GP-BUS

Instruction and Maintenance Manual



geopal®

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PENDING ITS-I 23ATEXQ36745 DBI reg. no 233.301 DIC444QMS

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IMPORTANT:

- Read this user manual carefully before using the GP-BUS.
- To ensure correct installation of the GP-BUS it is important that the installation be carried out by qualified personnel familiar with the national and international legislation, directives and standards applicable to its field of application.
- Always check that the supply voltage complies with that given on the data plate.
- This product complies with directives 89/336/EC and 73/23/EC, amended by directive 93/68/EC (CE labelling).

IMPORTANT:

- Carefully follow the instructions in section 5, ”Installation / Mounting”.

WARNING:

- Do not remove the lid in the presence of an explosive atmosphere.
- Be aware of electrostatic charges. Clean only using a damp cloth.

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1 Declaration of conformity

The producer

Geopal System A/S
Bygmarken 19
DK-3520 Farum

declares that the following product:

Type: GP-BUS
Name: Gas alarm detector

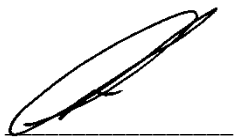
conforms to the following directives and standards:

Low Voltage Directive 2014/35/EC
EMC Directive 2014/30/EU

EN 61 000-6-2 (2019)
EN 61 000-6-4 (2019)
EN 50 270 (2015)

This declaration is given in compliance with Article 7, subsection 1 of the EMC Directive. For specifications of the acceptable EMC level, refer to the electrical data of the product.

Farum, 1 June 2025



Christian Møller
Manufacturer's signature.

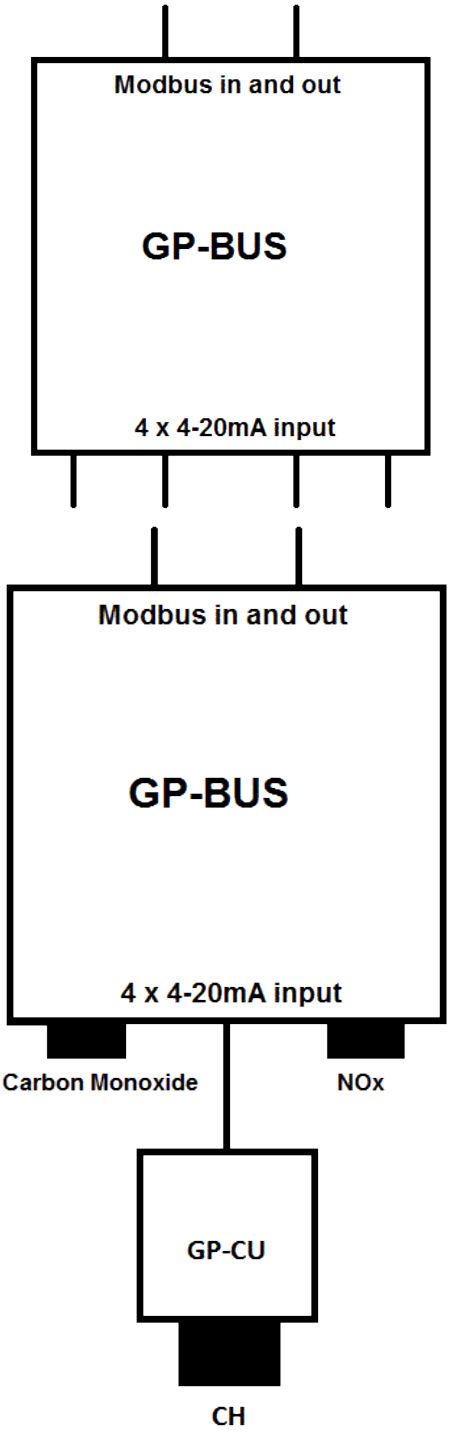
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2 Functions of the gas detector

2.1 General

Geopal GP-BUS is a Modbus unit with four analog inputs.
It is meant to connect standard 4-20 mA detectors/sensors to a ModBus RTU network.

The individual inputs can be configured to match the measuring range of the detector/sensor attached.



2.2 Typical example of use

A typical example use of GP-BUS is in underground car parks.

In this example, a Carbon monoxide and a Nitrogen Oxides sensor is built in the GP-BUS housing and an external GP-CU detector with CH sensor is attached. The fourth input is disabled, as it is not used.

The GP-BUS unit, with the Carbon monoxide and the NOx sensor must be installed in typical breathing height of approx. 1.50 meters. The GP-CU detector should be mounted at ground level approx. 10 to 20 cm above the floor.

