

Zehnder ComfoRoof MX Building Management System (BMS)

Manual

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1 Building Management System (BMS)



Refer to Modbus Organization for more information:

- MODBUS Application Protocol Specification V1.1.
- MODBUS Messaging on TCP/IP Implementation Guide V1.0b.

These documents are available at
<https://www.modbus.org/>



Abbreviations, Acronyms and Definitions used in de manual

CRMX	Zehnder ComfoRoof MX
BMS	Building Management System
Modbus	Data communication protocol
GND	Common (signal ground)

The BMS feature on the ComfoRoof MX is compliant with the Modbus TCP standard.

This document describes how to use this feature on the ComfoRoof MX.

1.1 OSI Model

The BMS feature used on the ComfoRoof MX is following the OSI model of Table 1.

Layer	OSI Model	
7	Application	Modbus Application Protocol
6	Presentation	Empty
5	Session	Empty
4	Transport	Empty
3	Network	Modbus TCP TCP/IP
2	Data Link	Ethernet
1	Physical	ISO 8802-3 Ethernet

Table 1 BMS OSI model

Communication speed

The maximum communication speed is 100MBit/s.

Cable

Length

The maximum length of the segment cable is 100 meter.

Type

Zehnder advises...

- Use Cat5 or better cabling.

1.2 Application Layer

Power-up

During the first minute the system is doing internal tests. After this time the BMS is activated.

Size of a read

A maximum of 125 Holding Registers can be read from the ComfoRoof MX in one command.

Response of a read (non existing or read protected memory)

When reading a non existing or read protected memory from the ComfoRoof MX the data returned is 0.

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1.3 Modbus Memory Map

Modbus Address	Description
0x0000	Soft reset
0x2206	Connection type: Wifi/LAN
0x2207	LAN mode: DHCP/Static
0x2208	LAN mode static: Static IP
0x220C	LAN mode static: Netmask
0x2210	LAN mode static: Gateway
0x2214	LAN mode static: DNS
0x23DB	WiFi Client SSID
0x23FB	WiFi Client Password
0x2870	Date and time
0x5006	Operating mode IG Wifi
0x5007	Set Point value for pressure control mode and modbus control mode
0x5008	2-Step Set Point Value Low
0x5009	2-Step Set Point Value High
0x5037	Pressure sensor adjustment
0x5116	P-Factor
0x5117	I-Factor
0x5122	Minimum fan speed
0x5123	Maximum fan speed
0x5601	Scheduled mode
0x5610	Time-segment configurations

Soft reset

Address: 0x0000

Writing 0xF310 to holding register 0x0000 will trigger a software reset. Device will reboot with local configuration and will be available again within few seconds. All connections will be interrupted during reboot process.

Connection type: Wifi/LAN

Address: 0x2206

This register is for setting the connection type to Wifi or LAN.

Modbus Address	Description
0x0000	Wifi
0x0001	LAN

LAN mode: DHCP/Static

Address: 0x2207

This register is for setting the LAN Static or DHCP mode.

Modbus Address	Description
0x0000	Static
0x0001	DHCP

LAN mode static: Static IP

Address: 0x2208 - 0x220B

These registers allow to change the static IP address. For example: 192.168.5.1

Address	Value (Hex)	Value (dec)	Description
0x2208	0x00C0	192	1st IP part
0x2209	0x00A8	168	2nd IP part
0x220A	0x0005	5	3rd IP part
0x220B	0x0001	1	4th IP part

LAN mode static: Netmask

Address: 0x220C - 0x220F

These registers allow to change the Netmask.

