

Quick start manual



INCA Process Gas Analyzer

Communication

Description of the communication options with the INCA process gas analyzer. This instruction comprises the reception of measurement and process data, remote control option and remote controlling the INCA using a PLC by implementing the H-Bus-protocol specification designed by the UNION Instruments GmbH, Germany.

V1.08

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1 INCA – Communication

The INCA process gas analyzer is equipped with a RS-232 interface. This interface is used for data exchange of measurement, process and control data between the analyzer and a remote station. Together with an additional fieldbus-gateway module different fieldbus protocols can be implemented.

Among others, the following protocols can be implemented:

- Ethernet (TCP/IP)
- Profibus-DP
- Modbus-RTU
- Modbus-TCP
- Profinet-IO
- CANopen

The INCA process gas analyzer allows two ways for a data exchange:

- 1.) automatic output of a specific data set which can be set up through the display-menu
- 2.) Data exchange of control commands to read measurement and process data and to control the analyzer. With this option a remote controlling of the measurement cycle is possible (e. g. switching measurement points).

For both options the H-Bus-protocol is used. It was developed and specified by the UNION Instruments GmbH.

Both above mentioned options are more focused on in the following paragraphs.

1.1 Automatic output (menu-setting: „Data output”)

The setting automatic data output can be configured using the menu and buttons on the analyzer's display. With this option the configured data set is sent every 15 seconds automatically over the RS-232 interface with a fixed baudrate of 9600 bit/s.

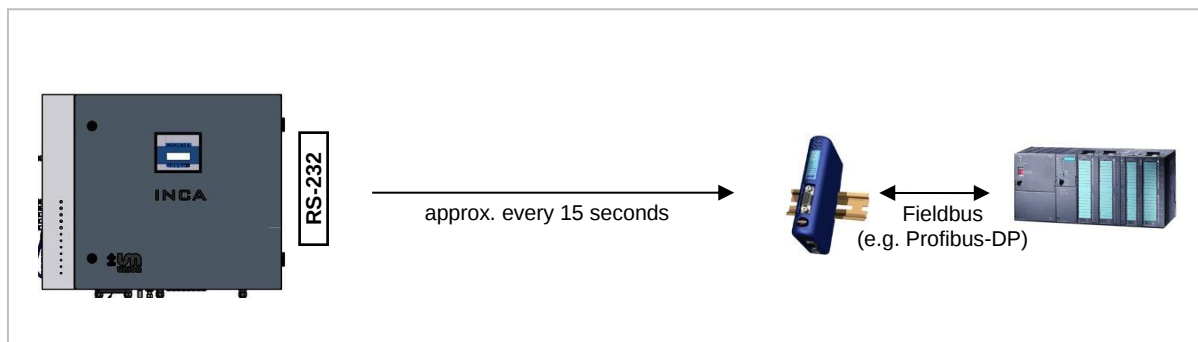


Figure 1: Automatic output of data option

Menu-setting:

MENU→SETTINGS→Data output→[selection]→[confirm by pressing Enter]

Selection:

- Data S (9600)¹
- Data M (9600)¹
- H-Bus 0x11 (9600) ← description see below
- H-Bus 0x12 (9600) ← description see below
- H-Bus 0x14 (9600)² ← description see below
- H-Bus 0x09 (9600)³ ← description see below
- H-Bus 0x10 (9600)⁴ ← description see below

All installed fieldbus-gateways (*Anybus Communicator*) are pre-configured in factory to receive those data sets and map those in their internal input buffer. A remote station can read the data from that input buffer – see documentation of specific fieldbus-gateway.

The communication between the fieldbus-gateway and the remote station must be implemented as specified by the fieldbus network requirements, such as the slave address, the data update interval, etc.

The data exchange between the analyzer and the fieldbus-gateway is automatically set-up and secured by a CRC16 checksum. The CRC16 checksum ensures that only valid data sets are received and mapped into the internal input buffer.

¹ the data sets „Data S” and „Data M” are customer specific data outputs and are not recommended

² available with firmware version V1.08 and newer (see display menu) and fieldbus gateway configuration V2.12 (see sticker)

³ available with firmware version V1.10 and newer (see display menu) and fieldbus gateway configuration V2.12 (see sticker)

⁴ available with firmware version V1.10 and newer (see display menu) and fieldbus gateway configuration V2.12 (see sticker)

1.2 Sending data on request

When using the second option data is sent by the analyzer on request by the remote station. The remote station requests data and sends commands using the H-Bus-protocol. It is possible to remotely control the measurement cycle customized to the needs at the analyzer's site of operation.

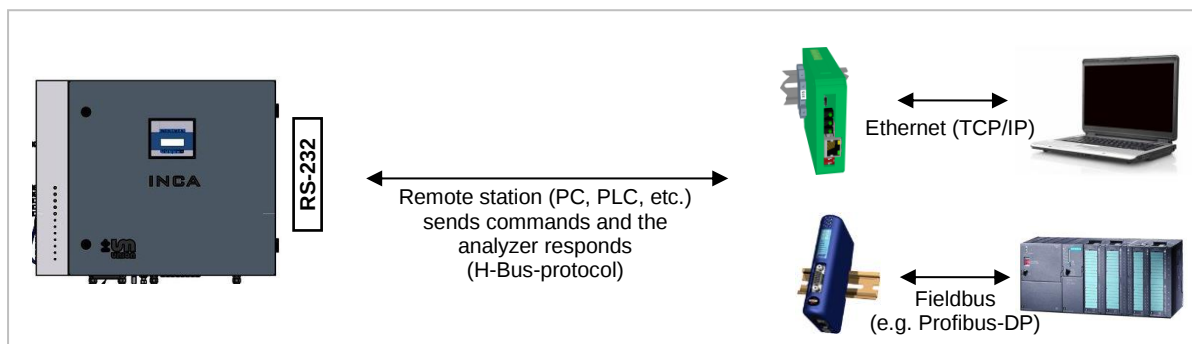


Figure 2: Sending data on request option

When using a fieldbus-gateway (*Anybus Communicator*) then the H-Bus-protocol command is written into the output buffer of the gateway.

With this option measurement and process data can be read, measurements can remotely be started and stopped and calibrations can be triggered.

Important note when using a fieldbus-gateway (*Anybus Communicator*):

Important



When communicating through a fieldbus-gateway (*Anybus Communicator*) then the menu-parameter-setting "Fallback baudrate" must be set to "9600 (Anybus)". Without a fieldbus-gateway this setting should be set to "OFF"⁵

MENÜ→PARAMETERS→Fallback baudrate→ 9600 (Anybus)
→[confirm by pressing Enter]

⁵ setting available with firmware version V1.08 and newer – if needed perform a firmware update using *INCACtrl*

2 H-Bus-Protocol

The H-Bus-Protocol is specified by UNION Instruments GmbH and allows a communication between a remote station and the INCA process gas analyzer.

Important



The below described commands are always represented in the hexadecimal number format as words (2 bytes). The preceding “0x” marks a representation in hexadecimal number format.
E. g.: The decimal number 17 is equivalent to 0x11 (byte-representation) respectively to 0x0011 (word-representation, 2 bytes)

2.1 Protocol specification

2.1.1 Byte-count

The protocol is word-oriented. 1 word consists of a series of 2 bytes. From this it follows that always an even number of bytes is sent in a command.

2.1.2 Byte-order

The coding of a word is little-endian (coll. Intel-format), i.e. the least significant byte is sent first.

Important



As required, the data words must be swapped in the remote station – see example.

Example decimal value 17 (H-Bus-command 0x0011):

Word-representation of the number 17 (hex.): 0x0011 (most significant byte: 0x00 least significant byte 0x11)

When transmitting this word, the least significant byte (0x11) is sent first and following this, the most significant byte (0x00) is sent.

2.1.3 Data structure



Figure 3: Data structure H-Bus-Protocol

The data structure of a command consists of

- the block length N, which indicates, how many data words will follow (not counting the check sum)
- number of N data words (1. word is always the command number and, if applicable, followed by data bytes)
- CRC16-checksum, is calculated over the N data words in “data block”.

Max. number of N : 256

Configuration RS-232: 9600 or 115200 bit/s, 8 data bit, 1 stop bit, no parity

The data block comprises the command number and, if applicable, additional information. The CRC16 is calculated over the data block. The preceding block length is not integrated in the CRC16-calculation.

2.1.4 Command repetition

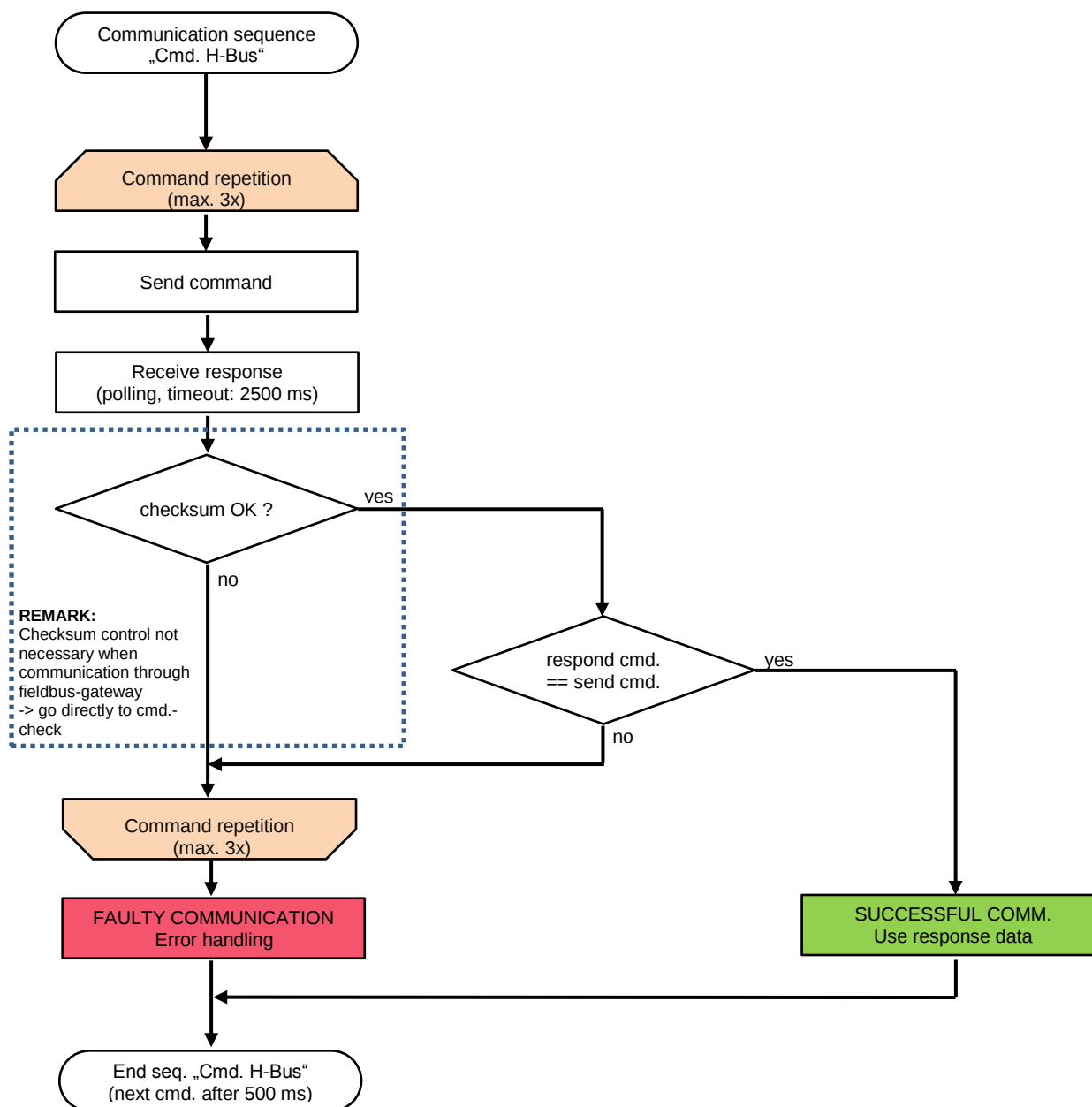
In case of a not answered requested command by the system (timeout 2500 milliseconds), the command should be repeated. After 3 failed command requests the remote station should perform an error handling or generate an error. Error handling must be specified by the remote station.