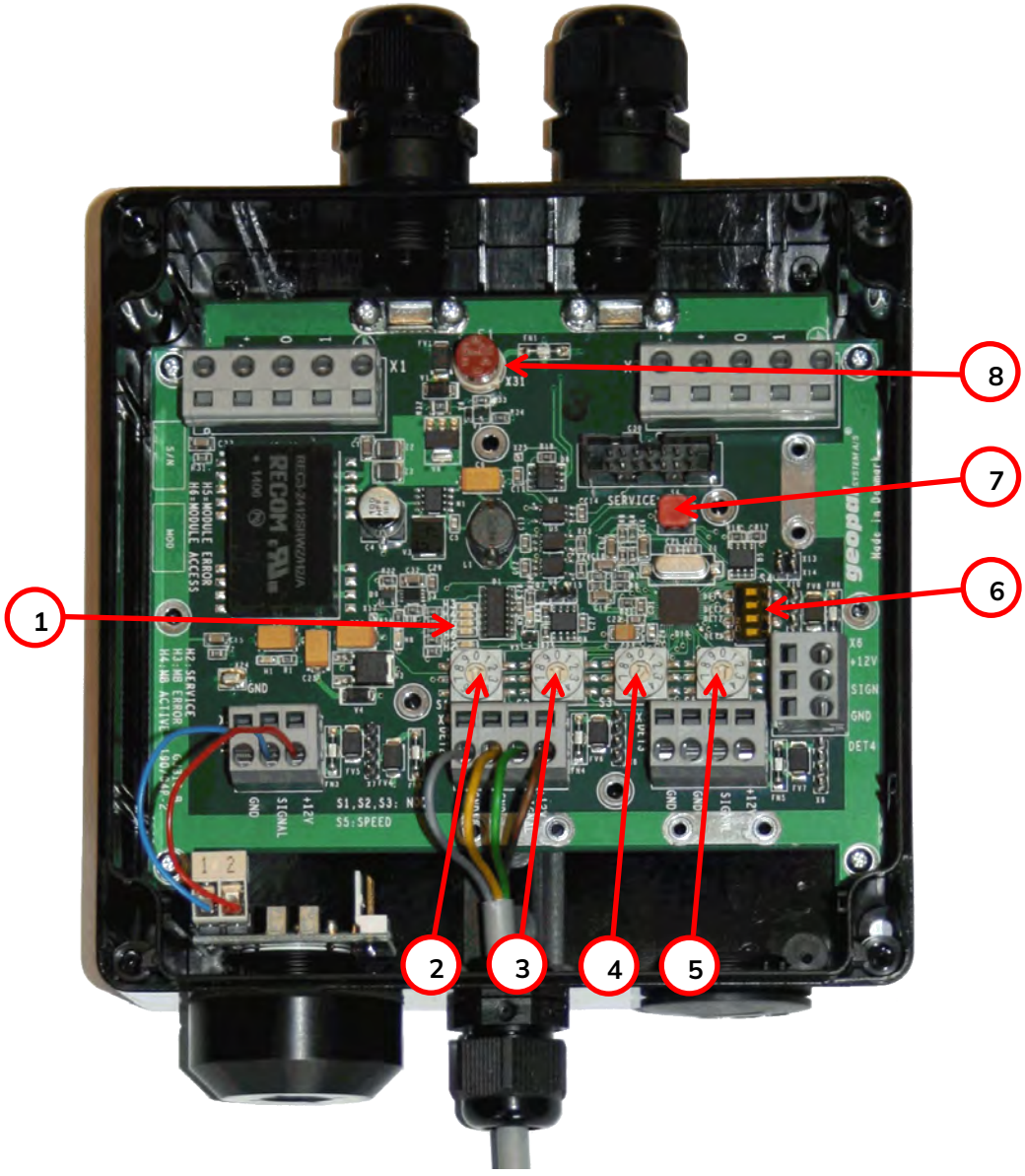
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3 Modbus unit

3.1 Control circuit board

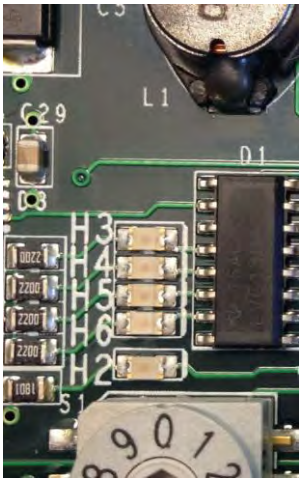
1. Status LED's
2. Node address switch S1
3. Node address switch S2
4. Node address switch S3
5. Baud rate selector switch S5
6. Channel enable/disable selector switch
7. Service button
8. Fuse

