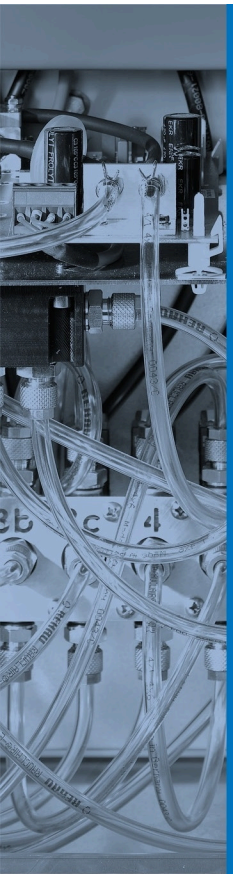
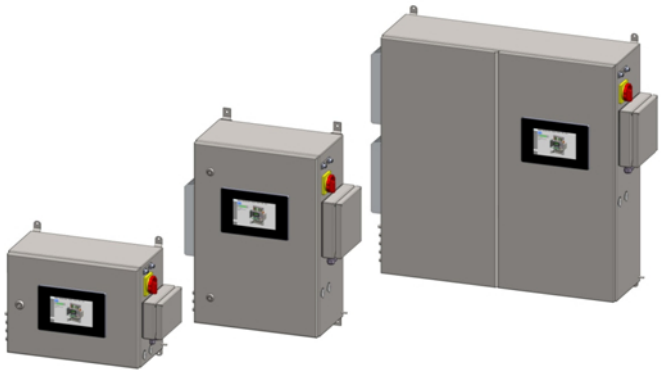


GAS ANALYSIS SYSTEM

SERIES 10 BUSCONNECTION AND INTERFACES



Original Operating Instructions

(Version 6.2)

Contact and Imprint

Please find the latest information online at www.awite.com . For any questions, comments or suggestions, please send an email to info@awite.com .

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1 Table of Contents

2 Safety instructions

When connecting the Awite gas analysis system to a higher-level control, not all of the safety relevant information is transmitted by default. Therefore, the state of the gas analysis system must also be checked on the display on the screen. Please note the information on the display on the screen.

Please also refer to the safety instructions in Part A and Part B!

3 Introduction

3.1 General Information

It is possible to communicate extensively with the Awite gas analysis system using different bus connections. In addition to measured values, you can query the current statuses of the measurement process and establish individual settings.

In addition to the bus connections described here, the Awite gas analysis system can be accessed using special software if the devices have an Ethernet interface. By using ProcessView, the visualisation is transferred to a different computer; with AwiView, the recorded measured values and events can be analysed and displayed. For both options, a separate description is available.

The plug connections and cables to be used are described in a different documentation. This document describes the software part of the bus connection.

3.2 Byte Sequence

When working with data bigger than 1 byte, the byte sequence is important. Unless otherwise specified, the big-endian format applies. Here the higher-value byte is at the lower address.

3.3 Usage data

For communication, 32 bytes are used for the data transmission to the Awite gas analysis system and, depending on bus connection and device set-up, at least128 bytes are allocated for the data transmission from the Awite gas analysis system to the automation system.

3.4 Startup Behavior

The device consists of different subsystems. These are started up separately. The following behavior applies to all bus connections.

1. After a power failure, all subsystems are started in the analysis device.
2. All bus modules initially forward the value ‘0’ to all addresses, also in the register for the life counter.
3. After starting up the actual analysis system, it starts to work and continuously increases the life counter. Value 0 is always skipped.

Check the life counter and the bits of the error status Bytes.

4 Bus connection

4.1 General Information

Normally at least the measured values as well as the status of the Awite gas analysis systemare read out. In most cases, a data transfer to the Awite gas analysis system is not necessary. Optionally, however, different commands and functions can be actuated. If the data transfer is not used, a memory for the Awite gas analysis system must still be specified in some bus systems (Profibus, Profinet). This memory area must not contain any non-initialized data (set to 0).

4.2 Output Area – Data from the Awite gas analysis system to the automation system

The status of the Awite gas analysis system can be seen in the first 16 bytes of the output area.

4.2.1 System Status Bytes

The bytes 0 to 15 (address depends on the bus system) contain information about the status of the Awite gas analysis system. The life counter and the error byte must definitely be evaluated.

Non-listed bits and bytes listed may be allocated for internal uses (non-0).

Table 1: Addresses about the status of the Awite gas analysis system in the output area for the respective bus systems.