When communicating through a fieldbus-gateway a “Flush”-command must be sent between two consecutive command requests to prepare the fieldbus communication memory for the new request.

2.1.5 Command request interval

A wait time of a minimum of 500 milliseconds must be kept between any two consecutive commands.

2.1.6 Communication sequence



2.2 Communication using a fieldbus-gateway (Anybus Communicator)

When using an *Anybus Communicator* fieldbus-gateway please take notice that this must be set up through the menu of the INCA process gas analyzer. The following setup is required:

Important

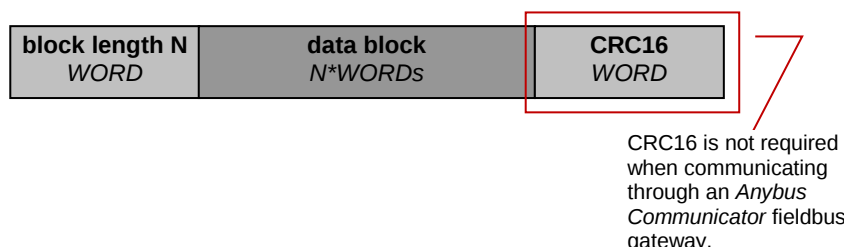


When communicating through a fieldbus-gateway (*Anybus Communicator*) then the menu-parameter-setting "Fallback baudrate" must be set to "9600 (Anybus)". Without a fieldbus-gateway this setting should be set to "OFF"⁶

MENÜ→PARAMETERS→Fallback baudrate→ 9600 (Anybus)
→[confirm by pressing Enter]



When transmitting commands through an *Anybus Communicator* fieldbus-gateway the CRC16 checksum is not required. Each command can be written to the output buffer of the fieldbus-gateway without the CRC16 checksum.



**Figure 4: Fieldbus gateway
*Anybus Communicator***

Important



When communicating through an *Anybus Communicator* fieldbus-gateway the CRC16-checksum can be ignored.

The CRC16 is calculated automatically by the *Anybus Communicator* fieldbus-gateway and transmitted automatically to the INCA process gas analyzer together with the requested command.

⁶ setting available with firmware version V1.08 and newer – if needed perform a firmware update using *INCACtrl*

2.2.1 Fieldbus-protocol: Profibus-DP

Input buffer: 120 words (240 bytes)
Output buffer: 14 words (28 bytes)
Slave-address: 2-words-command; 3-words-command; 9-words-command
settable directly on module (rotary DIP-switch)



Size	Ident	DIP	Referencia / Descripción	Dirección E	Dirección S
1	64		INPUT: 120 Byte (64 words)	200...1327	
2	64		INPUT: 64 Byte (32 words)	1328...1391	
3	16AE		INPUT: 32 Byte (16 words)	1392...1423	
4	8AAE		INPUT: 16 Byte (8 words)	1424...1439	
5	8AA		OUTPUT: 16 Byte (8 words)		1200...1215
6	4AA		OUTPUT: 8 Byte (4 words)		1216...1223
7	2AA		OUTPUT: 4 Byte (2 words)		1224...1227

INPUT	128 bytes	(64 words)
INPUT	64 bytes	(32 words)
INPUT	32 bytes	(16 words)
INPUT	16 bytes	(8 words)
OUTPUT	16 bytes	(8 words)
OUTPUT	8 bytes	(4 words)
OUTPUT	4 bytes	(2 words)

Figure 5: GSD-file mapping in remote station

Requesting data using the H-Bus-Protocol is achieved by writing the appropriate output registers in the output buffer.

Attention should be paid to the position of the commands. 2-words-commands are written to the first two words of the output buffer, 3-words-commands are written to the following 3 words. The 9-words-commands are written to the following 9 words.

See section *Example H-Bus-command 0x0014: interpretation of the* - page 19.

2.2.2 Fieldbus-protocol: Modbus-RTU and Modbus-TCP

Input buffer: 120 words
Register no. 0 - 240
Output buffer: 14 words (2-words-command; 3-words-command, 9-words-command)
2-words-command Register no. 1025 ... 1026
3-words-command Register no. 1027 ... 1029
9-words-command Register no. 1030 ... 1038
Address & baudrate: settable directly on module (DIP-switch)

Important

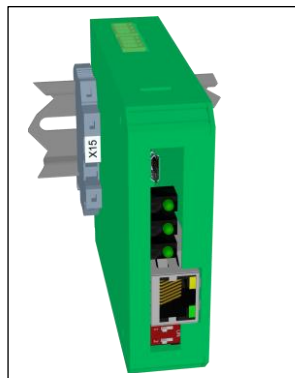


The allocation of the data in the input buffer is defined for each command in the command description. The data of a command return is always written to the beginning of the input buffer.

2.3 Communication via remote control module RCM (Ethernet, TCP/IP)

UNION Instruments GmbH offers optionally the remote control module RCM (Remote Control Module, part.-no. 08403199968).

Every INCA process gas analyzer (model “Version 2”, manufactured after 07/2010) can be upgraded with this module.⁷ An already built-in fieldbus-gateway can easily be connected to this module, to retain a running fieldbus connection.



With the remote control module RCM the INCA process gas analyzer can be attached to an existing ethernet network. In addition to that it is possible to set up the router of the network to make the INCA available for communication through the internet from a remote station from anywhere – e. g. from a PC out of the office. By using the PC-program *INCACtrl*⁸ remote service work can be performed on the analyzer. Current process and calibration data, errors and service messages and measurement and calibration history data can be read.

Figure 6: Remote Control Module RCM

2.3.1 Functionality

Remote control module RCM – connections and functionality	
Connection	Connector type and function
USB	Micro-USB Isolated serial connector for local connection to a PC to establish a communication with the PC-program <i>INCACtrl</i> . If this connection is connected to a PC, no communication over Ethernet TCP/IP or Fieldbus is available.
Ethernet	RJ-45-connector Connector to connect to an Ethernet network. While being communicated over this connection, the fieldbus-gateway is “offline”. After 5 seconds without communication over the Ethernet connection, the fieldbus-gateway is automatically set back “online” to retrieve new data from the analyzer. While being offline the values are frozen in the fieldbus-gateway.
Fieldbus-gateway	10-pole multipole connector To connect to fieldbus-gateway
Bus	3-pole multipole connector To connect internal power supply of INCA process gas analyzer
PCB-AddOn	Sub-D9 9-pole connector to connect the RCM with display board PCB-AddOn (located behind the display in door) through a standard crossed serial cable (→null modem cable).

Table 1: RCM – connectors and functionality

⁷ firmware update to version V1.08 or greater is necessary

⁸ version V1.02 or greater of program *INCACtrl* is necessary

2.3.2 Connectors, DIP-switches and status LEDs

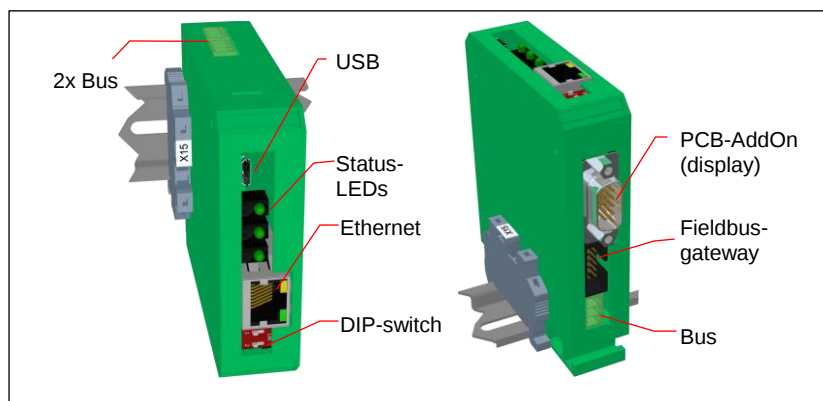


Figure 7: RCM - connectors (front view, bottom view)

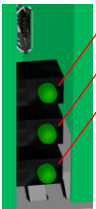
Remote control module RCM – DIP-switches and status LEDs	
DIP-switch / LEDs	Function
1	ON No fieldbus-gateway connected. Communication permanent via Ethernet. No automatic switching (REMARK: set menu-parameter "Fallback baudrate" via display-menu to "OFF") OFF (factory setting, default) fieldbus-gateway is connected . (REMARK: set menu-parameter "Fallback" via display menu to "9600 (Anybus)")
2	ON CP1 of Ethernet-module controls automatic switching (future use) OFF (factory setting, default) CP1 of Ethernet-module does not control automatic switching
 LED 1 LED 2 LED 3	LED 1 – USB active LED 2 – Anybus (fieldbus-gateway) active LED 3 – Ethernet active The status LEDs show, which connector is currently routed to the PCB-AddOn to communicate with the INCA process gas analyzer.

Table 2: RCM - DIP-switches and status LEDs

2.3.3 Installation

The Ethernet-module of the RCM is by default set to use DHCP-functionality to obtain an IP-address automatically if connected to a network supporting DHCP. If applicable, the IP address can be read back from the DHCP

If no DHCP-server is available then the module can be assigned an IP-address using the program *DeviceInstaller* from Lantronix (<http://www.lantronix.com>) – see figure below. Link to [download DeviceInstaller](#).

DeviceInstaller scans the network for the Ethernet-module without knowing its IP-address. In addition to that an IP-address can be assign just using the MAC-address of the module. The MAC-address is located on a sticker of the RCM.

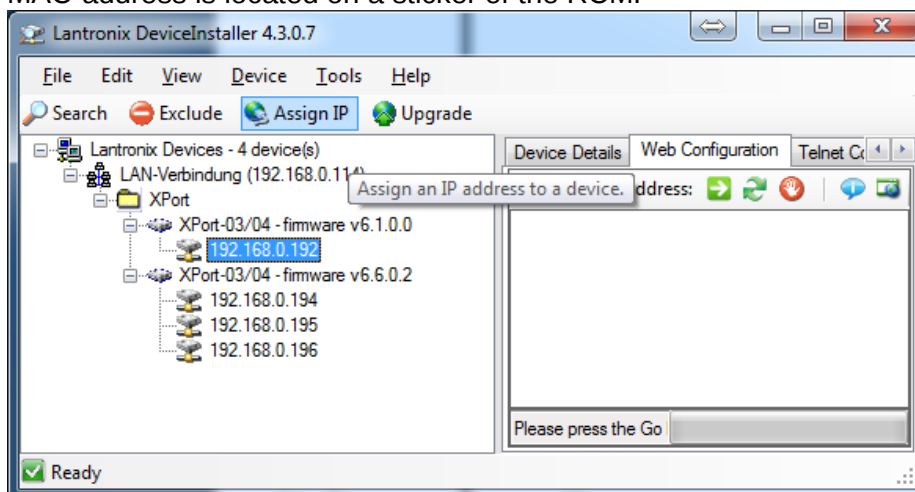


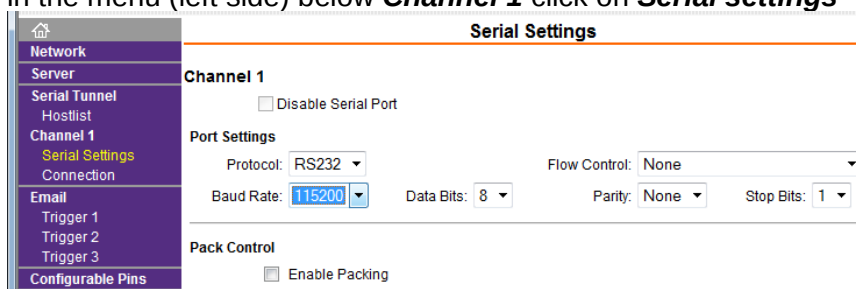
Figure 8: Assigning an IP-address using Lantronix *DeviceInstaller*

After assigning IP-address (IP-address must be known)

For best operation the baudrate of the built-in serial interface should be checked – it should be set up to 115200 bit/s – see figure below.

