

Communication Manual (EN)

Firmware Version 3.2.18



Communication Manual

for the *BlueVary* gas sensor



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This communication manual describes the communication functions of the *BlueVary* gas sensor via Modbus TCP, Modbus RTU and RS232.

For detailed information (in particular safety, operating, maintenance and disposal instructions), please refer to the current version of the *BlueVary* gas sensor operating manual.

Only for Modbus TCP communication different user levels are implemented, for Modbus RTU and RS232 no user levels are implemented to keep compatibility for older programs that were programmed for BlueInOnes.

1. Modbus General communication information



Note

The **BlueVary** sorts the installed cartridges corresponding to the measured gases.

If a CO₂ cartridge is installed it will always appear as first cartridge (first channel) independent of where it is placed.

If an O₂ cartridge is installed it will always appear as second cartridge (second channel) independent of where it is placed.

So always make sure to identify which cartridge is corresponding to which channel and thereby which registers.

Standard delivery settings are **bold**.

Standard delivery Modbus-ID is **1**.

All addresses in this communication manual are specified in decimal and hexadecimal values (dec/hex).

Floating values are specified as 32-bit float (IEEE754). The byte order is CDAB (little-endian byte swap).

1.1. Data transmission parameters for Modbus TCP

The communication parameters network address, subnet mask and gateway have to be set up in the menu of the **BlueVary**, please read the manual for further information.

The Modbus-ID has to be the same as set up in the menu of the **BlueVary**.

The used TCP-port is 502.

The **BlueVary** supports the following commands for Modbus TCP:

3	Read holding registers
4	Read input registers
6	Write single registers
16	Write multiple registers

1.2. Data transmission parameters for Modbus RTU

The following parameters must be set for serial data transmission:

Baud rate:	9600/19200/ 38400
Data-bits:	8
Parity bits:	None (optional even) → Address 0x74
Stop bits:	2 (1 if even parity is selected)

The **BlueVary** supports the following commands for Modbus RTU:

3	Read holding registers
6	Write single registers
16	Write multiple registers
17	Report slave ID

This mode normally is switched off to save Modbus addresses, it can be switched on via Modbus or RS232.

For compatibility with older PLC which request holding registers to be above 40001, the **BlueVary** also responds on requests for actual register address + 40001.

1.3. Modbus extended mode

This is a special mode for older Infors® reactors systems.

In this extended Modbus mode the sensor requires 7 Modbus addresses:

The first address is for normal Modbus operation.

On the next 6 Modbus addresses, the sensor responds only on requests for one float-value at Holding Register 0.

The responded values are:

Address +1: actual value channel 1

Address +2: actual value channel 2

Address +3: actual absolute humidity

Address +4: actual relative humidity

Address +5: actual pressure

Address +6: actual temperature

2. Modbus Writeable registers

2.1. Users and rights

To have access to the writing options of the writeable registers via Modbus TCP, first the user level has to be changed from “Normal user” to either “Calibration user”, “Installation user” or “Admin” depending on which register has to be manipulated.

To be able to calibrate the sensor (1-point or 2-point calibration) either the “Calibration user” or the “Admin” has to be locked in.

This can either be done

- by using the menu of the **BlueVary** or
- by manipulation the registers 121/0x0079 (User level) and 120/0x0078 (Password)



Note

Changing the user level over Modbus TCP will always result in the same change of the user level in the menu of the **BlueVary**.

To avoid problems with unauthorised input in the menu of the **BlueVary** always set the user level back to “Normal user” after calibration or setting up communication attributes.

To change the user level of the **BlueVary** via Modbus TCP

1. write the user level to register 121/0x0079
2. write the corresponding password to register 120/0x0078

2.1.1. User level register

Modbustype	TCP	RTU
Register address:	121/0x0079	
Modbus commands	3 Read holding registers 6 Write single registers 16 Write multiple registers	
Necessary user level for write option:	User	
Default value:		
Size:	1 Register (2 Byte)	
Data type:	Unsigned Integer	
Description:	User level as Unsigned Integer: "Normal user" = 0 "Calibration user" = 1 "Installation user" = 2 "Admin" = 3	

2.1.2. Password register

Modbustype	TCP	RTU
Register address:	120/0x0078	
Modbus commands	3 Read holding registers 6 Write single registers 16 Write multiple registers	
Necessary user level for write option:	User	
Default value:		
Size:	1 Register (2 Byte)	
Data type:	Unsigned Integer	
Description:	See manual of the BlueVary for the passwords of the different users. For safety reasons a read request will always reply 0.	

2.2. Sensor calibration



Note

Before starting a 1-point or a 2-point calibration for the cartridges of the **BlueVary** some general considerations have to be taken into account:

1. Read the manual of the **BlueVary** to understand how to use 1-point and 2-point calibration.
2. Make sure that the gases used for the calibration have the right concentration for the installed cartridges and an excellent accuracy ($\leq 1\%$ of value).
3. Make sure that the gas has flushed long enough (at least 30 min.) through the flow adaptor.
4. Perform a good 1-point calibration before trying a 2-point calibration
5. Change the user level to "Calibration user" or "Admin".