Address: Profibus, Profinet, TCP socket	Address: Ethernet/IP	Address: Modbus	Description
Byte 0	Byte 4	Register 800 (higher-value byte)	Device status
Byte 1	Byte 5	Register 800 (lower-value byte)	Operating status measuring point
Byte 2,3	Byte 6,7	Register 801	Number of the measuring point
Byte 5	Byte 9	Register 802 (lower-value byte)	Error status.
Byte 12,13	Byte 16,17	Register 806	Life counter
Byte 14,15	Byte 18,19	Register 807	Output values page

4.2.1.1 Byte Device Status - Bit Assignment

Table 2: Bit assignment Status answer (Byte number 0)

Bit number	Designation:	Description
3	ACKECHO	bit is set when the ECHO bit that belongs to it is set in the input area.
6	MAINT	If during maintenance the corresponding menu option is enabled, this bit indicates that the maintenance is in progress and that the measured values for the individual measuring points may not be valid.
7	IGNORE_BUS	During maintenance, the reaction to bus commands can be suppressed. This is indicated by this bit.

4.2.1.2 Byte Operating Status Measuring Point - Bit Assignment

The operating state of the 1st slot[1] is displayed here.

The partial state of devices equipped with several measuring gas pumps and which therefore measure several measuring points and/or channels in parallel (more than 1 'slot') is not displayed with this bit. These can optionally be configured before delivery so that the operating state of these additional slots is also displayed in the output area.

Table 3: Bit assignment operating status measuring point (byte number 1) for slot 1. Only the most important operating statuses are output.

Bit number	Designation	Description
0	SUCK	Sucking in of the sample gas, bypassing the sensors.
1	MEAS	Sample gas is led via the sensors
3	FLUS	Flushing of the channel after the measurement
7	CALI	Calibration is being carried out

[1] The number of slots indicates how many measurements a device can perform in parallel

4.2.1.3 Bytes Number Measuring Point

Table 4: Description number measuring point (byte number 2 and 3)

Byte number	Designation	Description
2,3	Number of the measuring point	Number of the measuring point, which is currently being measured. Output as a 16-bit integer

Only one measuring point can be displayed here. More complex devices that measure several measuring points in parallel can optionally be configured individually before delivery.

4.2.1.4 Byte Error Status - Bit Assignment

Table 5: Bit assignment error status (Byte number 5)

Bit number	Designation	Description
0	ERR_ACTU	At least one error has occurred.
1	ERR_AACK	At least one current error has not been acknowledged yet.
2	ERR_NACK	At least one error has not been acknowledged (but might already be resolved)
3	ERR_STOP	Device is fully or partly set to STOP.
4	ERR_SAVE	State is not safe.

4.2.1.5 Bytes Life Counter

Table 6: Description life counter (Byte number 12 and 13)

Byte number	Designation	Description
12, 13	Life counter	Forwards the value 0 only after switching on. Is increased with every transmission cycle. From now only takes on values between 0x0001 and 0xFFFF (-32768 to 32767, without 0). The increase occurs every few seconds depending on the predefined setting.

The life counter can be used to check whether the device has been completely started and whether it is updating the data area at all. Details see chapter 4.2.2.1

The life counter can also be used to determine whether the data format is correct, as the counter increases monotonously and only accepts values between -32768 and 32767. In operational mode, the 0 value is skipped.

4.2.1.6 Bytes Output Values Page

Table 7: Description output values page (byte number 14 and 15)

Byte number	Designation	Description
14, 15	Output values page	The number of the set value page will be output here. The page number is normally pre-configured by Awite.

4.2.2 Checking of the Status of the Awite gas analysis system

4.2.2.1 Life counter

The life counter can be evaluated in order to verify the Awite gas analysis system.

After the server component has been started up, the life counter is "0". Once the actual analysis system is started up, the life counter is set to 1 and then steadily increased. In operational mode, the value 0 is skipped and therefore the life counter is never equal to 0. If the value has not changed within a 5 minute period or the value has changed to 0, then the device has been switched off, got stuck, or a connection is faulty. As the system should be ready and up and running again after 5 minutes of having been switched off and restarted, an alarm/message should be triggered after 5 minutes.

- **Import data only if the life counter is unequal to '0'. After the server subsystem has been started up, the life counter as well as all other data are '0'. In operation, the life counter is always unequal to 0.**
- **Check the life counter for changes and send out a message if it does not change over a 5 minute period.**
- **Also check the error bits. In the event of unacknowledged errors, action should be taken. The acknowledgement then occurs on the display of the Awite gas analysis system.**

4.2.2.2 Echo bit

As an alternative to the life counter an ECHO bit can be set periodically. (see Tab. 13) If this bit is set, the corresponding status bit ACKECHO (see Tab. 2) will be set. When it is reset then ACKECHO will also be reset. Thereby it can be tested whether the system is responding. When restarting or automatically reinitializing (max. once a day) the response time is about 1 to 2 minutes.