To check/set up the baudrate:

- 1.) enter **IP-Adresse** of the Ethernet-module in the browser
- 2.) confirm the login screen by pressing „OK“ (no user name or password required)
- 3.) in the menu (left side) below **Channel 1** click on **Serial settings**



- 4.) select “**Baud Rate 115200**” if not already set and confirm with „OK“-button (bottom of screen)
- 5.) Restart by pressing **Apply settings** in left menu.

2.3.4 Default-settings and communication using INCACtrl

The settings of the Ethernet-module of the RCM are set by default to:

IP über DHCP:	On
Port:	10001
Protocol:	TCP/IP

RS-232:	115200 bit/s, 8 Datenbit, 1 Stoppbit, keine Parität
---------	---

TCP/IP-setting *INCActrl*

To communicate using INCActrl over the Ethernet-module of the RCM, the IP-address and port must be configured in the software. By choosing **Options**→**Connection settings...** the communication protocol can be set to **TCP/IP** and IP-address and port can be entered. Confirm by clicking **Close**-button.

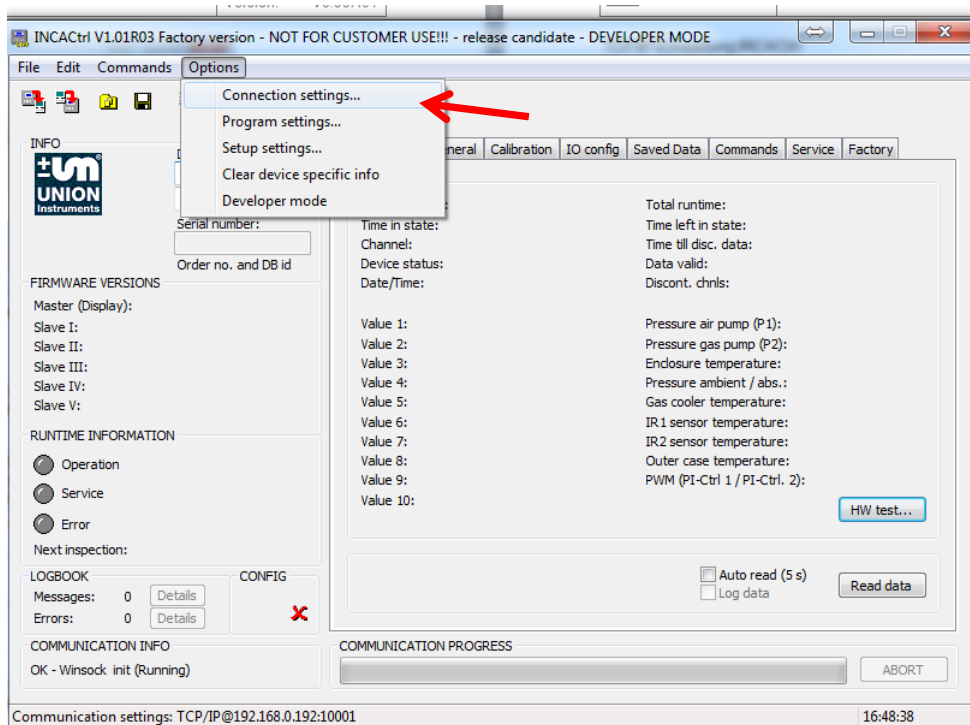


Figure 9: *INCActrl* – Select „Connction settings...“

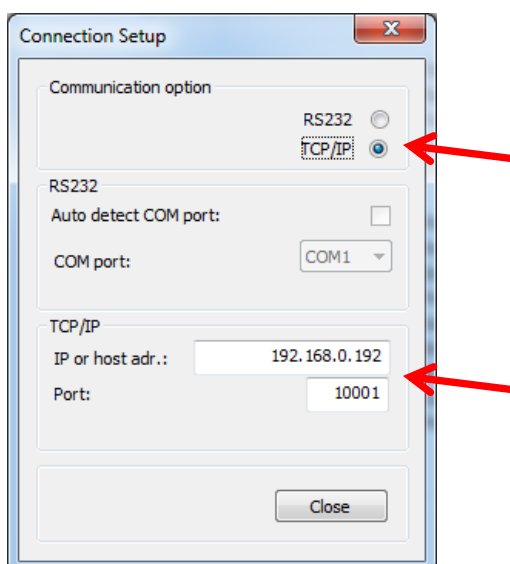


Figure 10: TCP-IP-set up using "Connection Setup"-dialog

2.4 Summary of the most important H-Bus-commands (e. g. for remote-control)

H-Bus-command	
Command	Function and description
0x0000	Flush Must always be sent before a new command is written to the output buffer of the fieldbus-gateway <i>Anybus Communicator</i> . The command is needed to flush the output buffer. Works as 2-words-, 3-words- and 9-words-command e. g. before sending a 3-words-command a 3-words-flush must be sent Important remark: <i>„Flush“ is only needed, when communicating using a fieldbus-gateway (Anybus Communicator) → menu-settings are important – see above description!</i>
0x0009	Send measurement- and process data (16 sensors, current channel) Send status information (state, times, online-data available, etc.) and send measurement results (max. of 16 sensor readings of currently measuring channel)
0x0010	Send measurement data (10 sensors, 10 channels) Send measurement results (max. 10 channels with 10 sensor readings per channel)
0x0011	Send measurement data (4 sensors, 10 channels) Send measurement results (max. 10 channels with 4 sensor readings per channel)
0x0012	Send measurement data (6 sensors, 10 channels) Send measurement results (max. 10 channels with 6 sensor readings per channel)
0x0016	Send age of measurement data (10 channels) Send the age of each measurement for every channel in minutes
0x0017	Send messages and errors Read the last 10 messages and errors from the event list.
0x0019	Send process data Send status information (state, times, online-Data available, etc.)
0x0031	Start measurement Command to start a measurement on a specific channel
0x0035	Start measurement II Request measurement on a specific channel (sample point) Optional parameters: stop measurement after measurement, skip EC-sensor, etc.
0x0036	Stop measurement Set analyzer to stop state When this command is sent, the analyzer goes into a stop mode after five minutes of purging air through the systems. Pumps and valves are turned off. No gas consumption by analyzer while ins stop-mode.
0x0051	Start calibration gas 1 Start calibration with calibration gas 1 Calibration gas must be connected to the “Input calibration gas 1” and must be set up using PC-program <i>INCACtrl</i> .

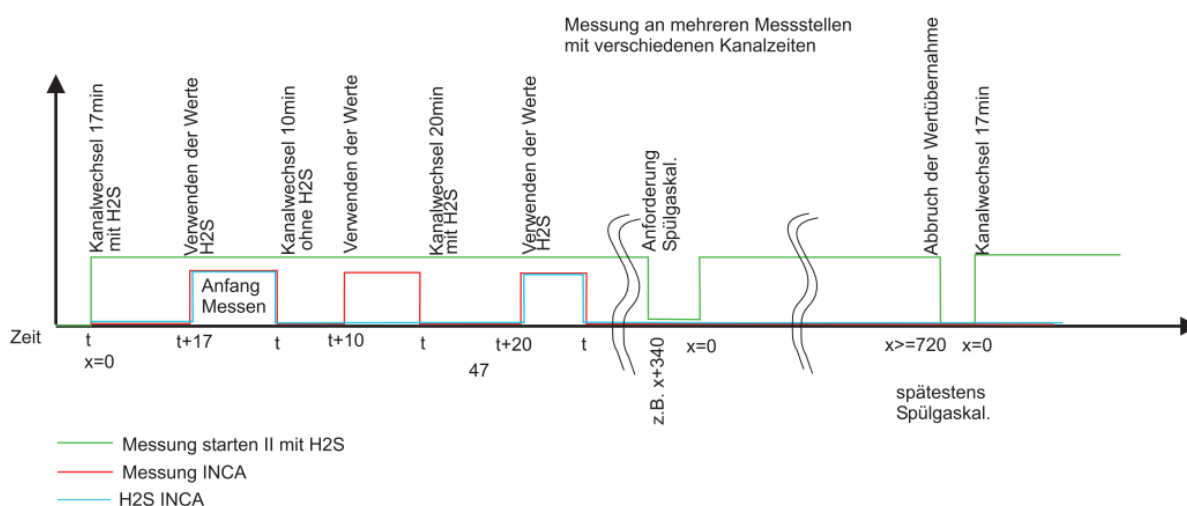
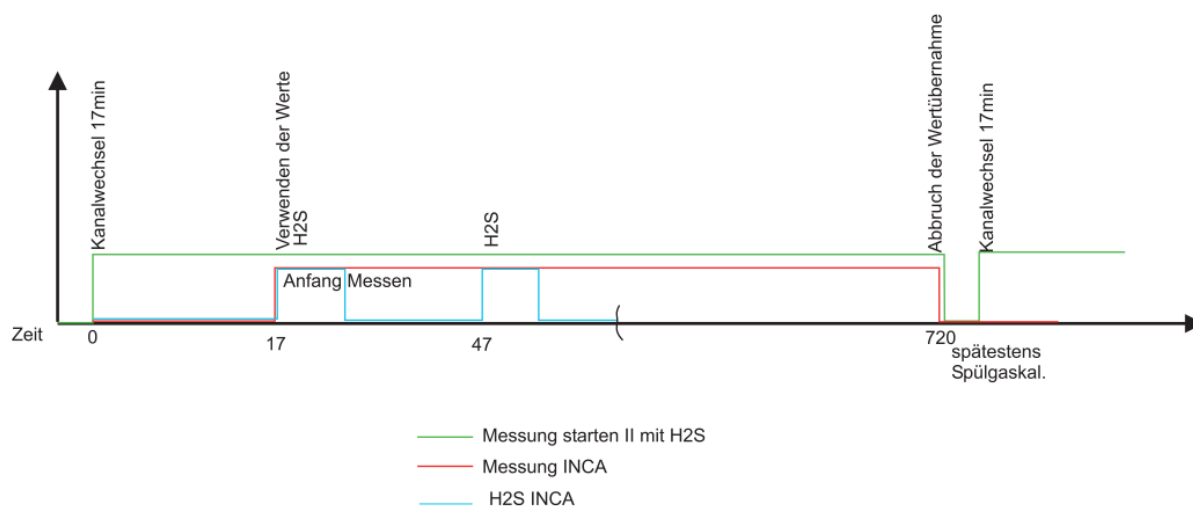
0x0052	Start calibration gas 2⁹ Start calibration with calibration gas 2 Calibration gas must be connected to the “Input calibration gas 2” and must be set up using PC-program <i>INCACtrl</i> .
0x0053	Start calibration purge gas Start calibration with purge gas (in general ambient air)

Tab. 3: Summary H-Bus-commands (excerpt)

⁹ “Input calibration gas 2” only available for specific analyzer types (e. g. INCA3021, INCA3051)

2.4.1 Example: Measuring process for continuous mode devices¹⁰

Dauermessung an einer Messstelle



¹⁰ continuous mode: flashing asterisk “*” in upper right corner during MEASURING state