The 1-point calibration can be performed for either one cartridge solely or for both gas cartridges together.

For 1-point calibration

- of the 1st cartridge a 1/0x0001 has to be written into the 1-point execution register (112/0x0070)

- of the 2nd cartridge a 2/0x0002 has to be written into the 1-point execution register (112/0x0070) and
- of both cartridges at once a 3/0x0003 or 65535/0xffff has to be written into the 1-point execution register (112/0x0070).

The 2-point calibration can be performed for either one cartridge solely or for both gas cartridges together.

For 2-point calibration two different registers have to be written for each cartridge in the correct order:

1. Write the 2-point concentration register
Write the concentration value of the calibration gas into the cartridge specific 2-point concentration register (0/0x0000) for 1st cartridge, (16/0x0010) for 2nd cartridge.
2. Write the 2-point execution register
Write the value 65535/0xffff into the cartridge specific 2-point execution register (64/0x0040) for 1st cartridge, (80/0x0050) for 2nd cartridge.

After calibration make sure to set the user level back to "Normal user" again.

2.2.1. 1-point execution register

Modbustype	TCP	RTU
Register address:	112/0x0070	112/0x0070
Modbus commands	3 Read holding registers 6 Write single registers 16 Write multiple registers	3 Read holding registers 6 Write single registers 16 Write multiple registers
Necessary user level for write option:	Calibration user Admin	./.
Default value:		
Size:	1 Register (2 Byte)	
Data type:	Unsigned Integer	
Description:	1-point calibration is executed on both channels if 3/0x0003 or 65535/0xffff is written here. Just for channel 1 if 1/0x0001 is written, just for channel 2 if 2/0x0002 is written. Will immediately set back to 0/0x0000	

2.2.2. 2-point concentration register first channel

Modbustype	TCP	RTU
Register address:	0/0x0000	0/0x0000
Modbus commands	3 Read holding registers 16 Write multiple registers	3 Read holding registers 16 Write multiple registers
Necessary user level for write option:	Calibration user Admin	./.
Default value:	-3,40E+47	
Size:	2 register (4 Byte)	
Data type:	32bit float (IEEE754)	
Description:	Nominal value of calibration gas concentration in vol.-% for 2-point calibration of the first sensor channel (calibration is executed via address 64/0x40). If a negative value is written, all earlier 2-point calibrations are undone.	

2.2.3. 2-point concentration register second channel

Modbustype	TCP	RTU
Register address:	16/0x0010	16/0x0010
Modbus commands	3 Read holding registers 16 Write multiple registers	3 Read holding registers 16 Write multiple registers
Necessary user level for write option:	Calibration user Admin	./.
Default value:	-3,40E+47	
Size:	2 register (4 Byte)	
Data type:	32bit float (IEEE754)	
Description:	Nominal value of calibration gas concentration in vol.-% for 2-point calibration of the second sensor channel (calibration is executed via address 80/0x50). If a negative value is written, all earlier 2-point calibrations are undone.	

2.2.4. 2-point execution register first channel

Modbustype	TCP	RTU
Register address:	64/0x0040	64/0x0040
Modbus commands	3 Read holding registers 6 Write single registers 16 Write multiple registers	3 Read holding registers 6 Write single registers 16 Write multiple registers
Necessary user level for write option:	Calibration user Admin	./.
Default value:		
Size:	1 Register (2 Byte)	
Data type:	Unsigned Integer	
Description:	2-point calibration on first channel is executed if 65535/0xffff is written here, will immediately set back to 0/0x0000.	

2.2.5. 2-point execution register second channel

Modbustype	TCP	RTU
Register address:	80/0x0050	80/0x0050
Modbus commands	3 Read holding registers 6 Write single registers 16 Write multiple registers	3 Read holding registers 6 Write single registers 16 Write multiple registers
Necessary user level for write option:	Calibration user Admin	./.
Default value:		
Size:	1 Register (2 Byte)	
Data type:	Unsigned Integer	
Description:	2-point calibration on second channel is executed if 65535/0xffff is written here, will immediately set back to 0/0x0000	

2.3. Communication setup

Some communication parameters of the **BlueVary** can be set up over special Modbus registers. Be aware, that changing the communication parameters can result in a reset of the **BlueVary** to ensure correct communication afterwards.

For the RS232 interface of the **BlueVary** the baud rate can be set to 9600, 19200 or 38400 baud.

For the RS485 (Modbus RTU) interface of the **BlueVary** three parameters can be set:

- The baud rate can be set to 9600, 19200 or 38400 baud.
- The parity can be set to none (with 2 stop bits) or even (with 1 stop bit).
- Modbus extended can be enabled. This is a special communication mode for some Infors bioreactors as these bioreactors are not able to read more than one register on each Modbus address.

In addition, the Modbus ID (for RTU and TCP) can be set in the Range of 1 – 243.

2.3.1. RS232 baud rate register

Modbus type	TCP	RTU
Register address:	114/0x0072	114/0x0072
Modbus commands	3 Read holding registers 6 Write single registers 16 Write multiple registers	3 Read holding registers 6 Write single registers 16 Write multiple registers
Necessary user level for write option:	Installation user Admin	./.
Default value:	19200 (baud rate is set to 19200)	
Size:	1 Register (2 Byte)	
Data type:	Unsigned Integer	
Description:	Possible values are 9600, 19200 and 38400.	