By means of an an echo bit it can be tested whether communication is working in both directions. In order to test whether data is received, the life counter is the easier method.

4.2.3 Read-out of Measured Values

These values are in upwards order starting at byte 16 (address depends on the bus) and are dependent on the set value page. Unless otherwise agreed with Awite, the data will be transferred according toTab. 8. Depending on the how the system is equipped, not all values are allocated.

Optionally other or additional data can be transferred (this has to be ordered/configured separately). For the value pages starting at 100, the one- and two-digit value pages (eg value pages 0, 6, 82, 83) are expanded with customer-specific data with the aid of a CFT file. In the case of an extension, an additional address list is supplied by Awite along with the corresponding value page.

The value pages from 200 on will be only be used for special devices.

The preset value page can be verified with the help of the system status bytes 14 and 15 (see chapter 4.2.1**).**

4.2.3.1 Standard Value Page 0 (Value Page 0)

Table 8: Addresses of the measured values in the output range (Value page 0, Value page 100 and Value page 200) for the corresponding bus systems

Byte Address: Profibus, Profinet, TCP socket	Byte Address: Ethernet /IP	Register: Modbus	Measured quantity[2]	Measuring point	Unit
16	20	808	Carbon dioxide	1	1/10%
18	22	809	Hydrogen sulphide	1	ppm
20	24	810	Oxygen	1	1/100%
22	26	811	Methane	1	1/10%
24	28	812	Carbon dioxide	2	1/10%
26	30	813	Hydrogen sulphide	2	ppm
28	32	814	Oxygen	2	1/100%
30	34	815	Methane	2	1/10%

[2] Volume concentration or molar proportion

Byte Address: Profibus, Profinet, TCP socket	Byte Address: Ethernet /IP	Register: Modbus	Measured quantity[2]	Measuring point	Unit
32	36	816	Carbon dioxide	5/Air[3]	1/10%
34	38	817	Hydrogen sulphide	5/Air	ppm
36	40	818	Oxygen	5/Air	1/100%
38	42	819	Methane	5/Air	1/10%
40	44	820	Hydrogen	1	ppm
42	46	821	Hydrogen	2	ppm
44	48	822	Hydrogen	5/Air	ppm
46	50	823	Carbon dioxide	3	1/10%
48	52	824	Hydrogen sulphide	3	ppm
50	54	825	Oxygen	3	1/100%
52	56	826	Methane	3	1/10%
54	58	827	Hydrogen	3	ppm
56	60	828	Carbon dioxide	4	1/10%
58	62	829	Hydrogen sulphide	4	ppm
60	64	830	Oxygen	4	1/100%
62	66	831	Methane	4	1/10%
64	68	832	Hydrogen	4	ppm
66	70	833	Customer-specific	--	--
68	72	834	Customer-specific	--	--
70	74	835	Customer-specific	--	--
72	76	836	Customer-specific	--	--
74	78	837	Customer-specific	--	--

[2] Volume concentration or molar proportion

[3] Measuring point 5 (if available), otherwise the last measuring point (air)

4.2.3.2 Alternative Value Pages

These are pre-configured by Awite on request.

Table 9: Addresses of the measured values in the output range (Value page 6, Value page 106 and Value page 206) for the corresponding bus systems

Byte Address: Profibus, Profinet, TCP socket	Byte Address: Ethernet /IP	Register: Modbus	Measured quantity[4]	Measuring point	Unit
16	20	808	Carbon dioxide	1	1/10%
18	22	809	Hydrogen sulphide	1	ppm
20	24	810	Oxygen	1	1/100%
22	26	811	Methane	1	1/10%
24	28	812	Carbon dioxide	2	1/10%
26	30	813	Hydrogen sulphide	2	ppm
28	32	814	Oxygen	2	1/100%
30	34	815	Methane	2	1/10%
32	36	816	Carbon dioxide	5/Air[5]	1/10%
34	38	817	Hydrogen sulphide	5/Air	ppm
36	40	818	Oxygen	5/Air	1/100%
38	42	819	Methane	5/Air	1/10%
40	44	820	Hydrogen	1	ppm
42	46	821	Hydrogen	2	ppm
44	48	822	Hydrogen	5/Air	ppm
46	50	823	Carbon dioxide	3	1/10%
48	52	824	Hydrogen sulphide	3	ppm
50	54	825	Oxygen	3	1/100%
52	56	826	Methane	3	1/10%

[4] Volume concentration or molar proportion

[5] Measuring point 5 (if available), otherwise the last measuring point (air)