2.4.2 Example H-Bus-command 0x0014: interpretation of the data

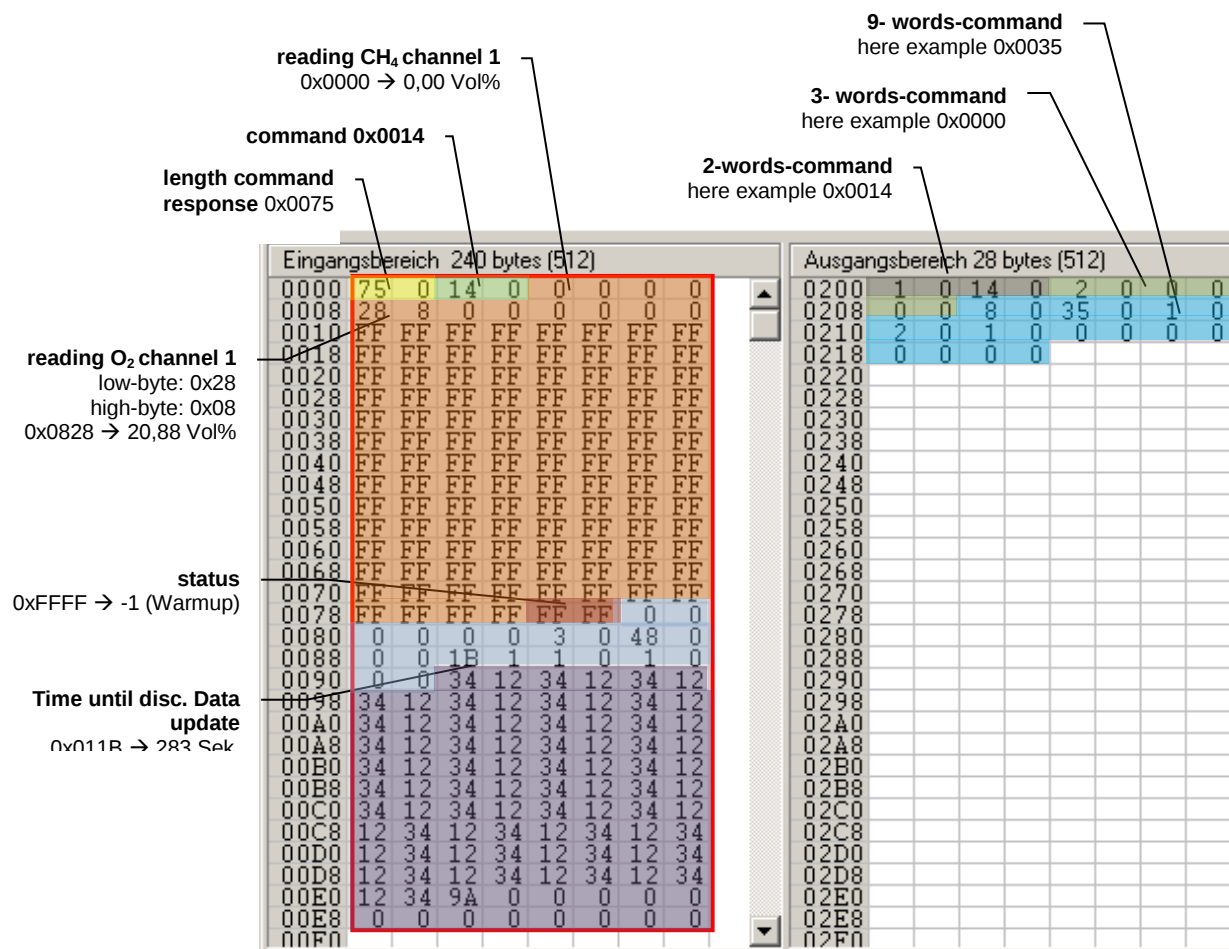


Figure 11: Memory mapping taken from fieldbus gateway *Anybus Communicator*

2.5 H-Bus-protocol commands description

2.5.1 Command: 0x0000 - Anybus Flush

COMMAND LENGTH

2 words, 3 words or 9 words (not counting CRC16)

DESCRIPTION

The command is needed when communicating through a HMS fieldbus-gateway as a dummy-command. Since it is not possible to send the exact same commands consecutively a dummy command must be sent in between to clear the gateways internal memory. This command is needed for all command lengths and should always be sent in the exact same length as the following command must be written to the according position for the length of the command (e.g. a 9 words dummy command must be written to the position of the 9 words command).

The Flush-command should be send before sending a command. E.g. before sending a command (0x0035 – Start measurement II, 9 words) send a 9 words Flush-command.

Version firmware: V1.02 and newer
Version fieldbus-gateway: V2.06 (2 words- and 3 words-commands)
V2.10 and newer (9-words-command)

COMMAND REQUEST

Word	Value (hexadecimal)	Description
1	0x0001 oder 0x0002 oder 0x0008	length of request no. of words following this word (not calculating the check sum)
2	0x0000	command
variable (0, 1 or 7 words)	0x0000	Depending on the length of the command, the dummy-words must be filled in. The values written do not have any effect.
3* resp. 4* resp. 10*	calculated	check sum CRC16 (see comment below)

Example for a command request (byte wise hexadecimal notation, bytes of words are “swapped “ -> Little-Endian-Format):

2-words-command: 0x01 0x00 0x00 0x00 (0x01 0xB0*)
3-words-command: 0x02 0x00 0x00 0x00 0x00 0x00 (0x00 0x24*)
9-words-command: 0x08 0x00 0x00 0x00 7x 0x00 0x00 (0xBE 0xF0*)

* if communicating through a fieldbus-gateway *Anybus Communicator* no checksum is required. The checksum is calculated by the fieldbus-gateway itself and the transmitted to together with the requested command data to the analyzer.

COMMAND RESPONSE

The request is always confirmed by the INCA process gas analyzer. With that confirmation it is possible to verify the success of the communication between the remote station and the INCA process gas analyzer.

2.5.2 Command: 0x0009 - Send measurement data (16 sensors, current channel)

COMMAND LENGTH

2 words (not counting CRC16)

DESCRIPTION

Command to read 16 sensor readings and process data for the currently measured channel. The currently measured channel can be read in the process data.

Conversion factor (CF) und decimal place (DP):

Some values must be converted with a conversion factor and to display them in the given unit the number of decimal places after the comma must be observed.

Example: CH₄ - CF: 0.01 DP: 2

- transmitted value of 4921

- converted value: $4921 \cdot 0.01 = 49.21$

- output with 2 decimal places: 49.21 Vol%

Version firmware: V1.09R08 and newer

Version fieldbus-gateway: V2.12

COMMAND REQUEST

Word	Value (hexadecimal)	Description
1	0x0001	length of request no. of words following this word (not counting checksum)
2	0x0009	Command
3*	calculated	check sum CRC16 (see comment below)

Example for a command request (byte wise hexadecimal notation, bytes of words are "swapped" -> Little-Endian-Format):

0x01 0x00 0x09 0x00 (0x07 0xE0*)

* if communicating through a fieldbus-gateway *Anybus Communicator* no checksum is required. The checksum is calculated by the fieldbus-gateway itself and the transmitted to together with the requested command data to the analyzer.

COMMAND RESPONSE

→see following page

COMMAND RESPONSE 0x0009

Word	Value (hexadecimal)	Description
1	0x0075	length of request no. of words following this word (not counting checksum)
2	0x0009	Command
3	variable	measurement data current channel – CH ₄ CF: 0.01 DP: 2 unit: Vol%
4	variable	measurement data current channel – CO ₂ CF: 0.01 DP: 2 unit: Vol%
5	variable	measurement data current channel – O ₂ CF: 0.01 DP: 2 unit: Vol%
6	variable	measurement data current channel – H ₂ S CF: --- DP: 0 unit: ppm
7	variable	measurement data current channel – H ₂ CF: --- DP: 0 unit: ppm
8	variable	measurement data current channel – O ₂ (paramag.) CF: 0.01 DP: 2 unit: Vol%
9	variable	measurement data current channel – SG CF: 0.0001 DP: 4 unit: ---
10	variable	measurement data current channel – CH ₄ (selective) CF: 0.01 DP: 2 unit: Vol%
11	variable	measurement data current channel – C ₂ + CF: 0.01 DP: 2 unit: Vol%
12	variable	measurement data current channel – H ₂ (TCD) CF: 0.01 DP: 2 unit: Vol%
13	variable	measurement data current channel – to be defined
14	variable	measurement data current channel – to be defined
15	variable	measurement data current channel – H ₂ (calculated) CF: 0.01 DP: 2 unit: Vol%
16	variable	measurement data current channel – SG (calculated) CF: 0.0001 DP: 4 unit: ---
17	variable	measurement data current channel – Hi (calculated) CF: 2.00 DP: 0 unit: kJ/m ³ (1)
18	variable	measurement data current channel – Wi (calculated) CF: 2.00 DP: 0 unit: kJ/m ³ (1)
19	variable	status 0 = OK, 1 = warmup -1 = message, -2 = error (fatal), -3 = sensor error, -4 = device error, -5 = calibration error, -6 = service-request More information on error "-3" - "-6" can be found in the document "Errors and Service messages".
20	variable	calibration status 1 = calibration active 0 = calibration NOT active (measuring, warmup, etc.)
21	variable	online data I <i>for INCAs with continuous measurement config. (odd T-no., e. g. T101)</i> 1 = measurement data of continuously measured sensors of active channel is online and updated <i>for INCAs with discontinuous measurement config. (even T-no., e. g. T100)</i> 1 = measurement data of all sensors of active channel is online and updated
22	variable	online data II <i>only for INCAs with continuous measurement config. (odd T-no., e. g. T101)</i> 1 = measurement data of discontinuously measured sensors of active channel is online and updated
23	variable	state of INCA process gas analyzer 0=warmup, 1=purge with gas, 2=drain condensate, 3=measurement, 4=changing channel, 5=calibration purge gas, 6=calibration gas I, 7=calibration gas II, 8=test mode, 9= stop mode, 10=error (fatal error, analyzer stopped)

24	variable	seconds in state time in seconds since last state change (→ see word 6)
25	variable	seconds till next state change time in seconds until next state change (→ see word 6) REMARK: for INCAs with continuous measurement config. this value is set to zero
26	variable	seconds till discontinuous data time in seconds until discontinuous measured sensors are updated
27	variable	active channel currently measuring channel (valid range: 1-10)
28	variable	EC-measurement not active In current measurement cycle the EC-measurement (z. B. H ₂ S) is skipped 1=measurement is skipped triggered by command 0x0035 or through INCACtrl setting "skip H ₂ S-measurement" (data from last measurement is output until next measurement)
29	variable	μPulse stable μPulse-system is stabilized. If data is online and updated (→ see words 4 and 5) the current value is output. To validate functionality of μPulse-system
30	variable	fatal error error code for fatal error, if set (→ see word 6)
31	variable	sensor-error (first sensor is output first) (0=no error) 1=CO ₂ , 2=CH ₄ , 3=H ₂ S, 4=O ₂ (EC), 5=H ₂ , 6=O ₂ (Para.), 7=SG, 8=CH ₄ , 9=C ₂ +
32	variable	sensor-error code Error code to previous sensor-error (→ see word 14) <i>Exception:</i> If sensor-error is set, but code is 0, then sensor could not be activated on startup
33	variable	slave-error (0=no error) 1=IO, 2=Flow, 3=B-IO
34	variable	slave-error code Error code to previous slave-error (→ see word 16) <i>Exception:</i> If slave-error is set, bur code is 0, then slave could not be activated on startup.
35	variable	Calibration error – error encoded bitwise (if bit=1 → error) bit 0: error "Cal. Flow Gas" – no flow of calibration gas during last calibration bit 1: error "Cal. Flow Air" – no flow of ambient air during last calibration bit 2: error "Cal. setting" – wrong calibration settings (wrong gas) bit 3: error "Cal. time" – Zero-point calibration is requested first
36	variable	sensor „Cal. setting“ – sensor causing the error bitwise encoded (if bit=1 → error) → see next data set (→ see word 20)
37	variable	sensor „Cal. time“ – sensor causing the error bitwise encoded (if bit=1 → error) bit 0: CO ₂ , bit 1: CH ₄ , bit 2: H ₂ S, bit 3: O ₂ (EC), bit 4: H ₂ , bit 5: O ₂ (par.), bit 6: SG, bit 7: CH ₄ , bit 8: C ₂ +
38	variable	runtime error - bitwise encoded (if bit=1 → error) bit 0: error "Flow Gas" – no gas flow (process or calibration gas) bit 1: error "Flow Air" – no air flow (ambient air) bit 2: error "PWM IR1" – error heater control NDIR1 bit 3: error "Tmp. IR1" – error temperature NDIR1 bit 4: error "AD IR1" – error heater stability NDIR1 bit 5: error "PWM IR2" – error heater control NDIR2 bit 6: error "Tmp. IR2" – error temperature NDIR2 bit 7: error "AD IR2" – error heater stability NDIR2 bit 8: error "Tmp. cool" – error temperature gas cooler bit 9: error "PWM cool" – error cooler control gas cooler bit 10: error "Tmp. case" – error temperature enclosure bit 11: error "PWM PI-1" – error PI-control 1 (e. g. enclosure heater) bit 12: error "PWM PI-2" – error PI-control 2 (e. g. enclosure heater)
39	variable	service-request "calibration sensor" (1) if >0, then calibration requested for sensor (→ see display output)
40	variable	service-request "calibration sensor" (2) if >0, then calibration requested for sensor (→ see display output)
41	variable	service-request "usage sensor" (1) if >0, then sensor signal is too low (→ see display output)