For example: 255.255.255.0

Address	Value (Hex)	Value (dec)	Description
0x2208	0x00FF	255	1st Netmask part
0x2209	0x00FF	255	2nd Netmask part
0x220A	0x00FF	255	3rd Netmask part
0x220B	0x0000	0	4th Netmask part

LAN mode static: Gateway

Address: 0x2210 - 0x2213

These registers allow to change the Gateway IP address. For example: 192.168.5.254

Address	Value (Hex)	Value (dec)	Description
0x2208	0x00C0	192	1st Gateway part
0x2209	0x00A8	168	2nd Gateway part
0x220A	0x0005	5	3rd Gateway part
0x220B	0x00FE	254	4th Gateway part

LAN mode static: DNS

Address: 0x2214 - 0x2217

These registers allow to change the DNS address. For example: 192.168.5.254

Address	Value (Hex)	Value (dec)	Description
0x2208	0x00C0	192	1st DNS part
0x2209	0x00A8	168	2nd DNS part
0x220A	0x0005	5	3rd DNS part
0x220B	0x00FE	254	4th DNS part

WiFi Client SSID

Address: 0x23DB - 0x23FA

These registers allow to change the WiFi Accesspoint SSID. Each register is one digit of the SSID.

0x23DB -> 1st digit of SSID

0x23DC -> 2nd digit of SSID

....

The digits are written in ASCII and use the LSB of each register.

The value 0x0000 marks the end of the SSID.

Example:

SSID: ZehnderMX

Address	Value (Hex)	Value (dec)	Description
0x23DB	0x005A	90	1st SSID Digit ASCII: Z
0x23DC	0x0065	101	2nd SSID Digit ASCII: e
0x23DD	0x0068	104	3rd SSID Digit ASCII: h
0x23DE	0x006E	110	4th SSID Digit ASCII: n
...
0x23E2	0x004D	77	8th SSID Digit ASCII: M
0x23E3	0x0058	88	9th SSID Digit ASCII: X
0x23E4	0x0000	0	End mark for SSID

WiFi Client Password

Address: 0x23FB - 0x241A

These registers allow to change the WiFi Accesspoint Password. Each register is one digit of the Password.

0x23FB -> 1st digit of Password

0x23FC -> 2nd digit of Password

....

The digits are written in ASCII and use the LSB of each register.

The value 0x0000 marks the end of the Password.

Example: Password: ZehnderMX012

Address	Value (Hex)	Value (dec)	Description
0x23FB	0x005A	90	1st Password Digit ASCII: Z
0x23FC	0x0065	101	2nd Password Digit ASCII: e
0x23FD	0x0068	104	3rd Password Digit ASCII: h
0x23FE	0x006E	110	4th Password Digit ASCII: n
...
0x2402	0x004D	77	8th Password Digit ASCII: M
0x2403	0x0058	88	9th Password Digit ASCII: X
0x2404	0x0030	48	10th Password Digit ASCII: 0
0x2405	0x0031	49	11th Password Digit ASCII: 1
0x2406	0x0032	50	12th Password Digit ASCII: 2
0x2407	0x0000	0	End mark for Password

Date and time

Address: 0x2870 - 0x2875

These registers allow to manually adjust internal date and time.

Year

Address: 0x2870

Possible values: 2019 to 2099

Month

Address: 0x2871

Possible values: 1 to 12 (1: January - 12: December)

Day of month

Address: 0x2872

Possible values: 1 to 31

Hours

Address: 0x2873

Possible values: 0 to 23

Minutes

Address: 0x2874

Possible values: 0 to 59

Seconds

Address: 0x2875

Possible values: 0 to 59

Operating mode IntelliGate Wifi

Address: 0x5006

Possible operating modes:

Value	Description
0x0001	OM1: Pressure control
0x0002	OM0: Manual control over 0-10V input
0x0003	OM3: Manual control over 2 Steps
0x0004	OM4: Manual control via scheduler
0x0005	OM2: Manual control over Modbus

Set Point Value

Address: 0x5007

Set Point for Operation Mode Pressure control and Manual control via Modbus.