Byte Address: Profibus, Profinet, TCP socket	Byte Address: Ethernet /IP	Register: Modbus	Measured quantity[4]	Measuring point	Unit
54	58	827	Hydrogen	3	ppm
56	60	828	Carbon dioxide	4	1/10%
58	62	829	Hydrogen sulphide	4	ppm
60	64	830	Oxygen	4	1/100%
62	66	831	Methane	4	1/10%
64	68	832	Hydrogen	4	ppm
66	70	833	Carbon dioxide	5	1/10 %
68	72	834	Hydrogen sulphide	5	ppm
70	74	835	Oxygen	5	1/100 %
72	76	836	Methane	5	1/10 %
74	78	837	Hydrogen	5	ppm
76	80	838	Carbon dioxide	6	1/10 %
78	82	839	Hydrogen sulphide	6	ppm
80	84	840	Oxygen	6	1/100 %
82	86	841	Methane	6	1/10 %
84	88	842	Hydrogen	6	ppm
86	90	843	Carbon dioxide	7	1/10 %
88	92	844	Hydrogen sulphide	7	ppm
90	94	845	Oxygen	7	1/100 %
92	96	846	Methane	7	1/10 %
94	98	847	Hydrogen	7	ppm
96	100	848	Carbon dioxide	8	1/10 %
98	102	849	Hydrogen sulphide	8	ppm
100	104	850	Oxygen	8	1/100 %

[4] Volume concentration or molar proportion

Byte Address: Profibus, Profinet, TCP socket	Byte Address: Ethernet /IP	Register: Modbus	Measured quantity[4]	Measuring point	Unit
102	106	851	Methane	8	1/10 %
104	108	852	Hydrogen	8	ppm
106	110	853	Carbon dioxide	9	1/10 %
108	112	854	Hydrogen sulphide	9	ppm
110	114	855	Oxygen	9	1/100 %
112	116	856	Methane	9	1/10 %
114	118	857	Hydrogen	9	ppm

Table 10: Addresses of the measured values in the output range (Value page 82, Value page 182 and Value page 282) for the corresponding bus systems

Byte Address: Profibus, Profinet, TCP socket	Byte Address: Ethernet /IP	Register: Modbus	Measured quantity[6]	Measuring point	Unit
16-74	20-78	808-837	see "Tab. 8: Addresses of the measured values in the output range (Value page 0, Value page 100 and Value page 200) for the corresponding bus systems"		
76	80	838	16 actuators[7]		
78	82	839	Carbon dioxide	6	1/10 %
80	84	840	Hydrogen sulphide	6	ppm
82	86	841	Oxygen	6	1/100 %
84	88	842	Methane	6	1/10 %

4 Volume concentration or molar proportion

6 Volume concentration or molar proportion

7 The valve positions are transmitted as an integer number (1 = 1st valve, 2 = 2nd valve, 3 = 1st + 2nd valve etc.); therefore, in most bus systems, the 1st valve is in the 9th bit and the 9th valve in the 1st bit (Big-Endian, Motorola format, network order)

Byte Address: Profibus, Profinet, TCP socket	Byte Address: Ethernet /IP	Register: Modbus	Measured quantity[6]	Measuring point	Unit
86	90	843	Hydrogen	6	ppm
88	92	844	Carbon dioxide	7	1/10 %
90	94	845	Hydrogen sulphide	7	ppm
92	96	846	Oxygen	7	1/100 %
94	98	847	Methane	7	1/10 %
96	100	848	Hydrogen	7	ppm
98	102	849	Carbon dioxide	8	1/10 %
100	104	850	Hydrogen sulphide	8	ppm
102	106	851	Oxygen	8	1/100 %
104	108	852	Methane	8	1/10 %
106	110	853	Hydrogen	8	ppm
108	112	854	Carbon dioxide	9	1/10 %
110	114	855	Hydrogen sulphide	9	ppm
112	116	856	Oxygen	9	1/100 %
114	118	857	Methane	9	1/10 %
116	120	858	Hydrogen	9	ppm
118	122	859	Customer-specific	--	--
120	124	860	Customer-specific	--	--
122	126	861	Customer-specific	--	--
124	128	862	Customer-specific	--	--
126	130	863	Customer-specific	--	--

[6] Volume concentration or molar proportion

Table 11: Addresses of the measured values in the output range (Value page 83, Value page 183 and Value page 283) for the corresponding bus systems.