42	variable	service-request "age sensor" (1) if >0, then sensor age has been reached (→ see display output)
43	variable	service-request "check" (1) if >0, then a visual inspection should be performed (→ see manual)
44	variable	"Startup-Mode" active "Startup-Mode" activated through command 0x0035. All measurement data is updated and output at all times
45	variable	"Sensor Overload"-Alarm Out of range measurement on given channel value > 0 (1-10) = alarm for channel „value“ 0 = no alarm active With this alarm „sensor-error“ (→ see word 14) is set with the notifying sensor
46	variable	Test measurement 0 = no test measurement active 1 = test measurement through purge gas input 2 = test measurement through cal. gas input 1 3 = test measurement through cal. gas input 2
47	variable	Pressure for air-pump (in mbar); if P1 available, value >0, when pump running; invalid code (e.g. no pump or flow-detection): -32.0 +-0.1
48	variable	Pressure for gas-pump (in mbar); if P2 available, value >0, when pump running; invalid code (e.g. no pump or flow-detection): -32.0 +-0.1
49-117	variable	RESERVE – to be defined
118	variable	toggle-Bit – changing between 0 und 1 (only on autosend)
119*	calculated	check sum CRC16 (see comment below)

(1) – conversion from	$\text{kJ/m}^3 \rightarrow \text{kcal/m}^3$:	$1 \text{ kJ/m}^3 = 0,23885 \text{ kcal/m}^3$
	$\text{kJ/m}^3 \rightarrow \text{kWh/m}^3$:	$1 \text{ kJ/m}^3 = 0,00027778 \text{ kWh/m}^3$
	$\text{kJ/m}^3 \rightarrow \text{kWh/m}^3$:	$1 \text{ kJ/m}^3 = 0,025463 \text{ BTU/ft}^3$

A value of -1 (hexadecimal 0xFFFF) for measurement data defines that no valid measurement has been performed (e .g. deactivated channel).

* if communicating through a fieldbus-gateway *Anybus Communicator* no checksum is required. The checksum is calculated by the fieldbus-gateway itself and the transmitted to together with the requested command data to the analyzer.

2.5.3 Command: 0x0010 - Send measurement data (10 sensors, 10 channels)

COMMAND LENGTH

2 words (not counting CRC16)

DESCRIPTION

Command to read 10 sensor readings of 10 channels. The currently measured values of the active channel and the last saved values of the last measurement of the currently not measuring channels are transmitted.

Conversion factor (CF) und decimal place (DP):

Some values must be converted with a conversion factor and to display them in the given unit the number of decimal places after the comma must be observed.

Example: CH₄ - CF: 0.01 DP: 2

- transmitted value of 4921

- converted value: $4921 \cdot 0.01 = 49.21$

- output with 2 decimal places: 49.21 Vol%

Version firmware: V1.09R08 and newer

Version fieldbus-gateway: V2.12

COMMAND REQUEST

Word	Value (hexadecimal)	Description
1	0x0001	length of request no. of words following this word (not counting checksum)
2	0x0010	Command
3*	calculated	check sum CRC16 (see comment below)

Example for a command request (byte wise hexadecimal notation, bytes of words are "swapped" -> Little-Endian-Format):

0x01 0x00 0x10 0x00 (0x0C 0x70*)

* if communicating through a fieldbus-gateway *Anybus Communicator* no checksum is required. The checksum is calculated by the fieldbus-gateway itself and the transmitted together with the requested command data to the analyzer.

COMMAND RESPONSE

→see following page

COMMAND RESPONSE

Word	Value (hexadecimal)	Description			
1	0x0075	length of request no. of words following this word (not counting checksum)			
2	0x0010	Command			
3	variable	measurement data channel 1 – CH ₄	CF: 0.01	DP: 2	unit: Vol%
4	variable	measurement data channel 1 – CO ₂	CF: 0.01	DP: 2	unit: Vol%
5	variable	measurement data channel 1 – O ₂	CF: 0.01	DP: 2	unit: Vol%
6	variable	measurement data channel 1 – H ₂ S	CF: ---	DP: 0	unit: ppm
7	variable	measurement data channel 1 – H ₂	CF: ---	DP: 0	unit: ppm
8	variable	measurement data channel 1 – O ₂ (paramag.)	CF: 0.01	DP: 2	unit: Vol%
9	variable	measurement data channel 1 – SG	CF: 0.0001	DP: 4	unit: ---
10	variable	measurement data channel 1 – CH ₄ (selective)	CF: 0.01	DP: 2	unit: Vol%
11	variable	measurement data channel 1 – C ₂ +	CF: 0.01	DP: 2	unit: Vol%
12	variable	measurement data channel 1 – H ₂ (TCD)	CF: 0.01	DP: 2	unit: Vol%
13	variable	measurement data channel 2 – CH ₄	CF: 0.01	DP: 2	unit: Vol%
14	variable	measurement data channel 2 – CO ₂	CF: 0.01	DP: 2	unit: Vol%
15	variable	measurement data channel 2 – O ₂	CF: 0.01	DP: 2	unit: Vol%
16	variable	measurement data channel 2 – H ₂ S	CF: ---	DP: 0	unit: ppm
17	variable	measurement data channel 1 – H ₂	CF: ---	DP: 0	unit: ppm
18	variable	measurement data channel 2 – O ₂ (paramag.)	CF: 0.01	DP: 2	unit: Vol%
19	variable	measurement data channel 2 – SG	CF: 0.0001	DP: 4	unit: ---
20	variable	measurement data channel 2 – CH ₄ (selective)	CF: 0.01	DP: 2	unit: Vol%
21	variable	measurement data channel 2 – C ₂ +	CF: 0.01	DP: 2	unit: Vol%
22	variable	measurement data channel 2 – H ₂ (TCD)	CF: 0.01	DP: 2	unit: Vol%
23	variable	measurement data channel 3 – CH ₄	CF: 0.01	DP: 2	unit: Vol%
24	variable	measurement data channel 3 – CO ₂	CF: 0.01	DP: 2	unit: Vol%
25	variable	measurement data channel 3 – O ₂	CF: 0.01	DP: 2	unit: Vol%
26	variable	measurement data channel 3 – H ₂ S	CF: ---	DP: 0	unit: ppm
27	variable	measurement data channel 3 – H ₂	CF: ---	DP: 0	unit: ppm
28	variable	measurement data channel 3 – O ₂ (paramag.)	CF: 0.01	DP: 2	unit: Vol%
29	variable	measurement data channel 3 – SG	CF: 0.0001	DP: 4	unit: ---
30	variable	measurement data channel 3 – CH ₄ (selective)	CF: 0.01	DP: 2	unit: Vol%
31	variable	measurement data channel 3 – C ₂ +	CF: 0.01	DP: 2	unit: Vol%

32	variable	measurement data channel 3 – H ₂ (TCD)	CF: 0.01	DP: 2	unit: Vol%
33	variable	measurement data channel 4 – CH ₄	CF: 0.01	DP: 2	unit: Vol%
34	variable	measurement data channel 4 – CO ₂	CF: 0.01	DP: 2	unit: Vol%
35	variable	measurement data channel 4 – O ₂	CF: 0.01	DP: 2	unit: Vol%
36	variable	measurement data channel 4 – H ₂ S	CF: ---	DP: 0	unit: ppm
37	variable	measurement data channel 4 – H ₂	CF: ---	DP: 0	unit: ppm
38	variable	measurement data channel 4 – O ₂ (paramag.)	CF: 0.01	DP: 2	unit: Vol%
39	variable	measurement data channel 4 – SG	CF: 0.0001	DP: 4	unit: ---
40	variable	measurement data channel 4 – CH ₄ (selective)	CF: 0.01	DP: 2	unit: Vol%
41	variable	measurement data channel 4 – C ₂ +	CF: 0.01	DP: 2	unit: Vol%
42	variable	measurement data channel 4 – H ₂ (TCD)	CF: 0.01	DP: 2	unit: Vol%
43	variable	measurement data channel 15 – CH ₄	CF: 0.01	DP: 2	unit: Vol%
44	variable	measurement data channel 5 – CO ₂	CF: 0.01	DP: 2	unit: Vol%
45	variable	measurement data channel 5 – O ₂	CF: 0.01	DP: 2	unit: Vol%
46	variable	measurement data channel 5 – H ₂ S	CF: ---	DP: 0	unit: ppm
47	variable	measurement data channel 5 – H ₂	CF: ---	DP: 0	unit: ppm
48	variable	measurement data channel 5 – O ₂ (paramag.)	CF: 0.01	DP: 2	unit: Vol%
49	variable	measurement data channel 5 – SG	CF: 0.0001	DP: 4	unit: ---
50	variable	measurement data channel 5 – CH ₄ (selective)	CF: 0.01	DP: 2	unit: Vol%
51	variable	measurement data channel 5 – C ₂ +	CF: 0.01	DP: 2	unit: Vol%
52	variable	measurement data channel 5 – H ₂ (TCD)	CF: 0.01	DP: 2	unit: Vol%
53	variable	measurement data channel 6 – CH ₄	CF: 0.01	DP: 2	unit: Vol%
54	variable	measurement data channel 6 – CO ₂	CF: 0.01	DP: 2	unit: Vol%
55	variable	measurement data channel 6 – O ₂	CF: 0.01	DP: 2	unit: Vol%
56	variable	measurement data channel 6 – H ₂ S	CF: ---	DP: 0	unit: ppm
57	variable	measurement data channel 6 – H ₂	CF: ---	DP: 0	unit: ppm
58	variable	measurement data channel 6 – O ₂ (paramag.)	CF: 0.01	DP: 2	unit: Vol%
59	variable	measurement data channel 6 – SG	CF: 0.0001	DP: 4	unit: ---
60	variable	measurement data channel 6 – CH ₄ (selective)	CF: 0.01	DP: 2	unit: Vol%
61	variable	measurement data channel 6 – C ₂ +	CF: 0.01	DP: 2	unit: Vol%
62	variable	measurement data channel 6 – H ₂ (TCD)	CF: 0.01	DP: 2	unit: Vol%
63	variable	measurement data channel 7 – CH ₄	CF: 0.01	DP: 2	unit: Vol%
64	variable	measurement data channel 7 – CO ₂	CF: 0.01	DP: 2	unit: Vol%