Possible values: any unsigned 16-bit integer value.

i.e. for pressure control:

■ Register value 10 = 10Pa

■ Register value 123 = 123Pa

i.e. for manual Modbus control 0-100%:

■ Register value 0 = 0%

■ Register value 100 = 100%

2-Step Set Point Value Low

Address: 0x5008

Set Point for Operation Mode Manual control via 2-Steps when the High value (10V) is on the 0-10V input

Possible values: any unsigned 16-bit integer value.

i.e. for manual Modbus control 0-65535:

■ Register value 0 = 0%

■ Register value 100 = 100%

2-Step Set Point Value High

Address: 0x5009

Set Point for Operation Mode Pressure control via 2-Steps when the Low value (0V) is on the 0-10V input

Possible values: any unsigned 16-bit integer value.

i.e. for manual Modbus control 0-100:

■ Register value 0 = 0%

■ Register value 100 = 100%

Pressure sensor adjustment

Address: 0x5037

The output value of the pressure sensor can be changed to compensate for deviations in the output signal. The value set here is added to the value read from sensor. Register is in Pa units and with no decimal positions.

Possible values: any signed 16-bit integer value.

■ i.e.: Register value 10 = 10Pa

■ Register value -23 = -23Pa

P-Factor

Address: 0x5116

P-Factor determines the P share (share of absolute deviation) of the PI controller.

This means that values can be set for the P-factor between 0 and 100, in steps of 1.

I-Factor

Address: 0x5117

I-Factor determines the I share of the PI controller.

This means that values between 0 and 10 can thus be set for the I-factor in increments of 1.

Minimum and maximum fan speed

Address: 0x5122 - 0x5123

The two parameters “Minimum speed” (address 0x5122) and “Maximum speed” (address 0x5123) determine the function which assigns a duty cycle to the controller output.

Possible value range: 0 to 100.

With a controller output of 0%, the duty cycle quoted at output for “Minimum speed” is issued.

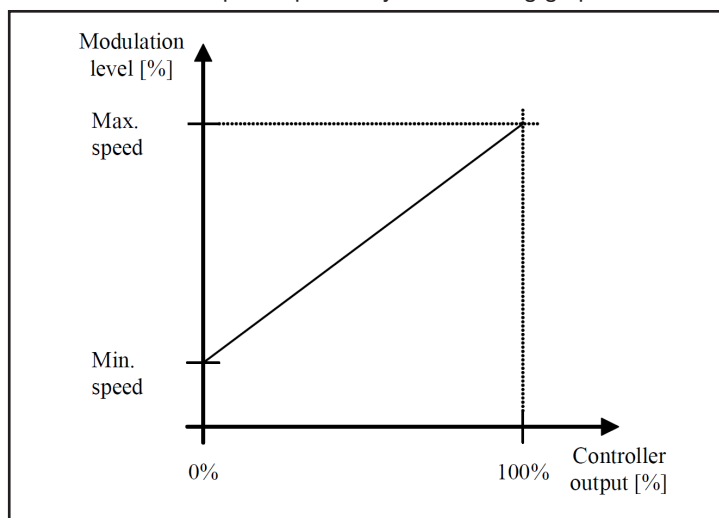
With a controller output of 100%, the duty cycle quoted at output for “Maximum speed” is issued.

Between these points, the response characteristics are linear, i.e the value range for the duty cycle.

A duty cycle of 0% corresponds to a voltage of 0V at output.

A duty cycle of 100% corresponds to a voltage of 10V at output.

This relationship is depicted by the following graphic:



With these parameters, it is possible to set a restriction on the duty cycle (minimum or maximum level).

Scheduled mode

Address: 0x5601

Scheduled or non-scheduled mode determines the origin of the setpoint used for the current control mode defined by operating mode 1.

Possible values:

Value	Description
0x0000	Non-scheduled mode
0x0001	Scheduled mode: setpoint is taken from corresponding time segment configuration.

If no valid time segment configuration is found, then non-scheduled mode will be used.

Time-segment configurations (scheduler)

There are 5 time-segment configurations per day available for every weekday.

