

Frese MODBUS System

Application

Frese MODBUS System enables MODBUS communication of the entire OPTIMA Compact valve series.

At the same time an active temperature transmitter or any other active sensor type is MODBUS enabled with the flexible Frese MODBUS Converter.

A very compact design enables installation of valve and actuator with minimal space requirements while the MODBUS converter can be located at a more convenient location nearby.

High IP protection class and easy installation is obtained with use of preconfigured cables with M8 and M12 quality connectors.

One MODBUS Converter for all OPTIMA Compact valves also means just one standardized MODBUS register for all valves and sensors.

Up to 38 MODBUS actuators and 38 transmitters can be placed on the same MODBUS master for DN10-DN32 valves without external power supply.



Benefits

Design

- One Modbus Converter covers 2 actuators and 2 temperature transmitters
- Operation of two independent valves and two independent and active temperature transmitters.
- Robust and easy system to commission and install.

Installation

- Easy installation of actuators and sensors because of cables with pre-installed connectors
- Minimized commissioning time due to automatic balancing of the system
- No requirements for straight diameters of pipe upstream and downstream of the valve
- Can be easily installed where space is limited

Features

- MODBUS RTU RS485 24V AC/DC based system
- Protection class: IP54 in any installation direction
- Flexible installation room – very compact valve and actuator
- Daisy chain cabling between devices means fewer cables in installation
- Remote commissioning possible.
- Remote monitoring and possible error codes warnings (e.g. sticking valve)
- Preconfigured cables – low risk of installation issues
- Actuator display with visual indication of valve position (DN10 - DN32)
- Active temperature transmitter input
- Valve position feedback via MODBUS
- Local LED light with status indication

Frese MODBUS System

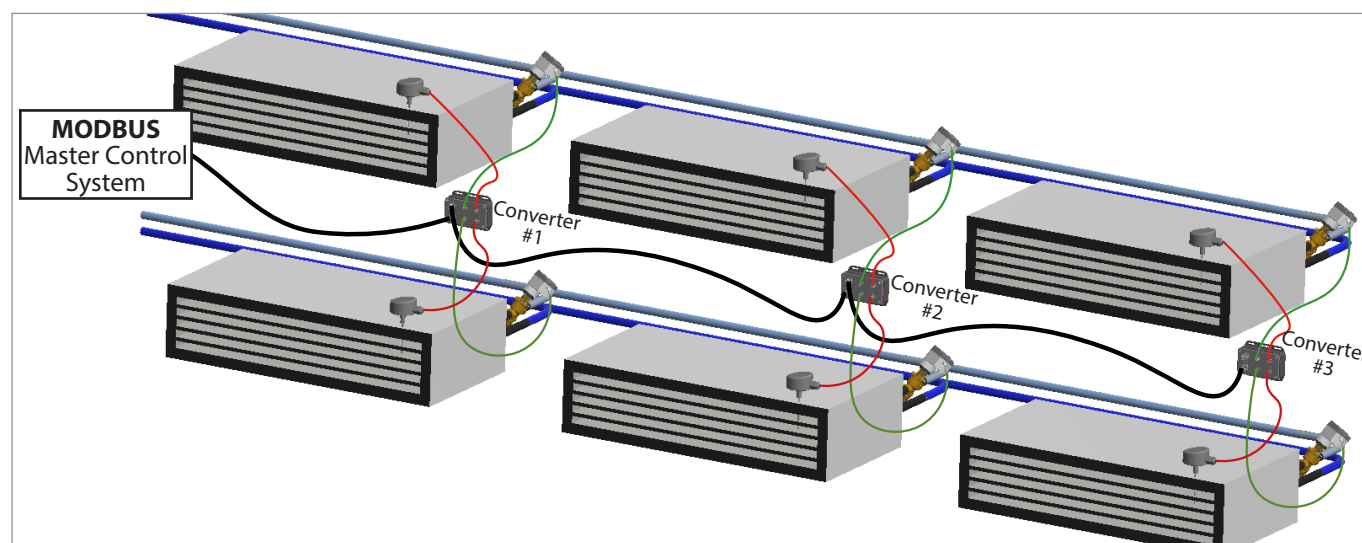
Function

Frese MODBUS RTU RS485 based system can be used to control 2 (0-10V) actuators and 2 temperature sensors. Both actuators and sensors are delivered with cables and connectors to plug directly into the MODBUS converter.

