 W
	Actuator rotates	3 VA / 2.5 W

Function data

Positioning time for nominal rotation angle	150 s (50 Hz) 120 s (60 Hz)
Nominal / maximum torque	10 Nm / < 14 Nm
Nominal / maximum rotation angle	90° / 95° ± 2°
Direction of rotation - Adjustable by tool or over bus	Clockwise (CW) / Counter-clockwise (CCW)

Connection cables

Cable length		0.9 m
Power supply/Communication	Number of cores and cross-sectional area	5 x 0.75 mm²
Service interface	Terminal strip	7-pin, grid 2.00 mm

Communication

|		
Communication protocol	Modbus RTU	RS-485, galvanically separated
	Number of nodes	Max. 32
	Address range	1...247 / 255 Default: 255
	Transmission formats	1-8-E-1 / 1-8-O-1 / 1-8-N-1 / 1-8-N-2 Default: 1-8-E-1
	Baudrates (kBaud)	Auto / 9.6 / 19.2 / 38.4 / 57.6 / 76.8 / 115.2 Default: Auto
	Termination	120 Ω electronically switchable Default: Off

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Degree of protection

Degree of protection	Degree of protection acc. to EN 60529 (see mounting instruction)	IP54
Safety class	Safety class acc. to EN 60730	III

Environmental conditions

		IEC 60721-3-x
Applicable standard Operation	Climatic conditions	Class 3K6
	Mounting location	Indoors
	Temperature general	-32...55 °C
	Humidity (non condensing)	5…95 % r. h.
Transport	Climatic conditions	Class 2K3
	Temperature	-25…70 °C
	Humidity	5...95 % r. h.
Storage	Climatic conditions	Class 1K3
	Temperature	-5…45 °C
	Humidity	5...95 % r. h.

Directives and standards

Product standard	EN60730-x
Electromagnetic compatibility (Application)	For residential, commercial and industrial environments
	GLB111.9E/MO
EU Conformity (CE)	A5W00000176[1]
RCM Conformity	A5W00000177[1]
UL, cUL - AC 24 V	UL 873 http://ul.com/database

## Mounting
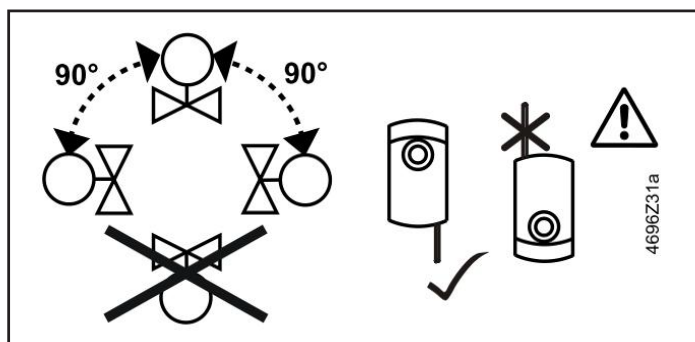
Do not open the rotary actuators

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Wiring

Internal diagrams

The Frese COMBIFLOW Modbus Rotary Actuator is supplied with a prewired connecting and communication cable. All interconnected devices must be connected to the same G0.

Core desig.	Core color	Terminal code	Description
1	Red (RD)	G	System voltage AC 24 V
2	Black (BK)	G0	System voltage AC 24 V
6	Violet (VT)	Ref	Reference
8	Grey (GY)	+	Bus (Modbus RTU)
9	Pink (PK)	-	Bus (Modbus RTU)
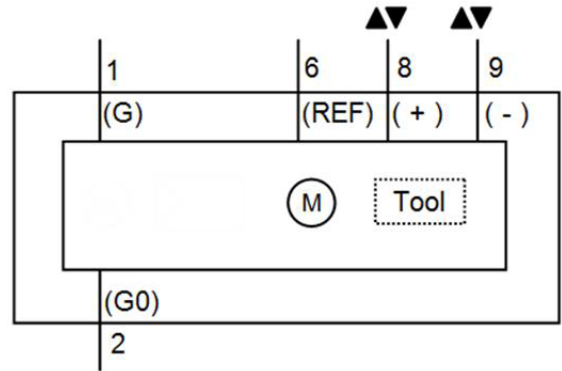
Note: *The operating voltage at terminals G and G0 must comply with the requirements under SELV or PELV. Safety transformers with twofold insulation as per EN 61558 required; they must be designed to be on 100 % of the time.*

Dimensions
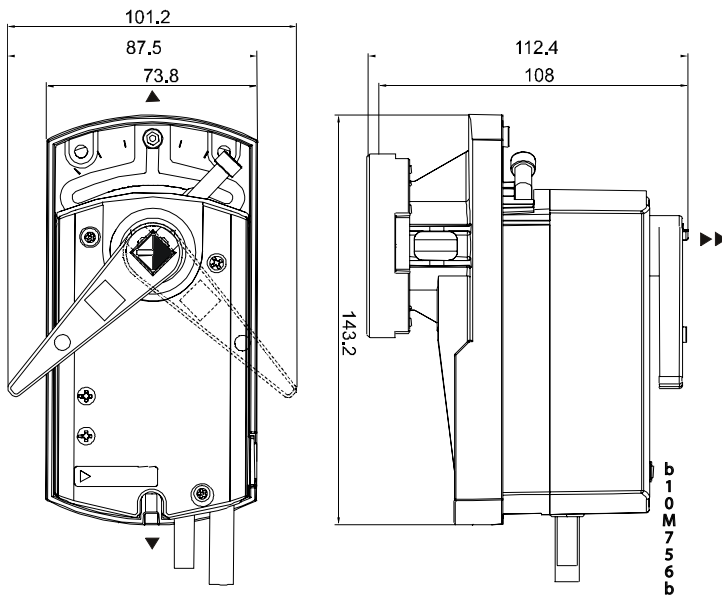
Dimensions in mm

► = >100mm   Minimum clearance from ceiling or wall for mounting

►► = >200mm   Connection, operation, maintenance etc.

Product programme

	Type	Weight kg.	Frese no.
	Frese COMBIFLOW Modbus Rotary Actuator	0,60	48-5398

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Maintenance

The Frese COMBIFLOW Modbus Rotary Actuator is maintenance-free. Disconnect the electrical connections from the terminals if you want to work at the device.

Environmental combatibility

The product environmental declaration A6V10209938 contains data on environmentally compatible product design and assessments (RoHS compliance, materials composition, packaging, environmental benefit, disposal).

Disposal

The device is considered an electronics device for disposal in terms of European Directive 2012/19/EU and may not be disposed of as domestic garbage.

•   Dispose of the device through channels provided for this purpose.

•   Comply with all local and currently applicable laws and regulations.

Note

Failure to comply with national safety regulations may result in

personal injury and property damage. Observe national provisions

and comply with the appropriate safety regulations.

Frese A/S
Sorøvej 8
DK- 4200 Slagelse
Tel: +45 58 56 00 00
info@frese.dk