Fig. 4.1:



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3.2 Status LED's



1.	H3	Red Modbus	Error
2.	H4	Green	Modbus Active
3.	H5	Red Module	Error
4.	H6	Green	Module Access
5.	H2	Blue	Service Mode

Designator	Colour	Name	Description
H3	Red	Modbus Error	This LED will flash for the following reasons: If the received command had a parity error. If the received command had a CRC error. If the received command was not supported. If self-test fails.
H4	Green	Modbus Active	Flashes each time the module recei-ves a command from the Modbus network.
H5	Red	Module Error	On during self-test. Flashing if self-test fails.
H6	Green	Module Access	Flashes each time the module recei-ves a command with its own node address.
H2	Blue	Service Mode	On when the "Service mode" is active. Flashes when there is less than 1 min to end of service mode.

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3.3 Service mode

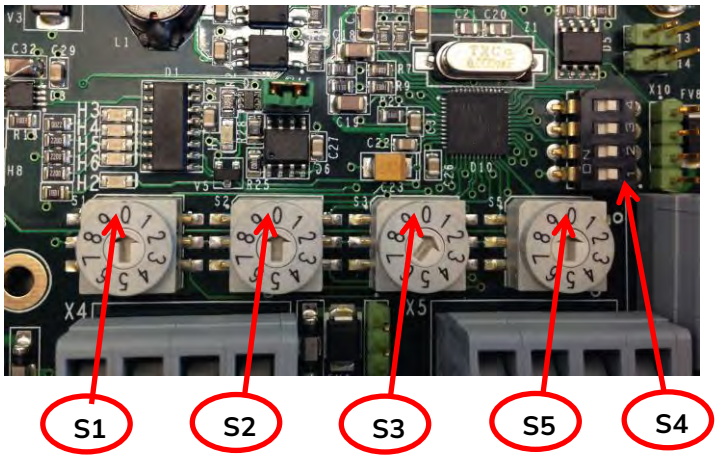
Service mode is used to prevent alarms from the detectors during service and calibration.
To enter service mode push the Service button (S6). This will set the unit in service mode for 5 min.
To extend the period, press the button again, and a new 5 min period will start.
When service mode is active, the Service mode LED will be on. When there is less than 1 min to Service mode ends, the LED will begin flashing.
When Service mode is active, the value “AI x Input PV” will be set to the corresponding “AI x Service Mode PV” value.
When the unit is in Service mode, the “Service mode” bit in the AI x status register (see AI Status word description) is set.

3.4 Node Address

Address configured via 3 rotary-switches (S1, S2 and S3).

Address = (S1*100) + (S2*10) + (S3*1)

Valid address range is 1 to 247.



3.5 Modbus speed

RS485 Baud rate configuring switch (S5)

0. 9600 - Default
1. 1200
2. 4800
3. 9600
4. 19200
5. 38400
6. 56000
7. 115200

3.6 Modbus communication settings

Even Parity.
8 Data bits
1 Stop bit

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3.7 Input Enable/Disable switch

Inputs that are not used should be disabled, via Input Enable/Disable switch S4.

If disabled the status bit will indicate that the input is not used.
If there is no detector connected, then “Below lower limit FV” status bit will be set.

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4 Modbus interface

4.1 Modbus commands supported

Broadcast communication from master to slave(s) through device address 0 is supported. No response from the slave is generated in that case. Broadcast communication is not secured by the normal check mechanisms and shall be limited to very few uses.

If you address the GP-BUS slave directly (using the assigned node address) only a few commands and functions are recognized.
Supported function codes are listed in the table below.

Function code	Command text	Description
0x03 hex	Read multiple registers	Reads the binary content of multiple 16-bit registers in the slave.
0x04 hex	Read input registers	Reading several analog inputs
0x06 hex	Write Single Register	
0x10 hex	Write multiple registers	Preset values into a sequence of 16-bit registers.
0x11 hex	Report Slave ID	The slave will respond to a Report Slave ID command (Command 17) request from the master by giving information about device type.
0x17 hex	Read/Write Multiple Registers	

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4.2 Modbus registers

For each of the four inputs on the GP-BUS there is a Status register and two Measurement registers.