The MODBUS converter can operate 2 terminal units with an actuator and a temperature sensor for each unit, and is

connected in a daisy chain connection from the main control system.

The Frese MODBUS converter can be used in connection with OPTIMA Compact valves in all sizes, combined with the relevant standard 0-10V actuators, and is therefore a standardized and a very flexible solution for MODBUS control.



Power supply setup

The power consumption increases with the size of the valve and actuator. Therefore the number of Frese MODBUS converters in a daisy chain are depending on the valve dimension.

DC power is recommended as AC power reduces the total numbers of consumers in the daisy chain. The number of MODBUS Converters in series is limited to max. 4 A via the M12 connectors and cables due to the limitation of the supply for the actuators.

| Valve dimension | * Number of converters without external power supply to actuators | |
|------------------------------|-------------------------------------------------------------------|-------------|
| | (DC system) | (AC system) |
| DN10-DN32 (threaded valves) | 19 | 12 |
| DN40-DN50 (threaded valves) | 8 | 6 |
| DN50-DN125 (flanged valves) | 4 | 3 |
| DN150-DN200 (flanged valves) | 1 | 1 |

*) Each MODBUS converter operates 2 actuators.

More MODBUS converters can be connected in series if external power supply is used (See page 7)

MODBUS Setup

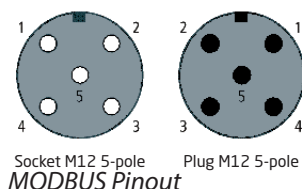
Frese MODBUS Converter supports the following function codes: 0 x 03 Read, 0 x 10 Write

All MODBUS registers are 16-Bit values.

Master MODBUS Controller: Connection description



MODBUS M12 – M12 Cable
Standard cable: **Not part of Frese delivery**



MODBUS Pinout

| Pin | MODBUS In/Out |
|-----|---------------|
| 1 | 24V, L2, GND |
| 2 | 24V, L1, + |
| 3 | Shield |
| 4 | Modbus D- |
| 5 | Modbus D+ |

Connections

Frese MODBUS System

Registers

| Register address | Function code (03H/10H) | Explanation | Default | Unit | Scaling | Range / Enumeration |
|---------------------------|-------------------------|-----------------------------------------------------------------------------|---------|-------|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FFH MODBUS address 00H | W | Global function: Stand-by, Drives off, Sensors off | 0000H | -- | -- | 0 = Normal 8000H = Standby |
| 01H | RW | Drive 1: New position | 0000H | % | 0,1 | 0..1000 |
| 02H | RW | Drive 2: New position | 0000H | % | 0,1 | 0..1000 |
| 03H | R | Drive 1: Read out current position | 0000H | 10 mV | 0,01 | 0..1000 |
| 04H | R | Drive 2: Read out current position | 0000H | 10 mV | 0,01 | 0..1000 |
| 05H | R | Sensor 1.1: Read out active sensor | 0000H | mA | 0,01 | 0-2000 |
| 06H | R | Sensor 2.1: Read out active sensor | 0000H | mA | 0,01 | 0-2000 |
| 09H | RW | Drive 1: on/off | 000H | -- | -- | 0000H = Off FFFFH = On |
| 0AH | RW | Drive 2: on/off | 000H | -- | -- | 0000H = Off FFFFH = On |
| 13H | RW | Reset: Drives will do new initialization STD: Power-off for 2 seconds | 00H | -- | -- | 0000H = Normal 8000H = Rst Drive1 0080H = Rst Drive2 |
| 14H | RW | Read out Error bits Drives | | -- | -- | Bit 10: D2 Feedback > 9V Bit 11: D2 Feedback < 1V Bit 12: D1 Feedback > 9V Bit 13: D1 Feedback < 1V Bit 14: Fail detected Bit 15: Converter error |
| 15H | RW | Transmitter setup | 00FFH | -- | -- | 8080H = Sensor on 8 sec. conversion time |
| 16H | RW | Transmitter start measurement | 00H | -- | -- | 8000H = W start 0000H = R complete |
| 17H | RW | Readout Error bits Sensors | | | | Bit 0: reserved Bit 1: reserved Bit 2: S2 shorted Bit 3: S2 Not found Bit 4: reserved Bit 5: reserved Bit 6: reserved Bit 7: S1 reserved Bit 8: reserved Bit 9: reserved Bit 10: S1 shorted Bit 11: S1 not found Bit 12: PSU overloaded Bit 13: D2 blocked Bit 14: D1 Blocked Bit 15: Unknown error + time not set |