65	variable	measurement data channel 7 – O ₂	CF: 0.01	DP: 2	unit: Vol%
66	variable	measurement data channel 7 – H ₂ S	CF: ---	DP: 0	unit: ppm
67	variable	measurement data channel 7 – H ₂	CF: ---	DP: 0	unit: ppm
68	variable	measurement data channel 7 – O ₂ (paramag.)	CF: 0.01	DP: 2	unit: Vol%
69	variable	measurement data channel 7 – SG	CF: 0.0001	DP: 4	unit: ---
70	variable	measurement data channel 7 – CH ₄ (selective)	CF: 0.01	DP: 2	unit: Vol%
71	variable	measurement data channel 7 – C ₂ +	CF: 0.01	DP: 2	unit: Vol%
72	variable	measurement data channel 7 – H ₂ (TCD)	CF: 0.01	DP: 2	unit: Vol%
73	variable	measurement data channel 8 – CH ₄	CF: 0.01	DP: 2	unit: Vol%
74	variable	measurement data channel 8 – CO ₂	CF: 0.01	DP: 2	unit: Vol%
75	variable	measurement data channel 8 – O ₂	CF: 0.01	DP: 2	unit: Vol%
76	variable	measurement data channel 8 – H ₂ S	CF: ---	DP: 0	unit: ppm
77	variable	measurement data channel 8 – H ₂	CF: ---	DP: 0	unit: ppm
78	variable	measurement data channel 8 – O ₂ (paramag.)	CF: 0.01	DP: 2	unit: Vol%
79	variable	measurement data channel 8 – SG	CF: 0.0001	DP: 4	unit: ---
80	variable	measurement data channel 8 – CH ₄ (selective)	CF: 0.01	DP: 2	unit: Vol%
81	variable	measurement data channel 8 – C ₂ +	CF: 0.01	DP: 2	unit: Vol%
82	variable	measurement data channel 8 – H ₂ (TCD)	CF: 0.01	DP: 2	unit: Vol%
83	variable	measurement data channel 9 – CH ₄	CF: 0.01	DP: 2	unit: Vol%
84	variable	measurement data channel 9 – CO ₂	CF: 0.01	DP: 2	unit: Vol%
85	variable	measurement data channel 9 – O ₂	CF: 0.01	DP: 2	unit: Vol%
86	variable	measurement data channel 9 – H ₂ S	CF: ---	DP: 0	unit: ppm
87	variable	measurement data channel 9 – H ₂	CF: ---	DP: 0	unit: ppm
88	variable	measurement data channel 9 – O ₂ (paramag.)	CF: 0.01	DP: 2	unit: Vol%
89	variable	measurement data channel 9 – SG	CF: 0.0001	DP: 4	unit: ---
90	variable	measurement data channel 9 – CH ₄ (selective)	CF: 0.01	DP: 2	unit: Vol%
91	variable	Measurement data channel 9 – C ₂ +	CF: 0.01	DP: 2	unit: Vol%
92	variable	measurement data channel 9 – H ₂ (TCD)	CF: 0.01	DP: 2	unit: Vol%
93	variable	measurement data channel 10 – CH ₄	CF: 0.01	DP: 2	unit: Vol%
94	variable	measurement data channel 10 – CO ₂	CF: 0.01	DP: 2	unit: Vol%
95	variable	measurement data channel 10 – O ₂	CF: 0.01	DP: 2	unit: Vol%
96	variable	measurement data channel 10 – H ₂ S	CF: ---	DP: 0	unit: ppm
97	variable	measurement data channel 10 – H ₂	CF: ---	DP: 0	unit: ppm

98	variable	measurement data channel 10 – O ₂ (paramag.)	CF: 0.01	DP: 2	unit: Vol%
99	variable	measurement data channel 10 – SG	CF: 0.0001	DP: 4	unit: ---
100	variable	measurement data channel 10 – CH ₄ (selective)	CF: 0.01	DP: 2	unit: Vol%
101	variable	measurement data channel 10 – C ₂ + Vol%	CF: 0.01	DP: 2	unit:
102	variable	measurement data channel 10 – H ₂ (TCD)	CF: 0.01	DP: 2	unit: Vol%
103	variable	status 0 = OK, 1 = warmup -1 = message, -2 = error (fatal), -3 = sensor error, -4 = device error, -5 = calibration error, -6 = service-request For more information on error "-3" - "-6" see document "Errors and Service messages".			
104- 117	variable	RESERVE – to be defined			
118	variable	toggle-Bit – changing between 0 und 1 (only on autosend) →to identify the updating of data in fieldbus-gateway			
119*	calculated	check sum CRC16 (see comment below)			

A value of -1 (hexadecimal 0xFFFF) for measurement data defines that no valid measurement has been performed (e .g. deactivated channel).

* if communicating through a fieldbus-gateway *Anybus Communicator* no checksum is required. The checksum is calculated by the fieldbus-gateway itself and the transmitted to together with the requested command data to the analyzer.

2.5.4 Command: 0x0011 - Send measurement data (4 sensors, 10 channels)

COMMAND LENGTH

2 words (not counting CRC16)

DESCRIPTION

Command to read current readings. For each channel (max. 10 channels) the last 4 measured and saved gas component values are transmitted.

Conversion factor (CF) und decimal place (DP):

Some values must be converted with a conversion factor and to display them in the given unit the number of decimal places after the comma must be observed.

Example: CH₄ - CF: 0.01 DP: 2

- transmitted value of 4921

- converted value: $4921 \cdot 0.01 = 49.21$

- output with 2 decimal places: 49.21 Vol%

Version firmware: V1.02 and newer

Version fieldbus-gateway: V2.06 and newer

COMMAND REQUEST

Word	Value (hexadecimal)	Description
1	0x0001	length of request no. of words following this word (not counting checksum)
2	0x0011	command
3*	calculated	check sum CRC16 (see comment below)

Example for a command request (byte wise hexadecimal notation, bytes of words are "swapped" -> Little-Endian-Format):

0x01 0x00 0x11 0x00 (0x0D 0xE0*)

* if communicating through a fieldbus-gateway *Anybus Communicator* no checksum is required. The checksum is calculated by the fieldbus-gateway itself and the transmitted together with the requested command data to the analyzer.

COMMAND RESPONSE

→see following page

COMMAND RESPONSE

Word	Value (hexadecimal)	Description			
1	0x002A	length of request no. of words following this word (not counting checksum)			
2	0x0011	command			
3	variable	measurement data channel 1 – CH ₄	CF: 0.01	DP: 2	unit: Vol%
4	variable	measurement data channel 1 – CO ₂	CF: 0.01	DP: 2	unit: Vol%
5	variable	measurement data channel 1 – O ₂	CF: 0.01	DP: 2	unit: Vol%
6	variable	measurement data channel 1 – H ₂ S	CF: ---	DP: 0	unit: ppm
7	variable	measurement data channel 2 – CH ₄	CF: 0.01	DP: 2	unit: Vol%
8	variable	measurement data channel 2 – CO ₂	CF: 0.01	DP: 2	unit: Vol%
9	variable	measurement data channel 2 – O ₂	CF: 0.01	DP: 2	unit: Vol%
10	variable	measurement data channel 2 – H ₂ S	CF: ---	DP: 0	unit: ppm
11	variable	measurement data channel 3 – CH ₄	CF: 0.01	DP: 2	unit: Vol%
12	variable	measurement data channel 3 – CO ₂	CF: 0.01	DP: 2	unit: Vol%
13	variable	measurement data channel 3 – O ₂	CF: 0.01	DP: 2	unit: Vol%
14	variable	measurement data channel 3 – H ₂ S	CF: ---	DP: 0	unit: ppm
15	variable	measurement data channel 4 – CH ₄	CF: 0.01	DP: 2	unit: Vol%
16	variable	measurement data channel 4 – CO ₂	CF: 0.01	DP: 2	unit: Vol%
17	variable	measurement data channel 4 – O ₂	CF: 0.01	DP: 2	unit: Vol%
18	variable	measurement data channel 4 – H ₂ S	CF: ---	DP: 0	unit: ppm
19	variable	measurement data channel 5 – CH ₄	CF: 0.01	DP: 2	unit: Vol%
20	variable	measurement data channel 5 – CO ₂	CF: 0.01	DP: 2	unit: Vol%
21	variable	measurement data channel 5 – O ₂	CF: 0.01	DP: 2	unit: Vol%
22	variable	measurement data channel 5 – H ₂ S	CF: ---	DP: 0	unit: ppm
23	variable	measurement data channel 6 – CH ₄	CF: 0.01	DP: 2	unit: Vol%
24	variable	measurement data channel 6 – CO ₂	CF: 0.01	DP: 2	unit: Vol%
25	variable	measurement data channel 6 – O ₂	CF: 0.01	DP: 2	unit: Vol%
26	variable	measurement data channel 6 – H ₂ S	CF: ---	DP: 0	unit: ppm
27	variable	measurement data channel 7 – CH ₄	CF: 0.01	DP: 2	unit: Vol%
28	variable	measurement data channel 7 – CO ₂	CF: 0.01	DP: 2	unit: Vol%
29	variable	measurement data channel 7 – O ₂	CF: 0.01	DP: 2	unit: Vol%
30	variable	measurement data channel 7 – H ₂ S	CF: ---	DP: 0	unit: ppm

31	variable	measurement data channel 8 – CH ₄	CF: 0.01	DP: 2	unit: Vol%
32	variable	measurement data channel 8 – CO ₂	CF: 0.01	DP: 2	unit: Vol%
33	variable	measurement data channel 8 – O ₂	CF: 0.01	DP: 2	unit: Vol%
34	variable	measurement data channel 8 – H ₂ S	CF: ---	DP: 0	unit: ppm
35	variable	measurement data channel 9 – CH ₄	CF: 0.01	DP: 2	unit: Vol%
36	variable	measurement data channel 9 – CO ₂	CF: 0.01	DP: 2	unit: Vol%
37	variable	measurement data channel 9 – O ₂	CF: 0.01	DP: 2	unit: Vol%
38	variable	measurement data channel 9 – H ₂ S	CF: ---	DP: 0	unit: ppm
39	variable	measurement data channel 10 – CH ₄	CF: 0.01	DP: 2	unit: Vol%
40	variable	measurement data channel 10 – CO ₂	CF: 0.01	DP: 2	unit: Vol%
41	variable	measurement data channel 10 – O ₂	CF: 0.01	DP: 2	unit: Vol%
42	variable	measurement data channel 10 – H ₂ S	CF: ---	DP: 0	unit: ppm
43	variable	status 0 = OK, 1 = warmup -1 = message, -2 = error (fatal), -3 = sensor error, -4 = device error, -5 = calibration error, -6 = service-request More information on error "-3" - "-6" can be found in the document "Errors and Service messages".			
44*	calculated	check sum CRC16 (see comment below)			

A value of -1 (hexadecimal 0xFFFF) for measurement data defines that no valid measurement has been performed (e.g. deactivated channel).

* if communicating through a fieldbus-gateway *Anybus Communicator* no checksum is required. The checksum is calculated by the fieldbus-gateway itself and the transmitted to together with the requested command data to the analyzer.

2.5.5 Command: 0x0012 - Send measurement data (6 sensors, 10 channels)

COMMAND LENGTH

2 words (not counting CRC16)

DESCRIPTION

Command to read current readings. For each channel (max. 10 channels) the last 6 measured and saved gas component values are transmitted.

Conversion factor (CF) und decimal place (DP):

Some values must be converted with a conversion factor and to display them in the given unit the number of decimal places after the comma must be observed.

Example: CH₄ - CF: 0.01 DP: 2

- transmitted value of 4921

- converted value: $4921 \cdot 0.01 = 49.21$

- output with 2 decimal places: 49.21 Vol%

Version firmware: V1.02 and newer

Version fieldbus-gateway: V2.06 and newer

COMMAND REQUEST

Word	Value (hexadecimal)	Description
1	0x0001	length of request no. of words following this word (not counting checksum)
2	0x0012	command
3*	calculated	check sum CRC16 (see comment below)

Example for a command request (byte wise hexadecimal notation, bytes of words are "swapped" -> Little-Endian-Format):

0x01 0x00 0x12 0x00 (0x0D 0x10*)

* if communicating through a fieldbus-gateway *Anybus Communicator* no checksum is required. The checksum is calculated by the fieldbus-gateway itself and the transmitted to together with the requested command data to the analyzer.