2.3.2. RS485 (Modbus RTU) baud rate register

Modbustype	TCP	RTU
Register address:	115/0x0073	115/0x0073
Modbus commands	3 Read holding registers 6 Write single registers 16 Write multiple registers	3 Read holding registers 6 Write single registers 16 Write multiple registers
Necessary user level for write option:	Installation user Admin	./.
Default value:	38400 (baud rate is set to 38400)	
Size:	1 Register (2 Byte)	
Data type:	Unsigned Integer	
Description:	Possible values are 9600, 19200 and 38400.	

2.3.3. RS485 (Modbus RTU) parity register

Modbustype	TCP	RTU
Register address:	116/0x0074	116/0x0074
Modbus commands	3 Read holding registers 6 Write single registers 16 Write multiple registers	3 Read holding registers 6 Write single registers 16 Write multiple registers
Necessary user level for write option:	Installation user Admin	./.
Default value:	0 - no Parity with 2 stop bits	
Size:	1 Register (2 Byte)	
Data type:	Unsigned Integer	
Description:	Possible values are 0 = no Parity (with 2 stop bits) or 1 = even Parity (with 1 stop bit).	

2.3.4. RS485 (Modbus RTU) extended mode register

Modbustype	TCP	RTU
Register address:	130/0x0082	130/0x0082
Modbus commands	3 Read holding registers 6 Write single registers 16 Write multiple registers	3 Read holding registers 6 Write single registers 16 Write multiple registers
Necessary user level for write option:	Installation user Admin	./.
Default value:	0 - no Extended Mode	
Size:	1 Register (2 Byte)	
Data type:	Unsigned Integer	
Description:	If set to 1, the extended Modbus mode is enabled. For additional information see chapter 1.3.	

2.3.5. Modbus ID

Modbustype	TCP	RTU
Register address:	118/0x0076	118/0x0076
Modbus commands	3 Read holding registers 6 Write single registers 16 Write multiple registers	3 Read holding registers 6 Write single registers 16 Write multiple registers
Necessary user level for write option:	Installation user Admin	./.
Default value:		
Size:	1 Register (2 Byte)	
Data type:	Unsigned Integer	
Description:	Possible addresses are 1 - 243.	

2.4. Reset

The **BlueVary** can be reset over the Modbus TCP port.

To execute a reset 65535/0xffff has to be written to the Reset execution register (119/0x0077).

2.4.1. Reset execution register

Modbustype	TCP	RTU
Register address:	119/0x0077	119/0x0077
Modbus commands	3 Read holding registers 6 Write single registers 16 Write multiple registers	3 Read holding registers 6 Write single registers 16 Write multiple registers
Necessary user level for write option:	Calibration User InstallationUser Admin	./.
Default value:		
Size:	1 Register (2 Byte)	
Data type:	Unsigned Integer	
Description:	A reset is executed when 65535/0xffff is written here	

3. Modbus Read only registers

3.1. Central Unit (CU)

3.1.1. CU ID register

Modbustype	TCP	RTU
Register address:	4512/0x11a0	4512/0x11a0
Modbus commands	4 Read input registers	3 Read holding registers
Necessary user level for write option:	Normal user	./.
Default value:		
Size:	1 Register (2 Byte)	
Data type:	Unsigned Integer	
Description:	Production ID of the BlueVary central unit	

3.1.2. CU Serial number register

Modbustype	TCP	RTU
Register address:	4513/0x11a1	4513/0x11a1
Modbus commands	4 Read input registers	3 Read holding registers
Necessary user level for write option:	Normal user	./.
Default value:		
Size:	8 Register (16 Byte)	
Data type:	16 ASCII-chars	
Description:	Serial number of the BlueVary central unit.	

3.1.3. CU Status register

Modbustype	TCP	RTU
Register address:	4521/0x11a9	4521/0x11a9
Modbus commands	4 Read input registers	3 Read holding registers
Necessary user level for write option:	Normal user	/.
Default value:		
Size:	1 Register (2 Byte)	
Data type:	Integer	
Description:	bit coded status information	
Value	Meaning	
0x0001	Working	
0x0002	Cartridge with less than 1 month lifetime connected	
0x0004	1-point calibration in progress	
0x0008	1-point calibration requested	

0x0010	Error during 1-point calibration
0x0020	Heating up
0x0040	System error
0x0080	At least 1 incompatible cartridge in use

3.1.4. CU Operation hours register

Modbustype	TCP	RTU
Register address:	4522/0x11aa	4522/0x11aa
Modbus commands	4 Read input registers	3 Read holding registers
Necessary user level for write option:	Normal user	./.
Default value:		
Size:	1 Register (2 Byte)	
Data type:	16 Bit Integer	
Description:	Number of actual operation hours.	