Byte Address: Profibus, Profinet, TCP-Socket	Byte Address: Ethernet /IP	Register: Modbus	Measured quantity[8]	Measuring point	Unit
16-74	20-78	808-837	see "Tab. 8: Addresses of the measured values in the output range (Value page 0, Value page 100 and Value page 200) for the corresponding bus systems"		
76	80	838	16 actuators[9]		
78	82	839	Carbon dioxide	6	1/10 %
80	84	840	Hydrogen sulphide	6	ppm
82	86	841	Oxygen	6	1/100 %
84	88	842	Methane	6	1/10 %
86	90	843	Hydrogen	6	ppm
88	92	844	Carbon dioxide	7	1/10 %
90	94	845	Hydrogen sulphide	7	ppm
92	96	846	Oxygen	7	1/100 %
94	98	847	Methane	7	1/10 %
96	100	848	Hydrogen	7	ppm
98	102	849	Carbon dioxide	8	1/10 %
100	104	850	Hydrogen sulphide	8	ppm
102	106	851	Oxygen	8	1/100 %
104	108	852	Methane	8	1/10 %
106	110	853	Hydrogen	8	ppm

[8] Volume concentration or molar proportion

[9] The valve positions are transmitted as an integer number (1 = 1st valve, 2 = 2nd valve, 3 = 1st + 2nd valve etc.); therefore, in most bus systems, the 1st valve is in the 9th bit and the 9th valve in the 1st bit (Big-Endian, Motorola format, network order)

Byte Address: Profibus, Profinet, TCP-Socket	Byte Address: Ethernet /IP	Register: Modbus	Measured quantity[8]	Measuring point	Unit
108	112	854	Carbon dioxide	9	1/10 %
110	114	855	Hydrogen sulphide	9	ppm
112	116	856	Oxygen	9	1/100 %
114	118	857	Methane	9	1/10 %
116	120	858	Hydrogen	9	ppm
118	122	859	Carbon dioxide	10	1/10 %
120	124	860	Hydrogen sulphide	10	ppm
122	126	861	Oxygen	10	1/100 %
124	128	862	Methane	10	1/10 %
126	130	863	Hydrogen	10	ppm

4.3 Input area - data from the automation system to the Awite gas analysis system (optional)

Ín order to actuate the Awite gas analysis system , the so-called command page must be set, which requires bytes 14 und 15 to be actuated. This command page determines how the data in the input area (i.e. for the Awite gas analysis system the incoming data) starting at byte 16. The standard command page is page number 80 (see **Tab. 12)**.

Optionally other data can be transferred (this has to be ordered/configured separately). For the command pages starting at 100, the one- and two-digit command pages (e.g. command page 80) are expanded with customer-specific data with the aid of a CFT file. In the case of an extension, an additional address list is supplied by Awite along with the corresponding value page.

- **It is be ensured that in case the extended storage range (from the 16th byte onwards) is not used, the command page shows the value 0 in the 14th and 15th byte).**
- **Also do no write any values in unlisted bits and bytes, as these could be used internally or analysed in future versions.**

[8] Volume concentration or molar proportion

Table 12: Addresses of the Awite gas analysis systems in the entrance zone for command page 80

Byte address: Profibus, Profinet, TCP socket, Ethernet/IP	Register: Modbus	Description
Byte 0	Register 768 (higher-value byte)	Control byte
Byte 14,15	Register 775	Command page (defined content starting at byte 17)
Byte 18,19	Register 777	16 bits: Measuring points 1-16, trigger measurement. A measurement is only initiated or set to be overdue with flank 0->1 of the respective bit.
Byte 20,21	Register 778	16 bits: Stop controllers 1-16. When resetting the respective bit, the stop is cancelled again.
Byte 22,23	Register 779	16 bits: Reset controller 1-16.
Byte 24,25	Register 780	16 bits: Release calibration 1-16

4.3.1 Control Byte - Bit Assignment

Table 13: Bit assignment control byte (byte number 0)

Bit number	Designation	Description
2	STOP	As long as this bit is set, the system is stopped and no measurement is carried out.
3	ECHO	If this bit is set, the corresponding status bit ACKECHO (see Tab. 2) will be set. When it is reset, then ACKECHO will also be reset. Thereby it can be tested whether the system is responding.

4.3.2 Example of Application

Initiate new measurement by setting bits:

In the input area of the Awite gas analysis system, write the integer value 80 to the 14th and 15th byte or to the Modbus register 775. From this moment on, the measuring points 1-8 or 9-16 (when changing the respective bit from 0 to 1) are triggered by setting bits in bytes 18 and 19.

Example:

Allocate the value 5 to byte 18: Measuring points 1 and 3 (decimal 5 = binary 00000101) are measured or pre-registered for measurement.

With continuous measuring points, the measurement is carried out as soon or as long the bit is set. At discontinuous measuring points, the measurement only takes place if the state of the bit is changed from 0 to 1.

5 Bus systems

5.1 Profibus Connection

The Awite gas analysis system may optionally get equipped with a Profibus Slave assembly. This allows for the system to be integrated into a Profibus network.

The Profibus Slave assembly is designed in the following variants:

- Hilscher Net TAP50
- Wachendorff HD67562

The relevant variant for your system can be taken from the electrical diagram supplied.