- **Status:** Status word is described in chapter 4.4 AI Status word description.
- **Input FV:** Field value is the raw input value.
- **Input PV:** Process Value is the processed value of the field value based on the configuration registers for the input channel.

Measurement and Status registers					
Register Address		Length (word)	Access	Type	Description
[dec]	[hex]				
100	0x64	1	Read	Holding Register	AI 0 Status
101	0x65	1	Read	Holding Register	AI 0 Input FV
102	0x66	1	Read	Holding Register	AI 0 Input PV
103	0x67	1	Read	Holding Register	AI 1 Status
104	0x68	1	Read	Holding Register	AI 1 Input FV
105	0x69	1	Read	Holding Register	AI 1 Input PV
106	0x6A	1	Read	Holding Register	AI 2 Status
107	0x6B	1	Read	Holding Register	AI 2 Input FV
108	0x6C	1	Read	Holding Register	AI 2 Input PV
109	0x6D	1	Read	Holding Register	AI 3 Status
110	0x6E	1	Read	Holding Register	AI 3 Input FV
111	0x6F	1	Read	Holding Register	AI 3 Input PV

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For each input there is a set of configurations registers that can be used to manipulate the behaviour of the **Input PV** register.

- **Scaling Factor:** Scaling factor for the calculation of input PV
- **Scaling Offset:** Offset for the calculation of input PV.
- **Lower limit input PV:** If input PV is below this limit the corresponding bit in the status word is set.
- **Upper limit input PV:** If input PV is above this limit the corresponding bit in the status word is set.
- **Lower limit input FV:** If input FV is below this limit the corresponding bit in the status word is set.
- **Service mode PV:** This value is set in the input PV register when in service mode.

Configurations registers					
Register Address		Length (word)	Access	Type*	Description
[dec]	[hex]				
200	0xC8	1	Read/Write	HR	AI 0 Scaling Factor
201	0xC9	1	Read/Write	HR	AI 0 Scaling Offset
202	0xCA	1	Read/Write	HR	AI 0 lower limit input PV
203	0xCB	1	Read/Write	HR	AI 0 upper limit input PV
204	0xCC	1	Read/Write	HR	AI 0 lower limit input FV
205	0xCD	1	Read/Write	HR	Reserved
206	0xCE	1	Read/Write	HR	AI 0 Service Mode PV
207	0xCF	1	Read/Write	HR	AI 1 Scaling Factor
208	0xD0	1	Read/Write	HR	AI 1 Scaling Offset
209	0xD1	1	Read/Write	HR	AI 1 lower limit input PV
210	0xD2	1	Read/Write	HR	AI 1 upper limit input PV
211	0xD3	1	Read/Write	HR	AI 1 lower limit input FV
212	0xD4	1	Read/Write	HR	Reserved
213	0xD5	1	Read/Write	HR	AI 1 Service Mode PV
214	0xD6	1	Read/Write	HR	AI 2 Scaling Factor
215	0xD7	1	Read/Write	HR	AI 2 Scaling Offset
216	0xD8	1	Read/Write	HR	AI 2 lower limit input PV
217	0xD9	1	Read/Write	HR	AI 2 upper limit input PV
218	0xDA	1	Read/Write	HR	AI 2 lower limit input FV
219	0xDB	1	Read/Write	HR	Reserved
220	0xDC	1	Read/Write	HR	AI 2 Service Mode PV
221	0xDD	1	Read/Write	HR	AI 3 Scaling Factor
222	0xDE	1	Read/Write	HR	AI 3 Scaling Offset
223	0xDF	1	Read/Write	HR	AI 3 lower limit input PV
224	0xE0	1	Read/Write	HR	AI 3 upper limit input PV
225	0xE1	1	Read/Write	HR	AI 3 lower limit input FV
226	0xE2	1	Read/Write	HR	Reserved
227	0xE3	1	Read/Write	HR	AI 3 Service Mode PV

*HR is Holding Register.

The information registers contain information about the GP-BUS unit.

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Device information registers					
Register Address		Length (word)	Access	Type *	Description
[dec]	[hex]				
1003	0x3EB	1	Write/Read	HR	RESET (0x55AA)
1100	0x44C	1	Read	HR	Firmware version(1.01)
1101	0x44D	3	Read	HR	Device code (“GP-BUS”)

Trying to write to a read only register will return an “illegal register address” error.
*HR is Holding Register.

4.3 Reset function

There are two ways to reset the Modbus unit.