3.1.5. CU Sensor name register

Modbustype	TCP	RTU
Register address:	4560/0x11d0	4560/0x11d0
Modbus commands	4 Read input registers	3 Read holding registers
Necessary user level for write option:	Normal user	./.
Default value:		
Size:	8 Register (16 Byte)	
Data type:	16 ASCII-chars	
Description:	Sensor name of the BlueVary	

3.1.6. CU Firmware register

Modbustype	TCP	RTU
Register address:	4576/0x11e0	4576/0x11e0
Modbus commands	4 Read input registers	3 Read holding registers
Necessary user level for write option:	Normal user	/.
Default value:		
Size:	4 Register (8 Byte)	
Data type:	8 ASCII-chars	
Description:	Shows the installed firmware version of the central unit.	

3.2. Channel 1 (C1)

3.2.1. C1 Concentration register

Modbustype	TCP	RTU
Register address:	4096/0x1000	4096/0x1000
Modbus commands	4 Read input registers	3 Read holding registers
Necessary user level for write option:	Normal user	./.
Default value:		
Size:	2 Register (4 Byte)	
Data type:	32bit float (IEEE754)	
Description:	Measured concentration in vol.-%, first channel.	

3.2.2. C1 1-point concentration register

Modbustype	TCP	RTU
Register address:	4106/0x100a	4106/0x100a
Modbus commands	4 Read input registers	3 Read holding registers
Necessary user level for write option:	Normal user	./.
Default value:		
Size:	2 Register (4 Byte)	
Data type:	32bit float (IEEE754)	
Description:	Value of gas concentration in vol.-% for the 1-point calibration, first channel.	

3.2.3. C1 1-point calibration factor register

Modbustype	TCP	RTU
Register address:	4108/0x100c	4108/0x100c
Modbus commands	4 Read input registers	3 Read holding registers
Necessary user level for write option:	Normal user	./.
Default value:		
Size:	2 Register (4 Byte)	
Data type:	32bit float (IEEE754)	
Description:	Value of the calculated 1-point calibration factor, first channel.	

3.2.4. C1 2-point calibration factor register

Modbustype	TCP	RTU
Register address:	4110/0x100e	4110/0x100e
Modbus commands	4 Read input registers	3 Read holding registers
Necessary user level for write option:	Normal user	./.
Default value:		
Size:	2 Register (4 Byte)	
Data type:	32bit float (IEEE754)	
Description:	Value of the calculated 2-point calibration factor, first channel.	

3.2.5. C1 time of last 1-point calibration register

Modbustype	TCP	RTU
Register address:	4224/0x1080	4224/0x1080
Modbus commands	4 Read input registers	3 Read holding registers
Necessary user level for write option:	Normal user	./.
Default value:		
Size:	1 Register (2 Byte)	
Data type:	16 bit Integer	
Description:	Operation hour counter at the last 1-point calibration, first channel.	

3.2.6. C1 number of 1-point calibrations register

Modbustype	TCP	RTU
Register address:	4225/0x1081	4225/0x1081
Modbus commands	4 Read input registers	3 Read holding registers
Necessary user level for write option:	Normal user	./.
Default value:		
Size:	1 Register (2 Byte)	
Data type:	16 bit Integer	
Description:	Number of 1-point calibrations, first cartridge.	

3.2.7. C1 time of last 2-point calibration register

Modbustype	TCP	RTU
Register address:	4226/0x1082	4226/0x1082
Modbus commands	4 Read input registers	3 Read holding registers
Necessary user level for write option:	Normal user	./.
Default value:		
Size:	1 Register (2 Byte)	
Data type:	16 bit Integer	
Description:	Operation hour counter at the last 2-point calibration, first channel.	

3.2.8. C1 number of 2-point calibrations register

Modbustype	TCP	RTU
Register address:	4227/0x1083	4227/0x1083
Modbus commands	4 Read input registers	3 Read holding registers
Necessary user level for write option:	Normal user	./.
Default value:		
Size:	1 Register (2 Byte)	
Data type:	16 bit Integer	
Description:	Number of 2-point calibrations, first channel.	

3.2.9. C1 Id register

Modbustype	TCP	RTU
Register address:	4228/0x1084	4228/0x1084
Modbus commands	4 Read input registers	3 Read holding registers
Necessary user level for write option:	Normal user	./.
Default value:		
Size:	2 Register (4 Byte)	
Data type:	32 bit Integer	
Description:	ID number of the cartridge, first channel.	

3.2.10. C1 number of operating hours register

Modbustype	TCP	RTU
Register address:	4234/0x108a	4234/0x108a
Modbus commands	4 Read input registers	3 Read holding registers
Necessary user level for write option:	Normal user	./.
Default value:		
Size:	1 Register (2 Byte)	
Data type:	16 bit Integer	
Description:	Number of operating hours of the cartridge, first channel.	

3.2.11. C1 number of operating hours left register

Modbustype	TCP	RTU
Register address:	4235/0x108b	4235/0x108b
Modbus commands	4 Read input registers	3 Read holding registers
Necessary user level for write option:	Normal user	./.
Default value:		
Size:	1 Register (2 Byte)	
Data type:	16 bit Integer	
Description:	Number of operating hours left for the cartridge, first channel.	