The following table indicates the addresses depending on time-segment and weekday:

Address	Weekday	Time-segment
0x5610	Monday	1
0x5620		2
0x5630		3
0x5640		4
0x5650		5
0x5690	Tuesday	1
0x56A0		2
0x56B0		3
0x56C0		4
0x56D0		5
0x5710	Wednesday	1
0x5720		2
0x5730		3
0x5740		4
0x5750		5
0x5790	Thursday	1
0x57A0		2
0x57B0		3
0x57C0		4
0x57D0		5
0x5810	Friday	1
0x5820		2
0x5830		3
0x5840		4
0x5850		5
0x5890	Saturday	1
0x58A0		2
0x58B0		3
0x58C0		4
0x58D0		5
0x5910	Sunday	1
0x5920		2
0x5930		3
0x5940		4
0x5950		5

Every time-segment configuration has the same structure. Only Monday-1 time-segment is detailed.

Monday-1 time-segment configuration

Address: 0x5610 - 0x5613

Activation

Address: 0x5610

Time-segment can be enabled and disabled.

Possible values:

Value	Description
0x0000	OFF: Time-segment disabled.
0x0001	ON: Time-segment disabled.

Start time

Address: 0x5611

Start time is defined by hour and minutes:

0x5611 MSB: Hours: Possible values: 0 to 23

0x5611 LSB: Minutes: Possible values: 0 to 59

Setpoint

Address: 0x5613

Set Point for Operation Mode Pressure control and Manual control via Modbus.

Possible values: any unsigned 16-bit integer value.

i.e. for pressure control:

- Register value 10 = 10Pa
- Register value 123 = 123Pa

i.e. for manual Modbus control 0-100%:

- Register value 0 = 0%
- Register value 100 = 100%

End time

Address: 0x5616

Start time is defined by hour and minutes:

0x5611 MSB: Hours: Possible values: 0 to 23

0x5611 LSB: Minutes: Possible values: 0 to 59

Input registers

Overview

The following list provides an overview of all user-level input registers:

Modbus Address	Description
0x6001	Status
0x6002	Warning
0x6010	Actual fan speed
0x6013	0-10V input voltage
0x6021	Air pressure
0x6024	Fan temperature
0x6700	Firmware version
0x6736	Hardware variant
0x6737	Hardware version
0x673A	Fan serial number
0x673D	Fan type
0x6743	Production Date Fan
0x6744	Production Date IntelliGate Wifi
0x6745	IntelliGate Wifi serial number

Status

Address: 0x6001

The device status register indicates current devices errors.

Encoding:

MSB

0	0	0	UzLow	0	0	0	EMGCY
---	---	---	-------	---	---	---	-------

LSB

BLK	HLL	TFM	FB	SKF	TFE	FANCOMM	HWERR
-----	-----	-----	----	-----	-----	---------	-------

If a bit is set, the error described below has occurred:

UzLOW:	DC-link undervoltage
EMGCY:	Device entered "emergency mode" due to some critical error.
BLK:	Fan blocked
HLL:	Hall failure
TFM:	Motor overheated
FB :	Fan bad / general at every error
SKF:	Master/Slave error: between internal fan controllers
TFE:	Power module overheated
FANCOMM:	Fan communication failure.
HWERR:	Hardware error detected during power-on self-test.

Warning

Address: 0x6002

The device status register indicates current devices errors.

Encoding:

MSB

LRF	UeHigh	0	UzHigh	Heating	Cable break	n_Low	0
-----	--------	---	--------	---------	-------------	-------	---

LSB

Brake	UzLow	TEI_high	TM_high	TE_high	P_Limit	L_high	I_Limit
-------	-------	----------	---------	---------	---------	--------	---------

If a bit is set, the error described below has occurred:

LRF:	Shedding function active
UeHigh:	Supply voltage high
UzHigh:	DC-link voltage high
Heating:	Heating activated
Cable break:	cable break at set value analogue input
n_Low:	Actual speed is less than the speed limit set for speed monitoring
Brake:	Braking operation
UzLow:	DC-link voltage low
TEI_high:	Electronics temperature high
TM_high:	Motor temperature high
TE_high:	Power module temperature high
P_Limit:	Power limit reached
L_high:	Line impedance too high
I_Limit:	current limit reached

Actual fan speed

Address: 0x6010

Current value of the fan speed in rpm.