COMMAND RESPONSE

→see following page

COMMAND RESPONSE

Word	Value (hexadecimal)	Description			
1	0x003E	length of request no. of words following this word (not counting checksum)			
2	0x0012	command			
3	variable	measurement data channel 1 – CH ₄	CF: 0.01	DP: 2	unit: Vol%
4	variable	measurement data channel 1 – CO ₂	CF: 0.01	DP: 2	unit: Vol%
5	variable	measurement data channel 1 – O ₂	CF: 0.01	DP: 2	unit: Vol%
6	variable	measurement data channel 1 – H ₂ S	CF: ---	DP: 0	unit: ppm
7	variable	measurement data channel 1 – H ₂	CF: ---	DP: 0	unit: ppm
8	variable	measurement data channel 1 – O ₂ (paramag.)	CF: 0.01	DP: 2	unit: Vol%
9	variable	measurement data channel 2 – CH ₄	CF: 0.01	DP: 2	unit: Vol%
10	variable	measurement data channel 2 – CO ₂	CF: 0.01	DP: 2	unit: Vol%
11	variable	measurement data channel 2 – O ₂	CF: 0.01	DP: 2	unit: Vol%
12	variable	measurement data channel 2 – H ₂ S	CF: ---	DP: 0	unit: ppm
13	variable	measurement data channel 2 – H ₂	CF: ---	DP: 0	unit: ppm
14	variable	measurement data channel 2 – O ₂ (paramag.)	CF: 0.01	DP: 2	unit: Vol%
15	variable	measurement data channel 3 – CH ₄	CF: 0.01	DP: 2	unit: Vol%
16	variable	measurement data channel 3 – CO ₂	CF: 0.01	DP: 2	unit: Vol%
17	variable	measurement data channel 3 – O ₂	CF: 0.01	DP: 2	unit: Vol%
18	variable	measurement data channel 3 – H ₂ S	CF: ---	DP: 0	unit: ppm
19	variable	measurement data channel 3 – H ₂	CF: ---	DP: 0	unit: ppm
20	variable	measurement data channel 3 – O ₂ (paramag.)	CF: 0.01	DP: 2	unit: Vol%
21	variable	measurement data channel 4 – CH ₄	CF: 0.01	DP: 2	unit: Vol%
22	variable	measurement data channel 4 – CO ₂	CF: 0.01	DP: 2	unit: Vol%
23	variable	measurement data channel 2 – O ₂	CF: 0.01	DP: 2	unit: Vol%
24	variable	measurement data channel 4 – H ₂ S	CF: ---	DP: 0	unit: ppm
25	variable	measurement data channel 4 – H ₂	CF: ---	DP: 0	unit: ppm
26	variable	measurement data channel 4 – O ₂ (paramag.)	CF: 0.01	DP: 2	unit: Vol%
27	variable	measurement data channel 5 – CH ₄	CF: 0.01	DP: 2	unit: Vol%
28	variable	measurement data channel 5 – CO ₂	CF: 0.01	DP: 2	unit: Vol%
29	variable	measurement data channel 5 – O ₂	CF: 0.01	DP: 2	unit: Vol%
30	variable	measurement data channel 5 – H ₂ S	CF: ---	DP: 0	unit: ppm
31	variable	measurement data channel 5 – H ₂	CF: ---	DP: 0	unit: ppm

32	variable	measurement data channel 5 – O ₂ (paramag.)	CF: 0.01	DP: 2	unit: Vol%
33	variable	measurement data channel 6 – CH ₄	CF: 0.01	DP: 2	unit: Vol%
34	variable	measurement data channel 6 – CO ₂	CF: 0.01	DP: 2	unit: Vol%
35	variable	measurement data channel 6 – O ₂	CF: 0.01	DP: 2	unit: Vol%
36	variable	measurement data channel 6 – H ₂ S	CF: ---	DP: 0	unit: ppm
37	variable	measurement data channel 6 – H ₂	CF: ---	DP: 0	unit: ppm
38	variable	measurement data channel 6 – O ₂ (paramag.)	CF: 0.01	DP: 2	unit: Vol%
39	variable	measurement data channel 7 – CH ₄	CF: 0.01	DP: 2	unit: Vol%
40	variable	measurement data channel 7 – CO ₂	CF: 0.01	DP: 2	unit: Vol%
41	variable	measurement data channel 7 – O ₂	CF: 0.01	DP: 2	unit: Vol%
42	variable	measurement data channel 7 – H ₂ S	CF: ---	DP: 0	unit: ppm
43	variable	measurement data channel 7 – H ₂	CF: ---	DP: 0	unit: ppm
44	variable	measurement data channel 7 – O ₂ (paramag.)	CF: 0.01	DP: 2	unit: Vol%
45	variable	measurement data channel 8 – CH ₄	CF: 0.01	DP: 2	unit: Vol%
46	variable	measurement data channel 8 – CO ₂	CF: 0.01	DP: 2	unit: Vol%
47	variable	measurement data channel 8 – O ₂	CF: 0.01	DP: 2	unit: Vol%
48	variable	measurement data channel 8 – H ₂ S	CF: ---	DP: 0	unit: ppm
49	variable	measurement data channel 8 – H ₂	CF: ---	DP: 0	unit: ppm
50	variable	measurement data channel 8 – O ₂ (paramag.)	CF: 0.01	DP: 2	unit: Vol%
51	variable	measurement data channel 9 – CH ₄	CF: 0.01	DP: 2	unit: Vol%
52	variable	measurement data channel 9 – CO ₂	CF: 0.01	DP: 2	unit: Vol%
53	variable	measurement data channel 9 – O ₂	CF: 0.01	DP: 2	unit: Vol%
54	variable	measurement data channel 9 – H ₂ S	CF: ---	DP: 0	unit: ppm
55	variable	measurement data channel 9 – H ₂	CF: ---	DP: 0	unit: ppm
56	variable	measurement data channel 9 – O ₂ (paramag.)	CF: 0.01	DP: 2	unit: Vol%
57	variable	measurement data channel 10 – CH ₄	CF: 0.01	DP: 2	unit: Vol%
58	variable	measurement data channel 10 – CO ₂	CF: 0.01	DP: 2	unit: Vol%
59	variable	measurement data channel 10 – O ₂	CF: 0.01	DP: 2	unit: Vol%
60	variable	measurement data channel 10 – H ₂ S	CF: ---	DP: 0	unit: ppm
61	variable	measurement data channel 10 – H ₂	CF: ---	DP: 0	unit: ppm
62	variable	measurement data channel 10 – O ₂ (paramag.)	CF: 0.01	DP: 2	unit: Vol%

63	variable	status 0 = OK, 1 = warmup -1 = message, -2 = error (fatal), -3 = sensor error, -4 = device error, -5 = calibration error, -6 = service-request More information on error "-3" - "-6" can be found in the document "Errors and Service messages".
64*	calculated	check sum CRC16 (see comment below)

A value of -1 (hexadecimal 0xFFFF) for measurement data defines that no valid measurement has been performed (e .g. deactivated channel).

* if communicating through a fieldbus-gateway *Anybus Communicator* no checksum is required. The checksum is calculated by the fieldbus-gateway itself and the transmitted to together with the requested command data to the analyzer.

2.5.6 Command: 0x0014 - Send meas. and process data (6 sensors, 10 channels)

COMMAND LENGTH

2 words (not counting CRC16)

DESCRIPTION

Command to read current readings. For each channel (max. 10 channels) the last 6 measured and saved gas component values are transmitted.

In addition to command structure 0x0012 the current process data is transmitted (command 0x0019).

Conversion factor (CF) und decimal place (DP):

- see command 0x0012

Version firmware: V1.06 and newer

Version fieldbus-gateway: V2.10 and newer

COMMAND REQUEST

Word	Value (hexadecimal)	Description
1	0x0001	length of request no. of words following this word (not counting checksum)
2	0x0014	command
3*	calculated	check sum CRC16 (see comment below)

Example for a command request (byte wise hexadecimal notation, bytes of words are “swapped “ -> Little-Endian-Format):

0x01 0x00 0x14 0x00 (0x0E 0xB0*)

* if communicating through a fieldbus-gateway *Anybus Communicator* no checksum is required. The checksum is calculated by the fieldbus-gateway itself and the transmitted to together with the requested command data to the analyzer.

BEFEHLSANTWORT

→siehe nächste Seite

COMMAND RESPONSE

Word	Value (hexadecimal)	Description			
1	0x0075	length of request no. of words following this word (not counting checksum)			
2	0x0014	command			
3	variable	Measurement data channel 1 – CH ₄	CF: 0.01	DP: 2	unit: Vol%
4	variable	measurement data channel 1 – CO ₂	CF: 0.01	DP: 2	unit: Vol%
5	variable	measurement data channel 1 – O ₂	CF: 0.01	DP: 2	unit: Vol%
6	variable	measurement data channel 1 – H ₂ S	CF: ---	DP: 0	unit: ppm
7	variable	measurement data channel 1 – H ₂	CF: ---	DP: 0	unit: ppm
8	variable	measurement data channel 1 – O ₂ (paramag.)	CF: 0.01	DP: 2	unit: Vol%
9	variable	measurement data channel 2 – CH ₄	CF: 0.01	DP: 2	unit: Vol%
10	variable	measurement data channel 2 – CO ₂	CF: 0.01	DP: 2	unit: Vol%
11	variable	measurement data channel 2 – O ₂	CF: 0.01	DP: 2	unit: Vol%
12	variable	measurement data channel 2 – H ₂ S	CF: ---	DP: 0	unit: ppm
13	variable	measurement data channel 2 – H ₂	CF: ---	DP: 0	unit: ppm
14	variable	measurement data channel 2 – O ₂ (paramag.)	CF: 0.01	DP: 2	unit: Vol%
15	variable	measurement data channel 3 – CH ₄	CF: 0.01	DP: 2	unit: Vol%
16	variable	measurement data channel 3 – CO ₂	CF: 0.01	DP: 2	unit: Vol%
17	variable	measurement data channel 3 – O ₂	CF: 0.01	DP: 2	unit: Vol%
18	variable	measurement data channel 3 – H ₂ S	CF: ---	DP: 0	unit: ppm
19	variable	measurement data channel 3 – H ₂	CF: ---	DP: 0	unit: ppm
20	variable	measurement data channel 3 – O ₂ (paramag.)	CF: 0.01	DP: 2	unit: Vol%
21	variable	measurement data channel 4 – CH ₄	CF: 0.01	DP: 2	unit: Vol%
22	variable	measurement data channel 4 – CO ₂	CF: 0.01	DP: 2	unit: Vol%
23	variable	measurement data channel 4 – O ₂	CF: 0.01	DP: 2	unit: Vol%
24	variable	measurement data channel 4 – H ₂ S	CF: ---	DP: 0	unit: ppm
25	variable	measurement data channel 4 – H ₂	CF: ---	DP: 0	unit: ppm
26	variable	measurement data channel 4 – O ₂ (paramag.)	CF: 0.01	DP: 2	unit: Vol%
27	variable	measurement data channel 5 – CH ₄	CF: 0.01	DP: 2	unit: Vol%
28	variable	measurement data channel 5 – CO ₂	CF: 0.01	DP: 2	unit: Vol%
29	variable	measurement data channel 5 – O ₂	CF: 0.01	DP: 2	unit: Vol%
30	variable	measurement data channel 5 – H ₂ S	CF: ---	DP: 0	unit: ppm
31	variable	measurement data channel 5 – H ₂	CF: ---	DP: 0	unit: ppm