Reading of temperature transmitter + trigger mode:

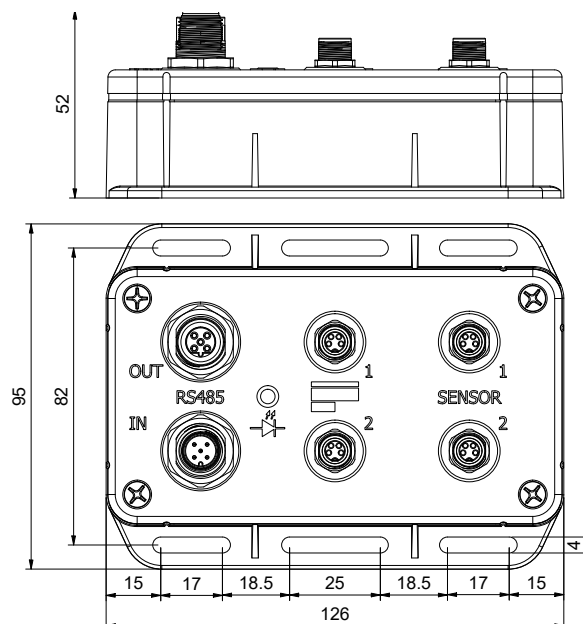
Setup reading time: Register 15H
Start reading: Register 16H (Poll for Zero)
Read value: 05H or 06H

Frese MODBUS System

MODBUS Converter (58-8955)

Technical Data

| | |
|------------------------------------|-------------------------------|
| Function: | MODBUS Slave/Node |
| Control unit material: | Polyamide Halogenfree |
| Operation voltage: | 24V AC/DC -10% / +20% |
| | Via bus cable |
| Power consumption: | Max 60mA (for the box only) |
| Control connection: | MODBUS RTU RS485 |
| Protection Class: | IP54 |
| | (Installed in all directions) |
| | IEC 61140 Class III |
| CE Conformity: | EN60730 Immunity Class B |
| Weight: | 100g |
| Actuator control signal: | 0-10V DC |
| | Bidirectional modulating |
| Temperature sensors: | 4-20mA active transmitters |
| Ambient temperature: | 0-50°C (During operation) |
| Baudrate: (Factory setting) | Automatic baudrate detection |



Commissioning

Standard-address setting is 244.