3.2.12. C1 time of admin overrule register

Modbustype	TCP	RTU
Register address:	4236/0x108c	4236/0x108c
Modbus commands	4 Read input registers	3 Read holding registers
Necessary user level for write option:	Normal user	./.
Default value:		
Size:	1 Register (2 Byte)	
Data type:	16 bit Integer	
Description:	Operating hour counter at admin overrule of the warning at startup for the cartridge, first channel.	

3.2.13. C1 gas name register

Modbustype	TCP	RTU
Register address:	4240/0x1090	4240/0x1090
Modbus commands	4 Read input registers	3 Read holding registers
Necessary user level for write option:	Normal user	./.
Default value:		
Size:	3 Register (6 Byte)	
Data type:	6 ASCII-chars	
Description:	Name of the gas, first channel	

3.2.14. C1 calibrator register

Modbustype	TCP	RTU
Register address:	4272/0x10b0	4272/0x10b0
Modbus commands	4 Read input registers	3 Read holding registers
Necessary user level for write option:	Normal user	./.
Default value:		
Size:	3 Register (6 Byte)	
Data type:	6 ASCII-chars	
Description:	Initials of factory calibrator, first channel	

3.3. Channel 2 (C2)

3.3.1. C2 Concentration register

Modbustype	TCP	RTU
Register address:	4128/0x1020	4128/0x1020
Modbus commands	4 Read input registers	3 Read holding registers
Necessary user level for write option:	Normal user	./.
Default value:		
Size:	2 Register (4 Byte)	
Data type:	32bit float (IEEE754)	
Description:	Measured concentration in vol.-%, second channel.	

3.3.2. C2 1-point concentration register

Modbustype	TCP	RTU
Register address:	4138/0x102a	4138/0x102a
Modbus commands	4 Read input registers	3 Read holding registers
Necessary user level for write option:	Normal user	./.
Default value:		
Size:	2 Register (4 Byte)	
Data type:	32bit float (IEEE754)	
Description:	Value of gas concentration in vol.-% for the 1-point calibration, second channel.	

3.3.3. C2 1-point calibration factor register

Modbustype	TCP	RTU
Register address:	4140/0x102c	4140/0x102c
Modbus commands	4 Read input registers	3 Read holding registers
Necessary user level for write option:	Normal user	./.
Default value:		
Size:	2 Register (4 Byte)	
Data type:	32bit float (IEEE754)	
Description:	Value of the calculated 1-point calibration factor, second channel.	

3.3.4. C2 2-point calibration factor register

Modbustype	TCP	RTU
Register address:	4142/0x102e	4142/0x102e
Modbus commands	4 Read input registers	3 Read holding registers
Necessary user level for write option:	Normal user	./.
Default value:		
Size:	2 Register (4 Byte)	
Data type:	32bit float (IEEE754)	
Description:	Value of the calculated 2-point calibration factor, second channel.	

3.3.5. C2 time of last 1-point calibration register

Modbustype	TCP	RTU
Register address:	4320/0x10e0	4320/0x10e0
Modbus commands	4 Read input registers	3 Read holding registers
Necessary user level for write option:	Normal user	./.
Default value:		
Size:	1 Register (2 Byte)	
Data type:	16 bit Integer	
Description:	Operation hour counter at the last 1-point calibration, second channel.	

3.3.6. C2 number of 1-point calibrations register

Modbustype	TCP	RTU
Register address:	4321/0x10e1	4321/0x10e1
Modbus commands	4 Read input registers	3 Read holding registers
Necessary user level for write option:	Normal user	./.
Default value:		
Size:	1 Register (2 Byte)	
Data type:	16 bit Integer	
Description:	Number of 1-point calibrations, second cartridge.	

3.3.7. C2 time of last 2-point calibration register

Modbustype	TCP	RTU
Register address:	4322/0x10e2	4322/0x10e2
Modbus commands	4 Read input registers	3 Read holding registers
Necessary user level for write option:	Normal user	./.
Default value:		
Size:	1 Register (2 Byte)	
Data type:	16 bit Integer	
Description:	Operation hour counter at the last 2-point calibration, second channel.	

3.3.8. C2 number of 2-point calibrations register

Modbustype	TCP	RTU
Register address:	4323/0x10e3	4323/0x10e3
Modbus commands	4 Read input registers	3 Read holding registers
Necessary user level for write option:	Normal user	./.
Default value:		
Size:	1 Register (2 Byte)	
Data type:	16 bit Integer	
Description:	Number of 2-point calibrations, second channel	

3.3.9. C2 ID register

Modbustype	TCP	RTU
Register address:	4324/0x10e4	4324/0x10e4
Modbus commands	4 Read input registers	3 Read holding registers
Necessary user level for write option:	Normal user	./.
Default value:		
Size:	2 Register (4 Byte)	
Data type:	32 bit Integer	
Description:	ID number of the cartridge, second channel.	