1- Reset via power off.
2- Reset via reset register 1003 [dec]. When writing 0x55AA [hex] to this, register the unit will reset. A reset takes approx. 5 seconds.

4.4 AI Status word description

The status word for each input channel is as described in the table below.

Reserved			Lower Limit FV	Upper Limit PV	Lower Limit PV	Service Mode	Enable
Bit 15	-	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Status examples

If more than one error occurs on an input, then the errors are added bitwise.

Error situation:	[dec]	[bin]
No errors, input enabled	1	0000 0000 0000 0001
Input disabled	0	0000 0000 0000 0000
Below lower limit FV, input enabled	17	0000 0000 0001 0001
In service mode and input enabled	3	0000 0000 0000 0011
In service mode and below lower limit FV	18	0000 0000 0001 0010

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5 Installation / Mounting

Installation and mounting must be carried out by qualified personnel.

5.1 Deployment of the detector

The detector is deployed in places where gas leaks may occur. In parking areas the detectors should be spread so each detector (set) covers an equal area.

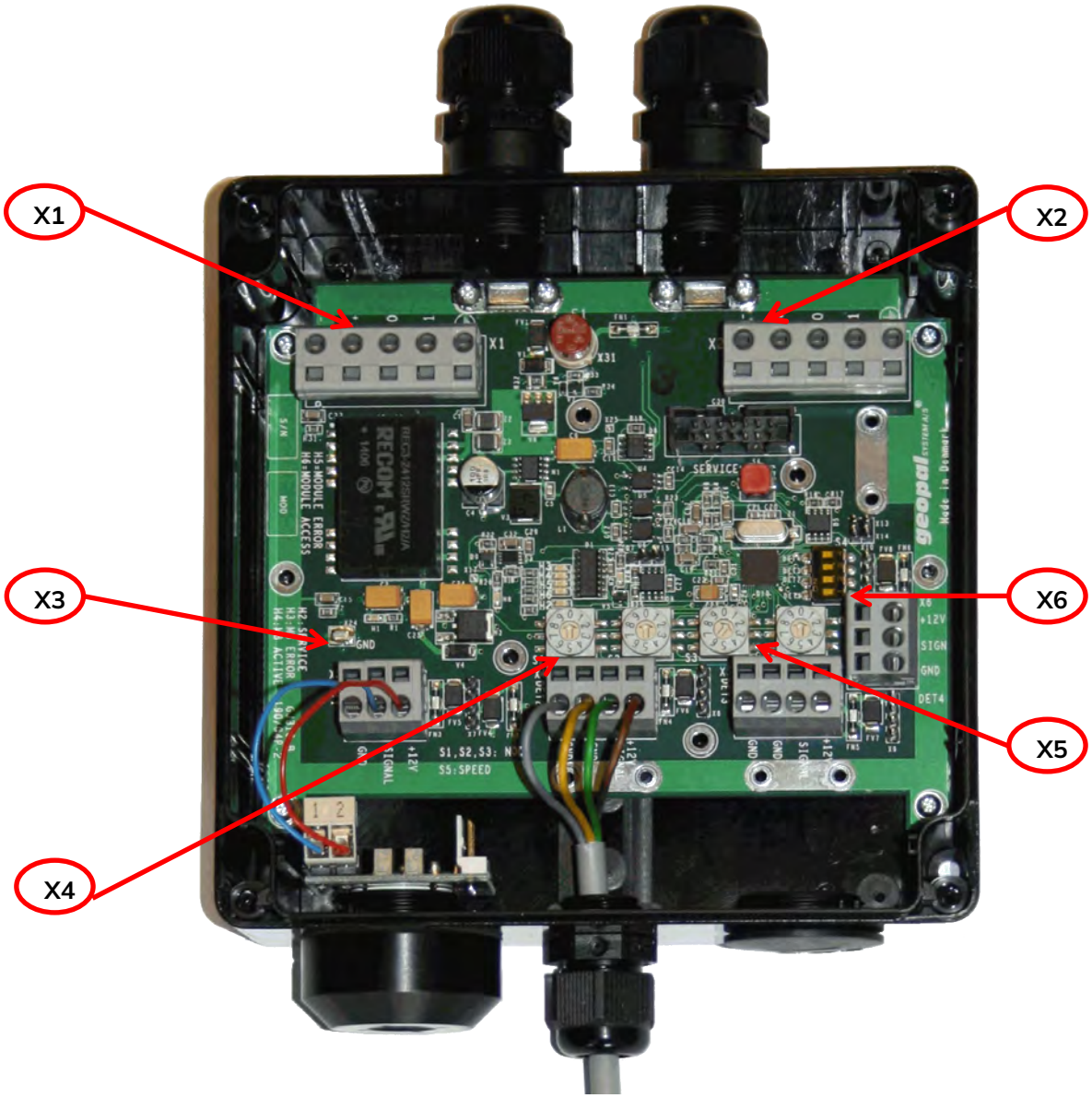
The position of the detector – high or low – depends typically on the density of the gas. Toxic gases like CO and NOx in parking areas will appear in low concentrations so they will behave as air, having the same density. Detectors for toxic gases are principally for personnel protection, and therefore installed in normal breathing level (app. 1,5m)