How to auto detect the baudrate:

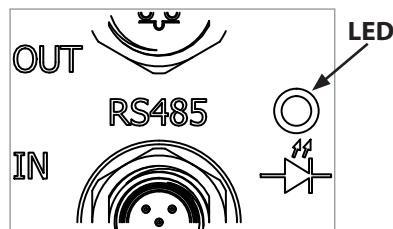
1. Open the MODBUS converter and change the address setting via DIP switch.
2. Switch on power supply for the MODBUS converter
3. Transmit a command to MODBUS converter address 01 using the preferred baudrate (always after power on)
E.g. 01 03 00 01 00 01 D5 CA
Now all MODBUS converters will use the new baudrate
Note: The above procedure needs to be repeated if the power supply has been down.
4. Send the setting of the MODBUS converter and the connected actuator and sensors. (See the register table, page 3)



| Switch no. | Description | Pos. On | Pos. Off |
|------------|----------------------|---------|----------|
| 1 | MODBUS Address Bit 0 | 1 | 0 |
| 2 | MODBUS Address Bit 1 | 1 | 0 |
| 3 | MODBUS Address Bit 2 | 1 | 0 |
| 4 | MODBUS Address Bit 3 | 1 | 0 |
| 5 | MODBUS Address Bit 4 | 1 | 0 |
| 6 | MODBUS Address Bit 5 | 1 | 0 |
| 7 | MODBUS Address Bit 6 | 1 | 0 |
| 8 | MODBUS Address Bit 7 | 1 | 0 |
| 9 | Baud rate | Auto | 19200 |
| 10 | Termination | YES | NO |

Default setting: All switched ON

LED indicator



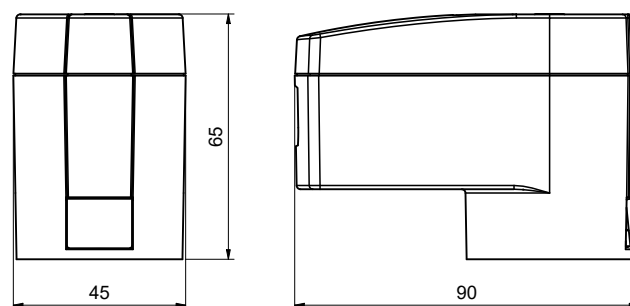
| LED light | Description |
|----------------|---------------------------------------------------------------------------------------------------------|
| Green | Normal function |
| White | Normal function, Modbus terminated |
| Green flashing | Public MODBUS traffic |
| White flashing | Sending MODBUS telegrams |
| Yellow | MODBUS converter in standby mode |
| Red flashing | One or both outputs are defect, because of overload or short circuit at the outputs of the valve drives |

Frese MODBUS System

Actuator DN10-DN32

Technical Data

| | |
|--------------------------------------|-----------------------------------------------------------|
| Characteristics: | Motoric actuator |
| Protection class: | IP 54 to EN 60529 (Can be installed in all directions) |
| Supply: | 24V AC/DC |
| Frequency: | 50/60 Hz |
| Control signal: | 0-10V DC |
| Actuating force: | 125 N |
| Stroke: | Auto calibration |
| Running time: | 15 s/mm |
| Ambient operating conditions: | 0°C to 50°C |
| Cable: | Halogen free incl. M8 connectors |



Types and Operation Data DN10-DN32 actuators

| Type | Valve Dimension | Cable length | Supply voltage | Power Consumption |
|---------|-----------------|--------------|------------------------------------------------------------|-------------------|
| 58-8910 | DN10-DN32 | 1 m | 24V AC, -10 %... +20 %, 50-60 Hz 24V DC, -20 %... +20 % | *2,6 VA/ 1,4W |
| 58-8911 | DN10-DN32 | 3 m | 24V AC, -10 %... +20 %, 50-60 Hz 24V DC, -20 %... +20 % | *2,6 VA/ 1,4W |