3.3.10. C2 number of operating hours register

Modbustype	TCP	RTU
Register address:	4330/0x10ea	4330/0x10ea
Modbus commands	4 Read input registers	3 Read holding registers
Necessary user level for write option:	Normal user	./.
Default value:		
Size:	1 Register (2 Byte)	
Data type:	16 bit Integer	
Description:	Number of operating hours of the cartridge, second channel	

3.3.11. C2 number of operating hours left register

Modbustype	TCP	RTU
Register address:	4331/0x10eb	4331/0x10eb
Modbus commands	4 Read input registers	3 Read holding registers
Necessary user level for write option:	Normal user	./.
Default value:		
Size:	1 Register (2 Byte)	
Data type:	16 bit Integer	
Description:	Number of operating hours left for the cartridge, second channel.	

3.3.12. C2 time of admin overrule register

Modbustype	TCP	RTU
Register address:	4332/0x10ec	4332/0x10ec
Modbus commands	4 Read input registers	3 Read holding registers
Necessary user level for write option:	Normal user	./.
Default value:		
Size:	1 Register (2 Byte)	
Data type:	16 bit Integer	
Description:	Operating hour counter at admin overrule of the warning at startup for the cartridge, second channel.	

3.3.13. C2 gas name register

Modbustype	TCP	RTU
Register address:	4336/0x10f0	4336/0x10f0
Modbus commands	4 Read input registers	3 Read holding registers
Necessary user level for write option:	Normal user	./.
Default value:		
Size:	3 Register (6 Byte)	
Data type:	6 ASCII-chars	
Description:	Name of the gas, second channel	

3.3.14. C2 calibrator register

Modbustype	TCP	RTU
Register address:	4368/0x1110	4368/0x1110
Modbus commands	4 Read input registers	3 Read holding registers
Necessary user level for write option:	Normal user	./.
Default value:		
Size:	3 Register (6 Byte)	
Data type:	6 ASCII-chars	
Description:	Initials of factory calibrator, second channel	

3.4. Humidity/Pressure (H/P)

3.4.1. H/P pressure register

Modbustype	TCP	RTU
Register address:	4192/0x1060	4192/0x1060
Modbus commands	4 Read input registers	3 Read holding registers
Necessary user level for write option:	Normal user	./.
Default value:		
Size:	2 Register (4 Byte)	
Data type:	32bit float (IEEE754)	
Description:	Measured pressure in bar_{abs} , humidity/pressure cartridge.	

3.4.2. H/P relative humidity register

Modbustype	TCP	RTU
Register address:	4194/0x1062	4194/0x1062
Modbus commands	4 Read input registers	3 Read holding registers
Necessary user level for write option:	Normal user	./.
Default value:		
Size:	2 Register (4 Byte)	
Data type:	32bit float (IEEE754)	
Description:	Value of the relative humidity in %, humidity/pressure cartridge.	

3.4.3. H/P absolute humidity register

Modbustype	TCP	RTU
Register address:	4196/0x1064	4196/0x1064
Modbus commands	4 Read input registers	3 Read holding registers
Necessary user level for write option:	Normal user	./.
Default value:		
Size:	2 Register (4 Byte)	
Data type:	32bit float (IEEE754)	
Description:	Value of the absolute humidity in vol.%, humidity/pressure cartridge.	

3.4.4. H/P gas temperature register

Modbustype	TCP	RTU
Register address:	4198/0x1066	4198/0x1066
Modbus commands	4 Read input registers	3 Read holding registers
Necessary user level for write option:	Normal user	./.
Default value:		
Size:	2 Register (4 Byte)	
Data type:	32bit float (IEEE754)	
Description:	Value of the gas temperature in °C inside the humidity/pressure cartridge.	

3.4.5. H/P ID register

Modbustype	TCP	RTU
Register address:	4420/0x1144	4420/0x1144
Modbus commands	4 Read input registers	3 Read holding registers
Necessary user level for write option:	Normal user	./.
Default value:		
Size:	2 Register (4 Byte)	
Data type:	32 bit Integer	
Description:	ID number of the humidity/pressure cartridge.	

3.4.6. H/P number of operating hours register

Modbustype	TCP	RTU
Register address:	4426/0x114a	4426/0x114a
Modbus commands	4 Read input registers	3 Read holding registers
Necessary user level for write option:	Normal user	./.
Default value:		
Size:	1 Register (2 Byte)	
Data type:	16 bit Integer	
Description:	Number of operating hours of the humidity/pressure cartridge.	

3.4.7. H/P number of operating hours left register

Modbustype	TCP	RTU
Register address:	4427/0x114b	4427/0x114b
Modbus commands	4 Read input registers	3 Read holding registers
Necessary user level for write option:	Normal user	./.
Default value:		
Size:	1 Register (2 Byte)	
Data type:	16 bit Integer	
Description:	Number of operating hours left for the humidity/pressure cartridge	

3.4.8. H/P time of admin overrule register

Modbustype	TCP	RTU
Register address:	4428/0x114c	4428/0x114c
Modbus commands	4 Read input registers	3 Read holding registers
Necessary user level for write option:	Normal user	./.
Default value:		
Size:	1 Register (2 Byte)	
Data type:	16 bit Integer	
Description:	Operating hour counter at admin overrule of the warning at startup for the humidity/pressure cartridge.	