5.1.1 Connection and Address Setting

The Profibus cable is connected according to the information contained in Part A of the Instruction Manual.

Hilscher Net TAP50

ID Adresse: The bus address is set using two rotary switches (Default ID88).
The change of the bus address only takes effect when the system is restarted.

Electric interface: RS 485

Speed: 9600 to 12 Mbit/s (automatically set)

The following baud rates are possible: 9600, 19200, 93750, 187500, 500000, 1.5M, 3M, 12M.

Cable length: maximum of 1200 to 100m, depending on the transmission speed.

You will find more information on the web at www.hilscher.com.

Wachendorff HD67562

ID address: Can be set via the corresponding Wachendorff configuration software (default ID88) and the corresponding connection Null modem cable (cable serial - pin 2 and 3 crossed).

Electric interface: RS 485

Speed: max 12 Mbit/s (automatically set)

Following baud rates are possible: 9600, 19200, 45450, 93750, 187500, 500000 ,1.5M, 3M, 6M, 12M.

Cable length: maximum of 1200 to 100m, depending on the transmission speed.

You will find more information on the web at www.wachendorff-prozesstechnik.de

Please ensure to use a correct termination. When switching off the Awite gas analysis system, the bus termination is not connected!

5.1.2 Master Connection

The corresponding GSD file will be provided when the system is dispatched. The file is also available from Awite if necessary.

Hilscher Net TAP50

The highest allowed bus address of the master is normally preset to 32. The modules in the .gsd file have to be included in the right sequence.

Version 1 (64iw 16ow)	Version 2 (122iw 16ow)
64 WORD INPUT	64 WORD INPUT
16 WORD OUTPUT	32 WORD INPUT
	16 WORD INPUT
	8 WORD INPUT
	2 WORD INPUT
	16 WORD OUTPUT

Wachendorff HD67562

The highest allowed bus address of the master is normally preset to 32. The modules in the .gsd file have to be included in the right sequence.

Version 1 (64iw 16ow)	Version 2 (122iw 16ow)
DI (PORT1) 64 BYTE INPUT	DI (PORT1) 64 BYTE INPUT
DI (PORT2) 64 BYTE INPUT	DI (PORT2) 64 BYTE INPUT
DO (PORT3) 32 BYTE OUTPUT	DI (PORT3) 64 BYTE INPUT
	DI (PORT4) 52 BYTE INPUT
	DO (PORT5) 32 BYTE OUTPUT

The name of the GSD file may need to be changed as some configuration tools only allow the default length of 8 letters (plus 'gsd').

5.1.3 Communication

Generally the master sends 16 words (not consistently[10] via the data block) to the Awite gas analysis system and reads 64 words (not consistently) into the input area. For the allocation of the memory, please refer to **Tab. 8.**

The measured values are available from address 16 onwards. For expanded communication possibilities, the memory area from address 0 onwards is used.

Table 14: Memory allocation for communication

Request to Awite System	
Data to gas analysis system	Byte 0
	to Byte 31

Response from Awite system	
Data from gas analysis system	Byte 0
	to Byte 15
Measured values from gas analysis system	Byte 16
	Version 1: bis Byte 127[11] Version 2: bis Byte 243[12]

5.2 TCP Socket

The Awite gas analysis systems are optionally equipped with an Ethernet port (100 Mbit/s). This makes it possible to connect the system to a control system and to integrate it with an office network as well.

5.2.1 Connection and Address Setting

An RJ 45 connector is used for the ethernet connection. Awite will firmly set the IP address before delivery, by default to **192.168.0.37. IP port 2080** is used by default for communication.

[10] Not consistently via the whole data range, as full consistency is not supported by all Profibus master systems. Consistently, however, via the 16-bit word.

[11] May vary depending on the system configuration.

[12] May vary depending on the system configuration.

5.2.2 Communication

The client (PLC or PC) opens a TCP socket connection with the defined IP address and port number. 32 bytes of data will be sent to this connection. If only the measured values are read out, this data can be filled with zero bytes. The Awite gas analysis system device sends back **128 bytes**[13] as a response.

The measured values are available from address 16 onwards. For expanded communication possibilities, the memory area from address 0 onwards is used.

Table 15: Memory allocation for communication

Request to Awite System	
Data to gas analysis system	Byte 0
	to Byte 31

Response from Awite system	
Data from gas analysis system	Byte 0
	to Byte 15
Measured values from gas analysis system	Byte 16
	to Byte 127

5.2.3 Details

The server function on the Awite process analysis system establishes a connection with the network port using the 'bind' and 'listen' function calls.

Thereafter, the follwing functions are processed in a cycle:

{

„accept"

„recv"

„send"

„close"

}

It must be ensured that the socket conection is closed after every received answer to make sure first of all that the bytes are really written out and secondly that the connection is freed up again so other members may start a query too as needed.