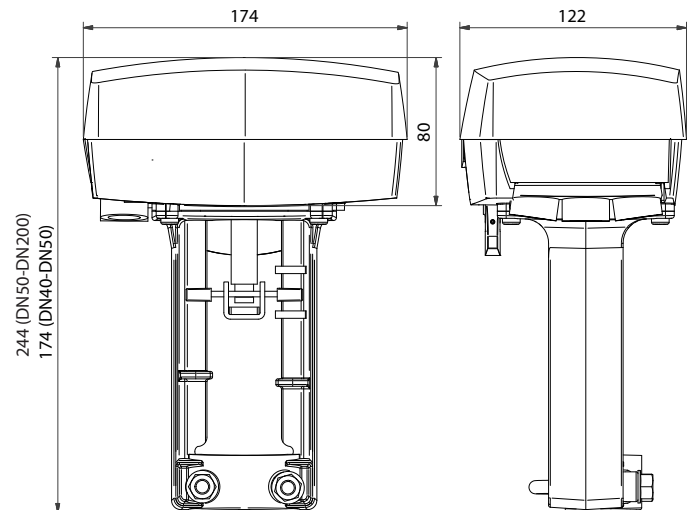
*) Max consumption - for transformer sizing

Frese MODBUS System

Actuator DN40-DN200

Technical Data

| | |
|--------------------------------------|-----------------------------------|
| Characteristics: | Motoric actuator |
| Protection class: | IP 54 to EN 60529 |
| Supply: | 24V AC/DC |
| Frequency AC: | 50/60 Hz |
| Control signal impedance: | Min. 100 kOhm (0-10V) |
| Stroke max: | 32mm DN40-DN50 52mm DN50-DN200 |
| Running time: DN40-DN50 | 60 s (0-10V) 60 s or 300 s |
| Running time: DN50-DN200 | 30 s (0-10V) 60 s or 300 s |
| Ambient operating conditions: | -10°C to 50°C |
| Manual operation: | Manual handle |
| Cable: | Not included |





Types and operation data DN40-DN200 actuators

| Type | Valve Dimension | Control signal Force | Supply voltage | Power Consumption |
|---------|--------------------|-----------------------------|---------------------------------|-------------------|
| 53-1296 | DN40-DN50 threaded | 0(2) - 10V / 3-pos 400N | 24V AC +/-25% 24V DC +/- 10% | 6 VA (*30VA) |
| 53-1297 | DN50-DN125 | 0(2) - 10V / 3-pos 800N | 24V AC +/-25% 24V DC +/- 10% | 15 VA (*50VA) |
| 53-1298 | DN150-DN200 | 0(2) - 10V / 3-pos 1500N | 24V AC +/-25% 24V DC +/- 10% | 24 VA (*50VA) |

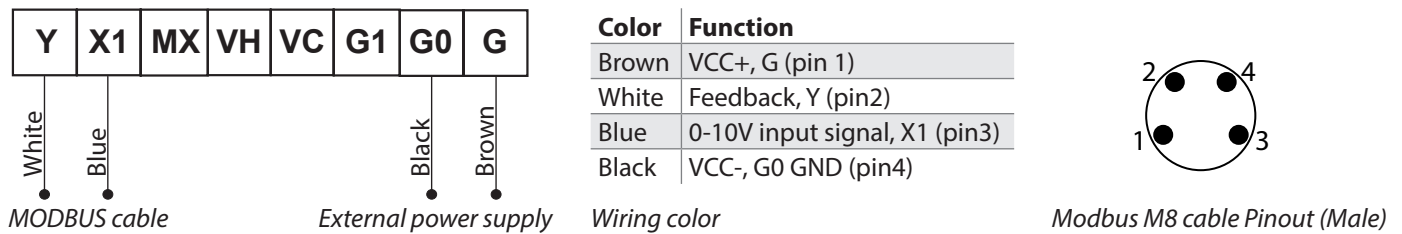
*) Max consumption - for transformer sizing