3.4.9. H/P gas name register

Modbustype	TCP	RTU
Register address:	4432/0x1150	4432/0x1150
Modbus commands	4 Read input registers	3 Read holding registers
Necessary user level for write option:	Normal user	./.
Default value:		
Size:	3 Register (6 Byte)	
Data type:	6 ASCII-chars	
Description:	Name of the gas (HUM or PRES), humidity/pressure cartridge	

3.4.10. H/P calibrator register

Modbustype	TCP	RTU
Register address:	4464/0x1170	4464/0x1170
Modbus commands	4 Read input registers	3 Read holding registers
Necessary user level for write option:	Normal user	./.
Default value:		
Size:	3 Register (6 Byte)	
Data type:	6 ASCII-chars	
Description:	Initials of factory calibrator, humidity/pressure cartridge	

4. RS232 Glossary

4.1. General

All commands to the **BlueVary** are beginning with the “&” char and every input (command or data) ends with the return char (#13). The probe normally does not echo the commands but does so for the data after demanding them.

The commands are not sensitive to upper/lower case charts.

For commands, requiring data, the probe returns “>>” after the return char has been send. The now entered data is echoed. After finishing the input with the return char the probe will send the (rounded) data added by a symbol and the checksum. If no data has been send, it will respond the stored data.

For most commands the return of the **BlueVary** will be as this:

Data from **BlueVary** followed by a space char, a “:”, the command char in upper case, a “,” and a checksum.

As an example for the “&i” command the response will be like this:

```
18 C02_29735 O2_29547 HUM_32739 :I,D5
```

Here the Information consists of the id of the centrum (18) followed by the gas and id of the first channel, second channel and third channel. All channels and the centrum-id are separated by a space char

4.2. Checksum calculation

For calculation of the checksum all transmitted bytes in front of the “,” will be added together. The least significant byte of the sum is transmitted as two ASCII characters in hex code.

For commands where an input has to be made (e.g. “&X”) 0x17 has to be added to the sum for the leading return and line feed chars (0x0D, 0x0A).

5. RS232 Fundamental commands

5.1. Sensor calibration



Note

Before starting a 1-point or a 2-point calibration for the cartridges of the **BlueVary** some general considerations have to be taken into account:

1. Read the manual of the **BlueVary** to understand how to use 1-point and 2-point calibration.
2. Make sure that the gases used for the calibration have the right concentration for the installed cartridges and an excellent accuracy ($\leq 1\%$ of value).
3. Make sure that the gas has flushed long enough (at least 30 min.) through the flow adaptor.
4. Perform a good 1-point calibration before trying a 2-point calibration

Over the RS232 commands the 1-point calibration can only be performed for all channels at once.

The 2-point calibration can be performed for each cartridge solely.

After entering the concentration in Vol.% the probe will response its nearest possible output after calibration.

Use “.” as a decimal separator.

If the cartridge cannot perform a proper 2-point calibration – for example if given gas concentration is too far from the measured concentration – the 2-point value will be reset to 1 and no 2-point correction will be performed.

5.1.1. 1-point execution via RS232

Command	&k
Response	Ok

5.1.2. 2-point calibration for the first channel via RS232

Command	&1
Response	>>
Input	For CO2 or CH4 or H2 the concentration should be in the range of 80 - 100% of the measuring range or at the concentration of most interest.
Response	The Input will be echoed. Then the used concentration for 2-point calibration will be returned
Example	>> 20 20.000000 :1,52

5.1.3. 2-point calibration for the second channel via RS232

Command	&2
Response	>>
Input	For O2 the concentration should be between at least 1 vol.% O2 and (if higher) the lowest concentration to be measured or for the BlueInOne cell 90 - 100% O2.
Response	The Input will be echoed. Then the used concentration for 2-point calibration will be returned.
Example	>> 100 100.000000 :2,82

5.2. Communication setup via RS232

Some communication parameters of the **BlueVary** can be set up over RS232. Be aware, that changing the communication parameters can result in a reset of the **BlueVary** to ensure correct communication afterwards.

For the RS232 interface of the **BlueVary** the baud rate can be set to 9600, **19200** or 38400 baud.

For the RS485 (Modbus RTU) interface of the **BlueVary** three parameters can be set:

- The baud rate can be set to 9600, 19200 or **38400** baud.
- The parity can be set to none (with 2 stop bits) or even (with 1 stop bit).
- Modbus extended can be enabled. This is a special communication mode for some Infors bioreactors as these bioreactors are not able to read more than one register on each Modbus address.

In addition, the Modbus ID (for RTU and TCP) can be set in the Range of **1 - 243**.