[13] May vary depending on the system configuration.

5.2.4 Testing the Connection

In the Download area on the Awite home page it is possible to download a test program which can be used to test this bus connection (awibus - test tcp socket).

5.2.5 Example PC

The following is an excerpt of the source code of the test program for the bus connection. The full source code is available on request.

Platform independent C++ source code with Qt:

```
while(1)

{
 // create new socket which will automatically destructed at the end of the loop:
 QTcpSocket socket;
 // connect socket with awite device:
 socket.connectToHost( QHostAddress( … ), 2080 );
        // wait a certain time for the connection
        socket.waitForConnected( 2000 ) );
        // send 32 bytes:
        const int iSend = 32;
        char request[iSend];
        for (int i = 0; i < iSend; i++)
                request[i] = 0;
        socket.write(request, iSend);
    socket.waitForBytesWritten( 3000 );
        // read 128 bytes:
        socket.waitForReadyRead( 5000 );
        ...
    buffer = socket.readAll();


        // use the data:
        // error bits in byte 5:
        bool actualError = buffer[5] & 0x01;
        bool actualAndNotAcknowledged = buffer[5] & 0x02;
```

```
    bool notAcknowledged = buffer[5] & 0x04;
    bool stopped = buffer[5] & 0x08;
    bool notSafe = buffer[5] & 0x10;
    // lifecounter on byte 12 and 13
    int lifecounter = buffer[12]*256+buffer[13];
    // first measurement value on byte 16 and 17; CO2 is in 1/10th
    float M1_CO2 = float(buffer[16] * 256 + buffer[17]) / 10.0;

} // at the end the destructor of the socket is called automatically
```

5.3 ProfiNet IO Slave

The Awite gas analysis systems are optionally fitted with a gateway module for Profinet (Hilscher NetTAP100). This allows for the system to be integrated with a Profinet network. The device description file is called GSDML-V2.2-HILSCHER-NT 100-RE PNS-20120806-143000.xml and will be provided when the system is dispatched. The file is also available from Awite if necessary.

The IO range for the cyclic data exchange (Profinet IO) is to be configured as follows (in the same sequence).

NT100-RE/RS
64 bytes input
64 bytes input
64 bytes input
32 bytes input
16 bytes input
4 bytes input
32 bytes output

5.3.1 Connection and Address Setting

An RJ 45 connector is used for the ethernet connection. The IP address is assigned by the master and has to be set with the appropriate software on-site. If any network components are used, it is to be ensured that they are suitable for Profinet.

Preset station name: nt100repns

Default IP address: none (0.0.0.0)

Instead of the configuration tool of the IO controller manufacturer, you can also use 'Ethernet Device Setup' tool of Hilscher (www.hilscher.com) to optionally change the station name and optionally set a permanent IP address.

5.3.2 Communication

The master starts the cyclic data exchange. The master writes 32 bytes of data into the gateway (output bytes for the master). These are interpreted by the Awite gas analysis system according to this description. If no communication is needed with the Awite gas analysis system, no data or 0 bytes are written. The Awite process analysis system sends **244 bytes** (input bytes for the master).

The measured values are available from address 16 onwards. For expanded communication options, the memory range from address 0 onwards is used. For the allocation of the memory, please refer to Tab. 8.

Table 16: Memory allocation for communication.

Request to Awite System	
Data to gas analysis system	Byte 0
	to Byte 31

Response from Awite system	
Data from gas analysis system	Byte 0
	to Byte 15
Measured values from gas analysis system	Byte 16
	to Byte 243

5.4 Ethernet/IP I/O Slave

The Awite gas analysis systems are optionally fitted with a gateway module for Ethernet/IP (Hilscher NetTAP100). This allows for the system to be integrated with an Ethernet/IP network.

Select a general module when integrating. (Hilscher Sycon.net: Modular Generic Adapter; Rockwell RSLogix: ETHERNET MODULE – 'Generic Ethernet Module').

The IO range for the cyclic data exchange should be configured as follows (and in the same sequence).

NT100-RE/RS
248 bytes input (244bytes Awite data begin after 4 bytes Ethernet/IP-Header)
32 bytes output

Example with Hilscher Sycon.Net:

Modular Generic Adapter

Assembly:

	ID	length
IN	101	248[14]
OUT	100	32
CFG	1	0

5.4.1 Connection and Address Setting

An RJ 45 connector is used for the ethernet connection. The IP address is preset by Awite to **192.168.1.65** and has to be specified when ordering. If any network components are used, they have to be suitable for Ethernet/IP. In the network Level3 network switches that supporting “multicasting" are required. Normal switches would filter out the packets.