Frese MODBUS System

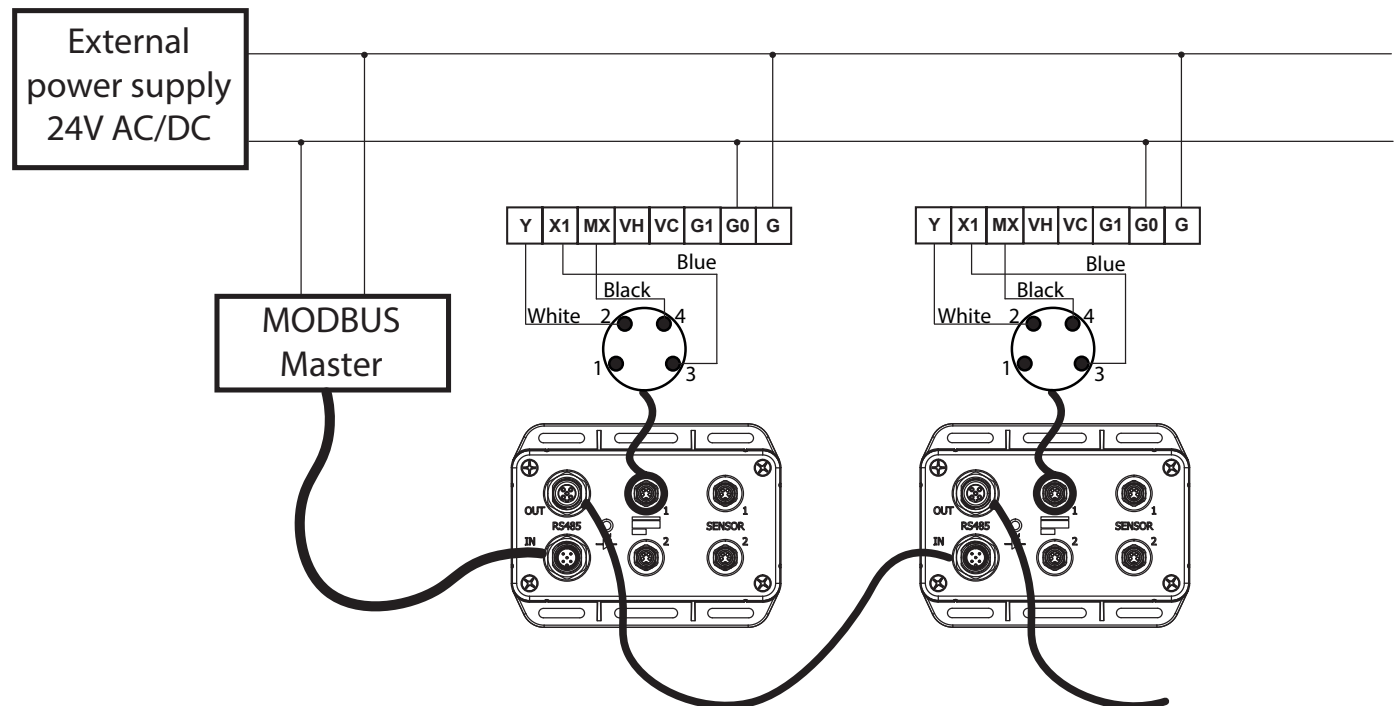
MODBUS system cables

| | Type | Item no. | Used for | Cable length |
|-----------------------------------------------------------------------------------|----------------------------------------------------------------------|----------|--------------------------------------------------------------|---------------------|
|  | Cable with M8 connector in one end and 4 free wires in the other end | 58-8952 | OPTIMA Compact Actuators DN40-200 | 5 m Halogen free |
|  | Extension cable with M8 connection in both ends | 58-8953 | Extension cable for all OPTIMA Compact actuators and sensors | 5 m Halogen free |

Cable connection for DN40-DN200 actuators



MODBUS & External power supply connection for DN40-DN200 actuators

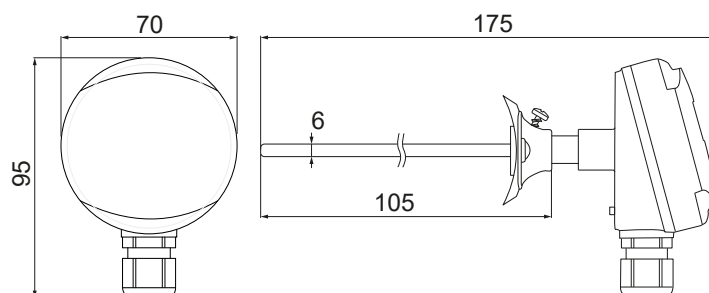


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
Temperature Transmitter (58-8954)