5.2.1. RS232 baud rate via RS232

Command	&a
Response	>>
Input	Either 9600, 19200 or 38400.
Response	The Input will be echoed. Then RS232 baud rate will be responded, if changed BlueVary will reset and the reset message will be sent.
Example	>> 19200 19200 :A,AE BlueSens Sensor V.: 3_2_20 SNR = 20180213000018

5.2.2. RS485 (Modbus RTU) baud via RS232

Command	&x
Response	>>
Input	Either 9600, 19200 or 38400 .
Response	The Input will be echoed. Then Modbus baud rate will be responded.
Example	>> 38400 38400 :X,C8

5.2.3. RS485 (Modbus RTU) parity via RS232

Command	&@
Response	>>
Input	0 – no parity with 2 stop bits or 1 – even parity with 1 stop bit
Response	The Input will be echoed. Then parity (0 or 1) will be responded.
Example	>> 0 0 :@,E1

5.2.5. Modbus ID

Command	&Y
Response	>>
Input	1 – 243
Response	The Input will be echoed. Then the Modbus ID will be responded.
Example	>> 21 21 :Y,2D

5.2.4. Modbus extended mode via RS232

Command	&\$
Response	>>
Input	0 – Modbus extended mode disabled 1 – Modbus extended mode enabled
Response	The Input will be echoed. Then Modbus extended mode (0 or 1) will be responded. For additional information see chapter 1.3.
Example	>> 0 0 :\$,C5

5.3. Reset execution via RS232

The **BlueVary** can be reset over RS232.

5.3.1. Reset execution via RS232

Command	&r or &z
Response	No response to the command, the BlueVary will directly been reset and the start up message will be send.
Example	HardReset BlueSens Sensor V.: 3_2_20 SNR = 20180213000018

5.4. Get values or parameters via RS232

5.4.1. Get measuring results via RS232

Command	&e
Response	Concentration1 concentration2 pressure :E, checksum The pressure is returned in units of bar (abs). Within the first hour after turning on the probe the reply will be Sensor 1: Sensor 2: Wait while sensor heats up :E If the probe is defect (light source or O2-element) the sensor will return Sensor 1: Sensor 2: Signal too low for measuring :E
Example	4.184594378E-02 2.098309135E+01 9.895477891E-01 :E,21

Get humidity and pressure via RS232

Command	&v
Response	Relativ humidity [%] temperature [° C] absolut humidity [vol.%]:V,checksum
Example	6.255741e+01 3.070382e+01 2.742114e+00 :V,86

5.4.2. Get ID via RS232

Command	&i
Response	ID central unit gas1_cartridge-id gas2_cartridge-id HUM(orPRES)_cartridge-id :I,checksum
Example	18 CO2_29735 O2_29547 HUM_32739 :I,D5

5.4.3. Read 1-point concentrations via RS232

Command	&g
Response	1-point concentration first channel 1-point con- centration second channel :I,checksum
Example	3.999999911E-02 2.096999931E+01 :G,FF

5.4.4. Get sensor information

Command	&s
Response	The response starts with resetline including the firmware version and serian number, followed by some general information and information about the central unit. Then the information of the cartridges is send. Here Calibration factor ist the factor for 2-pt cali- bration and KKORR is calculated during 1-pt cali- bration. Admin overrule is the timestamp when someone has ignored the warnig that a cartridge is not suit- able for a special application (e.g. an humidity cartridge is used together with biogas cartridges)
Example	BlueSens Sensor V.:3_2_20 SNR = 20180213000018 Producer = BlueSens gas sensor GmbH, Herten, Ger- many Web: www.bluesens.de ID = 18 Gassensor, Unit = Vol.% Produced at 13.02.2018 Calibrated at 15.02.2018 Calibrator: CS Operation Hours : 16547 Modbus ID : 21 Modbus Baudrate : 38400 Modbus Parity: none RS232 Baudrate: 19200 IP: 192.168.010.190 Mask: 255.255.255.000 Gate: 000.000.000.000

Ph: 00:90:E8:66:73:BD
DHCP: off

Sensor 1:

ID = 29735
Gas = CO2
Calibration factor = 9.999999960E-12
KKORR = 1.271878242E+00
Produced at 08.03.2018
Calibrated at 27.08.2019
Calibrator: CA
Operation Hours : 5830
last Calibration 1Pt : 5830
No. of Calibrations 1Pt : 18
last Calibration 2Pt : 4834
No. of Calibrations 2Pt : 1
Admin overrule : -1
Max concentration : 2.500000000E+01
Calibration concentration 1Pt : 3.999999911E-02
Version : 5.4.45 SNR = 107728D4810000A7

Sensor 2:

ID = 29547
Gas = O2
Calibration factor = 1.000000000E+00
KKORR = 8.704727143E-02
Produced at 02.02.2018
Calibrated at 06.02.2018
Calibrator: CS

Operation Hours : 5958
last Calibration 1Pt : 5957
No. of Calibrations 1Pt : 10
last Calibration 2Pt : 0
No. of Calibrations 2Pt : 0
Admin overrule : -1
Max concentration : 5.000000000E+01
Calibration concentration 1Pt : 2.096999931E+01
Version : 5.4.44 SNR = 106D54D481000026

Humidity/Pressure:

ID = 32739
Gas = HUM
Pressure unit = Bar
Produced at 26.02.2020
Calibrated at 10.03.2020
Calibrator: CS
Operation Hours : 431
Admin overrule : -1
Max concentration : 1.299999952E+00
Calibration concentration 1Pt : 1.000000000E+00
Version : 5.4.45 SNR = 1021144BA1000039

6. Legal notice

BlueVary Communication Manual – English

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