Detectors for dense gases (vapours from gasoline, LPG), is mounted 10-20 cm above the floor.

- The detector should be mounted so that the sensor element/nose points downwards when mounted outdoors or in locations cleaned using water, etc.
- If the detector is mounted close the floor or ground. It should be protected from impact, if it is likely to be hit by trucks/cars or other items.
- The detector must never be covered by boxes, containers, etc. which may prevent the air circulating in the room from reaching the detector.
- The detector should always be installed, bearing in mind to ensure acceptable access for service and calibration.

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5.2 Electrical connections



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X1 Modbus In/Out		
X1-1	Modbus power supply Gnd.	V-
X1-2	Modbus power supply 9-36Vdc	V+
X1-3	Modbus Data +	D0
X1-4	Modbus Data -	D1
X1-5	Cable Shield	SHIELD
X2 Modbus In/Out		
X2	The same as X1 connector for looped connection	
X3 (AI 0)		
X3-1	12V supply for sensor	+12V
X3-2	Sensor signal	SIGNAL
X3-3	Gnd for sensor	GND
X4 (AI 1)		
X4-1	12V supply for sensor	+12V
X4-2	Sensor signal	SIGNAL
X4-3	Gnd for sensor	GND
X4-4	Gnd for sensor	GND
X5 (AI 2)		
X5-1	12V supply for sensor	+12V
X5-2	Sensor signal	SIGNAL
X5-3	Gnd for sensor	GND
X5-4	Gnd for sensor	GND

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X6 (AI 3)		
X6-1	12V supply for sensor	+12V
X6-2	Sensor signal	SIGNAL
X6-3	Gnd for sensor	GND

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6 Adjustment and calibration

This must only be performed by qualified personnel.

6.1 Calibration overview

As the GP-BUS is an interface between a standard 4-20mA detector and the ModBus-network, no calibration is possible in the GP-BUS.

It is only the gas detectors, that need calibration.

When calibrating the gas detector/sensor, its measuring range is adjusted. This is done by performing a zero calibration (clean air) and a span calibration using test gas. The span point will typically be in the region of 25-50% of the measuring range for the
GP-CU (gasoline) and 50-100% for the CO and NOx sensor.
Gas types and concentrations for span calibration and measuring range are given on the detector's data/calibration certificate. If in doubt, contact Geopal A/S.

6.2 Service interval

For optimum safety, the detector should be tested and calibrated once a year. This is actually a legal requirement for numerous types of installation. A complete calibration consists of a zero calibration followed by calibration with a test gas.

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7 Warranty and disposal

7.1 Warranty

Warranty cover
Geopal System A/S provides the end user with a 1-year warranty beginning from the date of sale. The warranty period must be documented by means of the original invoice or receipt. The warranty covers defects attributable to the material and/or manufacturing faults.

Warranty period
The warranty period applies from the delivery of a brand new product to the end user.

If the date of purchase cannot be documented, the warranty period will start from the production date, which is stated on each product.

Scope of the warranty
The warranty does not cover labour costs in connection with the mounting of replacement products or components in cases when Geopal System A/S elects not to repair the product. The provision of replacement products or accessories does not extend the original warranty period. In the event that the original product is no longer accessible at the time the deficiencies reported, Geopal System A/S reserves the right to offer a similar replacement product or component.

Cover in compliance with the warranty requires the end-user to produce evidence of the fact that faults or damage is neither directly nor indirectly due to:

a) Incorrect mounting, i.e. mounting not in compliance with the mounting instructions or (in the absence of such instructions) at variance with sound craftsman-like practice.

b) mounting outside recommended mounting areas,

c) incorrect operation or misuse,

d) the use of incompatible spare parts or accessories,

e) transport, installation or other form of handling,

f) product modifications,

g) other faults or damage not attributable to material, production or construction faults, in that the preceding enumeration is not exhaustive.