Possible values: any unsigned 16-bit integer value.

i.e.: Register value 1000 = 1000 rpm.

Actual 0-10V input value

Address: 0x6013

Current value of the 0-10V input on the fan.

Possible values: any unsigned 16-bit integer value.

i.e.: Register value 1000 = 1V

Register value 10000 = 10V

Air pressure

Address: 0x6021

Current value of the air pressure measured by the pressure sensor in Pa units and with no decimal positions.

Possible values: any signed 16-bit integer value.

i.e.: Register value 10 = 10Pa

Fan temperature

Address: 0x6024

Current value of the electronics temperature measured by an internal temperature sensor in °C units with 1 decimal position.

Possible values: any signed 16-bit integer value.

i.e.: Register value 275 = 27.5°C

Firmware version

Address: 0x6700 - 0x6702

Firmware version uses a 3-digit format numbering:

Address	Description
0x6700	Major version number
0x6701	Minor version number
0x6702	Micro version number

Hardware variant

Address: 0x6736

Device hardware variant.

Value	Variant
1	CRMX 210/310/320 Manual
2	CRMX 210/310/320 Automatic
3	CRMX 110 Manual
4	CRMX 110 Automatic

Hardware version

Address: 0x6737

Device hardware version.

Address	Description
0x6737	Major version number
0x6738	Minor version number.
0x6739	Micro version number.

Fan serial number

Address: 0x673A - 0x673B

These registers will be written with fan serial number, using ebmpapst's short format in fan register 0xD1A2 and 0xD1A3.

IG Wifi 0x673A = Fan 0xD1A2 = MSB 3rd digit of SN; LSB 4th digit of SN

IG Wifi 0x673B = Fan 0xD1A3 = MSB 1st digit of SN; LSB 2nd digit of SN

Serial Number (ASCII) = MSB Data byte and LSB Data byte

Example:

SN: 12GY

Address	Value (Hex)	Value MSB (Hex)	Value LSB (Hex)	Value MSB (dec)	Value MSB (dec)	Description
0x673A	0x4769	0x47	0x69	71	105	3rd and 4th SN Digit in ASCII: GY
0x673B	0x3132	0x31	0x32	49	50	1st and 2nd SN Digit in ASCII: 12

Fan type

Address: 0x673D - 0x6742

These registers will be written with fan type, directly copied from the fan register 0xD1A5-0xD1AA.

IG Wifi 0x673D = Fan 0xD1A5 = MSB 2nd digit of fan type; LSB 1st digit of fan type

IG Wifi 0x673E = Fan 0xD1A6 = MSB 4th digit of fan type; LSB 3rd digit of fan type

IG Wifi 0x6742 = Fan 0xD1AA = MSB 12th digit of fan type; LSB 11th digit of fan type

Fan type (ASCII) = MSB Data byte and LSB Data byte

The old fan type will have 12 digits and start with M3G...

The new fan type will have only 10 digits, beginning with 83....

Example:

Fan Type 8300100452

Address	Value (Hex)	Value MSB (Hex)	Value LSB (Hex)	Value MSB (dec)	Value MSB (dec)	Description
0x673D	0x3338	0x33	0x38	51	56	2nd and 1st fan type Digit in ASCII: 38
0x673E	0x3030	0x30	0x30	48	48	4th and 3rd fan type Digit in ASCII: 00
...
0x6741	0x3235	0x32	0x35	50	53	10th and 9th fan type Digit in ASCII: 25

Production Date Fan

Address: 0x6743

Production year and week is coded in hex. The MSB is the year, the LSB the week.

i.e.: Register value 0x160A

MSB 0x16 => Year 22

LSB 0x0A => Week 10

Production Date IntelliGate Wifi

Address: 0x6744

Production year and week is coded in hex. The MSB is the year, the LSB the week.

i.e.: Register value 0x160A

MSB 0x16 => Year 22

LSB 0x0A => Week 10

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