The master has to control the cyclic data exchange; EEM alone is not sufficient. Allen Bradley SLC5/05 for example is not sufficient.

5.4.2 Communication

The master starts the cyclic data exchange. The master writes 32 bytes of data into the gateway (output bytes for the master). These are interpreted by the Awite gas analysis system according to this description. If no communication is needed with the Awite gas analysis system, no data or 0 bytes are written. The Awite process analysis system sends **128 bytes** (input bytes for the master).

The measured values are available from address 20 onwards. For expanded communication possibilities, the memory area from address 4 onwards is used.

[14] 4 bytes header + 244 bytes data

Table 17: Memory allocation for communication.

Request to Awite System	
Data to gas analysis system	Byte 0
	to Byte 31

Response from Awite system	
Data from gas analysis system	Byte 4[15]
	to Byte 19
Measured values from gas analysis system	Byte 20
	to Byte 247

5.5 Modbus TCP Slave

The Awite gas analysis systems are optionally equipped with an Ethernet port (100 Mbit/s). This makes it possible to connect the system to a control system and to integrate it with an office network as well.

5.5.1 Connection and Address Setting

An RJ 45 connector is used for the ethernet connection. For this type of communication, **IP port 502** (intended for Modbus TCP) is used by default. The data is saved to the panel computer (IP address can be specified, standard is **192.168.0.37**).

5.5.2 Communication

The communication partner optionally writes 16 registers (32 bytes) to register 768. The status information and measured values can be read out from register 800 onwards.

The measured values are available from register 808 onwards, the first 8 registers (16 bytes) contain status information). For expanded communication possibilities, the memory area from address 800 onwards is used. For the allocation of the memory, please refer to Tab. 8.

Table 18: Memory allocation for communication

Request to Awite system (Modbus function 0x10: Write multiple registers)	
Data to gas analysis system	Register 768

[15] 4 bytes Header

Request to Awite system (Modbus function 0x10: Write multiple registers)	
	to 784

Response from Awite system (Modbus function 0x04: Read Input Registers)	
Data from gas analysis system	Register 800
	to 807
Measured values from gas analysis system	from 808
	to at least 863[16]

5.5.3 Example

The error bits are stored in register 802. These bits can be read with the Modbus function READ INPUT REGISTER. The error bits are in the 2nd byte of the register, when the register value is output, the bits are in the lower-valued byte of the value (network byte order or big-endian).

Example in programming language C:

```
// read the register content
unsigned short int register802value = ....;
bool err_actual = false;
bool err_actual_and_not_acknowleged = false;
bool err_not_acknowledged = false;
bool device_stopped = false;
bool device_unsafe = false;
// test for bit 0
if (register802value & 1) { err_actual = true;};
// test for bit 1
if (register802value & 2) { err_actual_and_not_acknowleged = true;};
// test for bit 2
if (register802value & 4) {err_not_acknowledged = true;};
// test for bit 3
if (register802value & 8) {device_stopped = true;};
// test for bit 4
if (register802value & 16) {device_unsafe = true;};
```

[16] Depending on the device configuration, this address range can also be considerably larger.

5.6 Modbus RTU Slave

Using Modbus RTU Master, the Awite gas analysis system can be accessed in a similar way than using Modbus TCP. The cable is connected via a 5-pole round plug connector according to the assignment in the electric diagram.

The interface settings are:

- 8 data bits
- 1 stop bit
- even parity
- 9600 bit/s
- Modbus ID is 1

The interface is RS485 or RS232 (must be specified on the order). The data is saved in a similar way than for Modbus TCP.

6 Firmware and Document Versions

Date	Change	New Revision status	Editor
2014-11-18	First version	00-00	Rager
2014-12-12	Corrections layout	00-01	Fuchs
2015-02-09	Layout change history adapted	00-02	Holzner
2015-04-28	Change Design and Table of Contents	01-00	Holzner
2016-11-03	Chapters 2 and 3: Checking the status of the device revised (error bits, life counter) Footnote concerning bit sequence added on page 83 Profibus: Note on restriction of file name length of the GSD file Profinet: Default device name added Ethernet/IP: Note on Rockell RSLogix and generic Ethernet module	01-01	Murnleitner
2017-04-21	Insert safety instructions Change layout	02-00	Holzner
2017-11-24	Customization NetTAP 50	03-00	Holzner
2017-09-06	Profinet, page 26: wrong text Nt100redps replaced by nt100rep-ns	04-00	Murnleitner
2019-04-10	Superscript of footnote on page 28 was lost	04-01	Murnleitner

2020-04-30	Transfer to new editorial system	05-00	Novotny
2022-09-23	Variant Profibus slave module Wachendorff added	06-00	Holzner