Furthermore, cover in pursuance of the warranty is conditional on the end-user providing evidence that the fault or damage was not directly or indirectly attributable to - or that faults and deficiencies could not have been prevented by - failure to carry out maintenance as prescribed in the instruction and maintenance manual.

Written notification of defects
Notification of a defect covered by the warranty must be given in writing to Geopal System A/S or the distributor from which the product was purchased, within two (2) calendar months of the date on which the end user ascertained, or should have ascertained, the defect.

Geopal System A/S will then decide whether to repair or replace the product or to refund the purchase price.

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Repairs during warranty cover period
Unless Geopal System A/S decides otherwise, the end user is responsible for the repair. The warranty includes delivery free of charge of spare parts such materials necessary for the end user's repair of the product.

Supply of substitute goods
The provision of substitute goods applies to the replacement of the old product with a new one of the same type, model and quality. If at the time notification of the defect is received the product is no longer manufactured or produced in exactly the same version, Geopal System A/S is entitled to replace it with a similar product.

Transport/ carriage to and from Geopal System A/S and/or the distributor and dismounting/remounting of the product, if applicable, must be arranged with Geopal System A/S prior to implementation, in which case the costs will be defrayed by Geopal System A/S.

Not covered by the warranty
This warranty does not cover products not indicated under "Warranty cover". As regards accessories, including pre-installed accessories, reference is made to the producer's warranty provisions. As regards other Geopal System A/S products, regardless of whether these are pre-installed, the special conditions stated in this warranty apply, including those relating to the warranty period cf. "Warranty cover".

Geopal System A/S does not accept liability for consequential damage, including operating losses, or product liability over and above that encompassed by invariable legislation.

Geopal System A/S accepts no liability for losses directly or indirectly attributable to conditions over which Geopal System A/S has no control, including industrial action, lockouts, fire, war, terrorism, blockades, import restrictions, political unrest, exceptional natural occurrences, vandalism or other forms of force majeure.

Geopal System A/S does not accept liability for products not manufactured by Geopal System A/S, regardless of whether these are sold or are shown together with products indicated under "Warranty cover".

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8 Disposal of electric and electronic products



This product complies with the labelling requirements of the WEEE Directive (2002/96/EC). The attached label states that this electric/electronic product must not be disposed of together with household waste.

Product category:

The product can be classified in category 9 in relation to Appendix 1A of the WEEE Directive (2002/96/EC). "Monitoring and control instruments".

May not be disposed of together with household waste!

More detailed information about environmentally safe disposal of electric and electronic waste such as discarded equipment or parts thereof are obtainable from your distributor. See the Geopal System A/S website given on the product.

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9 Technical Specifications

9.1 General specifications

Start-uptime from installation	30 min due to sensor warm-up
Self-test	At power on and reset
Calibration GP-CU detector	See manual EM03040E GP-SA
Calibration GP-CO and GP-NOx	See manual EM04010E GP-CO
Enclosure Protection Class	IP 63
Enclosure [H x W x D]	Polycarbonat, Black [150mm x 150mm x 57mm]
Weight	0,5 kg

9.2 Environmental specifications

Installation temperature	-25 °C to + 50 °C
Storage temperature	-25 °C to + 80 °C
Humidity	20 to 100 %rh non-condensing

9.3 Network Specifications

Network type	MODBUS RTU
Maximum number of nodes	247
Network speed	1200, 4800, 9600, 19200, 38400, 56000 or 115200 bit/s Selectable by switch
Network topology	Serial (2 cable glands for in-/output)

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9.4 Electrical Specifications

Supply voltage	24-36VDC nom.
Maximum output	4 Watts in total for detectors
Output signals	Modbus RTU
Start-up current	0,70A
Nominal current	0,16A
Cable type	1x2xAWG18 + 1x2xAWG15 (Shielded)

9.5 GP-BUS Detector

Number of detectors/sensors	4
Input signal	4-20mA
Repeatability	+/- 5%
Long term stability	<5% FS over 12 months
Response time (t90)	<3 sec.
Maximum numbers of build in sensors	2
Typical gases	CO, NOx
Measurement range	CO (0-300ppm), NO2 (0-10 ppm)
Mounting	Respiratory level (1,50m)
Maximum numbers of external detectors	2
Typical gases	Hydrocarbons
Measurement range	0-100% LEL
Mounting	Floor level (10-20 cm)

9.6 Regulatory Specifications:

The device is compliant with the following directives and standards:

Approvals	Low Voltage Directive 2014/35/EC Electromagnet Compatibility Directive 2014/30/EU EN 61 000-6-2 (2019) EN 61 000-6-4 (2019) EN 50 270 (2015)
Quality	ISO 9001:2015

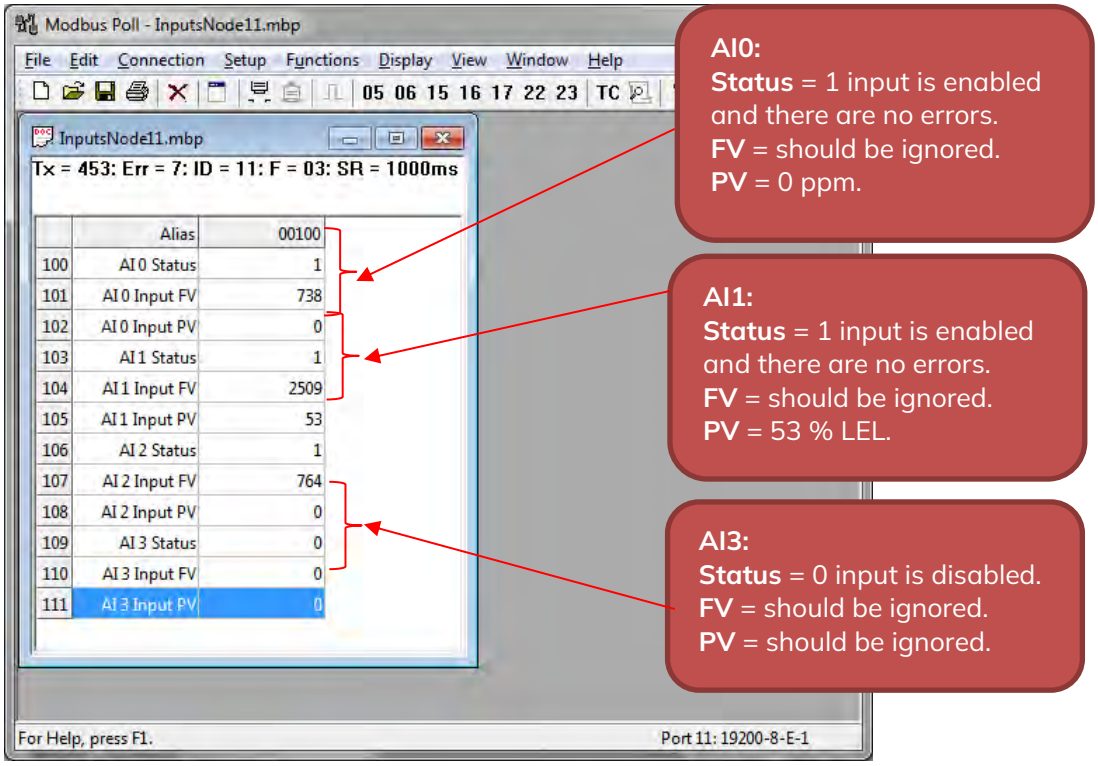
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10 Example of reading result from GP-BUS unit

Below is a reading from a GP-BUS detector, configured with Carbon monoxide, Nitrogen Oxides and Hexane detectors.
Using the software tool “Modbus Poll” the detector is read. All 12 words are read starting at address 100 [dec].

The detector inputs are configured as follows:

AI0	Carbon monoxide	0 – 300 ppm
AI1	Hexane	0 – 100 % LEL
AI2	NOx	0 – 20 ppm
AI3	Input is disabled	-



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11 Cable guidelines

Overview

Modbus-cables must be 2 x 2 twisted pair wire (V-,V+ & D1, D0).
Each pair is individually shielded to reduce interference from +24 V wires to the two MODBus's signal wires. Both pairs are shielded with a common copper braid.

Electrical specifications

Communication Cable pair

As the electrical specification of the Modbus is an RS-485 network, the cable must have a specific impedance of 120Ω.
This also means that in order to minimize reflections on the cable, we recommend to put a 120Ω resistor at each end of the cable (connected between D0 and D1).
Geopal A/S recommends to use a cable size AWG 18 (0,75 mm^2) or thicker.

Power Cable pair

Depending on the number of ModBus nodes, a separate return-cable could be used.
The cable-pair for the power system must be significantly thicker than the communication-pair, so Geopal A/S recommends to use AWG15 (1,5mm^2) or thicker.

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