Technical Data

| | |
|--------------------------------------|-----------------------------------------------|
| Characteristics: | PT1000 EN60751/B |
| Protection class: | IP 54 to EN 60529 |
| Supply: | 15..35V DC |
| Material: | AISI316 (Sensor) Plastic (Housing) |
| Pressure class: | PN16 |
| Ambient operating conditions: | 0°C to 60°C |
| Measuring range: | 0°C to 100°C Adjustable by DIP switches |
| Cable: | 3.0 m halogen free incl. connector |



Selecting measuring range

| 0...+50 °C | *0...+100 °C | -50...+50 °C | -50...+150 °C |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| S1 S2 | S1 S2 | S1 S2 | S1 S2 |
|  |  |  |  |

*) Factory setting

Output signal

| 0...+50 | 0...+100 | -50...+50 | -50...+150 | Signal |
|---------|----------|-----------|------------|--------|
| 0 °C | 0 °C | -50 °C | -50 °C | 4 mA |
| 25 °C | 50 °C | 0 °C | 50 °C | 12 mA |
| 50 °C | 100 °C | 50 °C | 150 °C | 20 mA |

OPTIMA Compact PICV


Technical data

| | |
|------------------------------------|------------------------------------------|
| Valve housing: | DZR Brass, CW602N |
| DN10-DN32 | Cast/Ductile Iron |
| DN40-DN200 | |
| Spring: | Stainless steel |
| Diaphragm: | HNBR/EPDM |
| O-rings: | EPDM |
| Pressure class: | PN25 (DN10-DN50) PN16/25 (DN50-DN200) |
| Max. differential pressure: | 800 kPa |
| Medium temperature range: | 0°C to 120°C |
| Flow range: | See OPTIMA Compact Technote |










Frese MODBUS System

Product Programme

| | Type | Frese no. |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|-----------|
|  | Frese MODBUS System 1 x MODBUS Converter 2 x Actuators (DN10-DN32) 2 x Temperature sensors | 58-8999 |

Accessory

| | Type | Frese no. |
|-------------------------------------------------------------------------------------|----------------------------------------------------------------------|-------------------------------------------------------------------|
|  | MODBUS Converter | 58-8955 |
|  | Temperature sensor with cable and M8 connector | 58-8954 |
|  | Actuator with cable and M8 connector For OPTIMA Compact DN10-DN32 | 58-8910 - with 1 m cable |
| | | 58-8911 - with 3 m cable |
|  | Actuator for OPTIMA Compact DN40-DN50 | 53-1296 |
| | Actuator for OPTIMA Compact DN50-DN125 | 53-1297 |
| | Actuator for OPTIMA Compact DN150-DN200 | 53-1298 |
|  | Halogen free cable with M8 connector and free wire, 5m | 58-8952 For connection of Frese actuators DN40-DN200 |
|  | Halogen free cable with M8 connectors, 5m | 58-8953 Extension cables for actuators and temperature sensors |
|  | OPTIMA Compact Pressure Independent Control Valve | OPTIMA Compact See Technote |

Specification Text

- The MODBUS System must be able to handle 2 terminal units with an analogue temperature sensor and a modulating actuator.
- The valve shall be supplied with 1" PT plugs.
- The pressure independent control valve shall be capable of closing against a maximum differential pressure of 600 kPa (6 bar) DN15-25 and 800 kPa (8 bar) DN25L- DN200 with a leakage rate at maximum 0.01% of the maximum rated volumetric flow and comply to EN1349 Class IV.
- The pressure independent control valve must be tested in accordance with the BSRIA document BTS.1 "Test Method for Pressure Independent Controls Valves" and manufacturer must be able to provide the test results upon request.

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