32	variable	measurement data channel 5 – O ₂ (paramag.)	CF: 0.01	DP: 2	unit: Vol%
33	variable	measurement_data channel 6 – CH ₄	CF: 0.01	DP: 2	unit: Vol%
34	variable	measurement data channel 6 – CO ₂	CF: 0.01	DP: 2	unit: Vol%
35	variable	measurement data channel 6 – O ₂	CF: 0.01	DP: 2	unit: Vol%
36	variable	measurement data channel 6 – H ₂ S	CF: ---	DP: 0	unit: ppm
37	variable	measurement data channel 6 – H ₂	CF: ---	DP: 0	unit: ppm
38	variable	measurement data channel 6 – O ₂ (paramag.)	CF: 0.01	DP: 2	unit: Vol%
39	variable	measurement_data channel 7 – CH ₄	CF: 0.01	DP: 2	unit: Vol%
40	variable	measurement data channel 7 – CO ₂	CF: 0.01	DP: 2	unit: Vol%
41	variable	measurement data channel 7 – O ₂	CF: 0.01	DP: 2	unit: Vol%
42	variable	measurement data channel 7 – H ₂ S	CF: ---	DP: 0	unit: ppm
43	variable	measurement data channel 7 – H ₂	CF: ---	DP: 0	unit: ppm
44	variable	measurement data channel 7 – O ₂ (paramag.)	CF: 0.01	DP: 2	unit: Vol%
45	variable	measurement_data channel 8 – CH ₄	CF: 0.01	DP: 2	unit: Vol%
46	variable	measurement data channel 8 – CO ₂	CF: 0.01	DP: 2	unit: Vol%
47	variable	measurement data channel 8 – O ₂	CF: 0.01	DP: 2	unit: Vol%
48	variable	measurement data channel 8 – H ₂ S	CF: ---	DP: 0	unit: ppm
49	variable	measurement data channel 8 – H ₂	CF: ---	DP: 0	unit: ppm
50	variable	measurement data channel 8 – O ₂ (paramag.)	CF: 0.01	DP: 2	unit: Vol%
51	variable	measurement_data channel 9 – CH ₄	CF: 0.01	DP: 2	unit: Vol%
52	variable	measurement data channel 9 – CO ₂	CF: 0.01	DP: 2	unit: Vol%
53	variable	measurement data channel 9 – O ₂	CF: 0.01	DP: 2	unit: Vol%
54	variable	measurement data channel 9 – H ₂ S	CF: ---	DP: 0	unit: ppm
55	variable	measurement data channel 9 – H ₂	CF: ---	DP: 0	unit: ppm
56	variable	measurement data channel 9 – O ₂ (paramag.)	CF: 0.01	DP: 2	unit: Vol%
57	variable	measurement_data channel 10 – CH ₄	CF: 0.01	DP: 2	unit: Vol%
58	variable	measurement data channel 10 – CO ₂	CF: 0.01	DP: 2	unit: Vol%
59	variable	measurement data channel 10 – O ₂	CF: 0.01	DP: 2	unit: Vol%
60	variable	measurement data channel 10 – H ₂ S	CF: ---	DP: 0	unit: ppm
61	variable	measurement data channel 10 – H ₂	CF: ---	DP: 0	unit: ppm
62	variable	measurement data channel 10 – O ₂ (paramag.)	CF: 0.01	DP: 2	unit: Vol%

63	variable	status 0 = OK, 1 = warmup -1 = message, -2 = error (fatal), -3 = sensor error, -4 = device error, -5 = calibration error, -6 = service-request More information on error "-3" - "-6" can be found in the document "Errors and Service messages".
64	variable	calibration status 1 = calibration active 0 = calibration NOT active (measuring, warmup, etc.)
65	variable	online data I <i>for INCAs with continuous measurement config. (odd T-no., e. g. T101)</i> 1 = measurement data of continuously measured sensors of active channel is online and updated <i>for INCAs with discontinuous measurement config. (even T-no., e. g. T100)</i> 1 = measurement data of all sensors of active channel is online and updated
66	variable	online data II <i>only for INCAs with continuous measurement config. (odd T-no., e. g. T101)</i> 1 = measurement data of discontinuously measured sensors of active channel is online and updated
67	variable	state of INCA process gas analyzer 0=warmup, 1=purge with gas, 2=drain condensate, 3=measurement, 4=changing channel, 5=calibration purge gas, 6=calibration gas I, 7=calibration gas II, 8=test mode, 9= stop mode, 10=error (fatal error, analyzer stopped)
68	variable	seconds in state time in seconds since last state change (→ see word 6)
69	variable	seconds till next state change time in seconds until next state change (→ see word 6) REMARK: for INCAs with continuous measurement config. this value is set to zero
70	variable	seconds till discontinuous data time in seconds until discontinuous measured sensors are updated
71	variable	active channel currently measuring channel (valid range: 1-10)
72	variable	EC-measurement not active In current measurement cycle the EC-measurement (z. B. H ₂ S) is skipped 1=measurement is skipped triggered by command 0x0035 or through INCACtrl setting "skip H ₂ S-measurement" (data from last measurement is output until next measurement)
73	variable	µPulse stable µPulse-system is stabilized. If data is online and updated (→ see words 4 and 5) the current value is output. To validate functionality of µPulse-system
74	variable	fatal error error code for fatal error, if set (→ see word 6)
75	variable	sensor-error (first sensor is output first) (0=no error) 1=CO ₂ , 2=CH ₄ , 3=H ₂ S, 4=O ₂ (EC), 5=H ₂ , 6=O ₂ (Para.), 7=SG, 8=CH ₄ , 9=C ₂ +
76	variable	sensor-error code Error code to previous sensor-error (→ see word 14) <i>Exception:</i> If sensor-error is set, but code is 0, then sensor could not be activated on startup
77	variable	slave-error (0=no error) 1=IO, 2=Flow, 3=B-IO
78	variable	slave-error code Error code to previous slave-error (→ see word 16) <i>Exception:</i> If slave-error is set, bur code is 0, then slave could not be activated on startup.
79	variable	Calibration error – error encoded bitwise (if bit=1 → error) bit 0: error "Cal. Flow Gas" – no flow of calibration gas during last calibration bit 1: error "Cal. Flow Air" – no flow of ambient air during last calibration bit 2: error "Cal. setting" – wrong calibration settings (wrong gas) bit 3: error "Cal. time" – Zero-point calibration is requested first

80	variable	sensor „Cal. setting“ – sensor causing the error bitwise encoded (if bit=1 → error) → see next data set (→ see word 20)
81	variable	sensor „Cal. time“ – sensor causing the error bitwise encoded (if bit=1 → error) bit 0: CO ₂ , bit 1: CH ₄ , bit 2: H ₂ S, bit 3: O ₂ (EC), bit 4: H ₂ , bit 5: O ₂ (par.), bit 6: SG, bit 7: CH ₄ , bit 8: C ₂ +
82	variable	runtime error - bitwise encoded (if bit=1 → error) bit 0: error “Flow Gas” – no gas flow (process or calibration gas) bit 1: error “Flow Air” – no air flow (ambient air) bit 2: error “PWM IR1” – error heater control NDIR1 bit 3: error “Tmp. IR1” – error temperature NDIR1 bit 4: error “AD IR1” – error heater stability NDIR1 bit 5: error “PWM IR2” – error heater control NDIR2 bit 6: error “Tmp. IR2” – error temperature NDIR2 bit 7: error “AD IR2” – error heater stability NDIR2 bit 8: error “Tmp. cool” – error temperature gas cooler bit 9: error “PWM cool” – error cooler control gas cooler bit 10: error “Tmp. case” – error temperature enclosure bit 11: error “PWM PI-1” – error PI-control 1 (e. g. enclosure heater) bit 12: error “PWM PI-2” – error PI-control 2 (e. g. enclosure heater)
83	variable	service-request “calibration sensor” (1) if >0, then calibration requested for sensor (→ see display output)
84	variable	service-request “calibration sensor” (2) if >0, then calibration requested for sensor (→ see display output)
85	variable	service-request “usage sensor” (1) if >0, then sensor signal is too low (→ see display output)
86	variable	service-request “age sensor” (1) if >0, then sensor age has been reached (→ see display output)
87	variable	service-request “check” (1) if >0, then a visual inspection should be performed (→ see manual)
88	variable	“Startup-Mode” active “Startup-Mode” activated through command 0x0035. All measurement data is updated and output at all times
89	variable	“Sensor Overload”-Alarm Out of range measurement on given channel value > 0 (1-10) = alarm for channel „value“ 0 = no alarm active With this alarm „sensor-error“ (→ see word 14) is set with the notifying sensor
90	variable	Test measurement 0 = no test measurement active 1 = test measurement through purge gas input 2 = test measurement through cal. gas input 1 3 = test measurement through cal. gas input 2
91	variable	Pressure for air-pump (in mbar); if P1 available, value >0, when pump running; invalid code (e.g. no pump or flow-detection): -32.0 +-0.1
92	variable	Pressure for gas-pump (in mbar); if P2 available, value >0, when pump running; invalid code (e.g. no pump or flow-detection): -32.0 +-0.1
93	- variable	RESERVE – to be defined
118		
119*	calculated	check sum CRC16 (see comment below)

* if communicating through a fieldbus-gateway *Anybus Communicator* no checksum is required. The checksum is calculated by the fieldbus-gateway itself and the transmitted to together with the requested command data to the analyzer.

2.5.7 Command: 0x0016 - Read age of measurement data (10 channels)

COMMAND LENGTH

2 words (not counting CRC16)

DESCRIPTION

Command to read the age of each measurement for every channel

Version firmware: V1.02 and newer

Version fieldbus-gateway: V2.06 and newer

COMMAND REQUEST

Word	Value (hexadecimal)	Description
1	0x0001	length of request no. of words following this word (not counting checksum)
2	0x0016	command
3*	calculated	check sum CRC16 (see comment below)

Example for a command request (byte wise hexadecimal notation, bytes of words are “swapped “ -> Little-Endian-Format):

2-words-command: 0x01 0x00 0x16 0x00 (0x0F 0xD0*)

* if communicating through a fieldbus-gateway *Anybus Communicator* no checksum is required. The checksum is calculated by the fieldbus-gateway itself and the transmitted to together with the requested command data to the analyzer.

COMMAND RESPONSE

Word	Value (hexadecimal)	Description
1	0x000B	length of request no. of words following this word (not counting checksum)
2	0x0016	command
3	variable	data channel 1 age of measurement data in minutes
4	variable	data channel 2 age of measurement data in minutes
...	...	...
12	variable	data channel 10 age of measurement data in minutes
13*	calculated	check sum CRC16 (see comment below)

* if communicating through a fieldbus-gateway *Anybus Communicator* no checksum is required. The checksum is calculated by the fieldbus-gateway itself and the transmitted to together with the requested command data to the analyzer.

2.5.8 Command: 0x0017 - Read messages and errors

COMMAND LENGTH

2 words (not counting CRC16)

DESCRIPTION

Read the last 10 messages and errors from the event list.

Example: Error no. (dec.) : 785
 Error no. (hex.) : 0x0311
 Description : min. pressure not reached, check pump and pressure at input

Version firmware: V1.02 and newer

Version fieldbus-gateway: V2.06 and newer

COMMAND REQUEST

Word	Value (hexadecimal)	Description
1	0x0001	length of request no. of words following this word (not counting checksum)
2	0x0017	command
3*	calculated	check sum CRC16 (see comment below)

Example for a command request (byte wise hexadecimal notation, bytes of words are “swapped “ -> Little-Endian-Format):

0x01 0x00 0x17 0x00 (0x0E 0x40*)

* if communicating through a fieldbus-gateway *Anybus Communicator* no checksum is required. The checksum is calculated by the fieldbus-gateway itself and the transmitted to together with the requested command data to the analyzer.

COMMAND RESPONSE

Word	Value (hexadecimal)	Description
1	0x000B	length of request no. of words following this word (not counting checksum)
2	0x0017	command
3	variable	message or error code (0x0000 = no message or error) last 10 messages or errors from oldest to newest
4	variable	message or error code (0x0000 = no message or error) last 10 messages or errors from oldest to newest
...	...	...
12	variable	message or error code (0x0000 = no message or error) last 10 messages or errors from oldest to newest
13*	calculated	check sum CRC16 (see comment below)

* if communicating through a fieldbus-gateway *Anybus Communicator* no checksum is required. The checksum is calculated by the fieldbus-gateway itself and the transmitted to together with the requested command data to the analyzer.

2.5.9 Command: 0x0019 - Read process data

COMMAND LENGTH

2 words (not counting CRC16)

DESCRIPTION

Command to read current process data information of analyzer.

Version firmware: V1.10 und newer

Version fieldbus-gateway: V2.10 und newer

COMMAND REQUEST

Word	Value (hexadecimal)	Description
1	0x0001	length of request no. of words following this word (not counting checksum)
2	0x0019	Command
3*	calculated	check sum CRC16 (see comment below)

Example for a command request (byte wise hexadecimal notation, bytes of words are “swapped “ -> Little-Endian-Format):

0x01 0x00 0x19 0x00 (0x0A 0x20*)

* if communicating through a fieldbus-gateway *Anybus Communicator* no checksum is required. The checksum is calculated by the fieldbus-gateway itself and the transmitted to together with the requested command data to the analyzer.

COMMAND RESPONSE

→see following page

COMMAND RESPONSE

Word	Value (hexadecimal)	Description
1	0x002A	length of request no. of words following this word (not counting checksum)
2	0x0019	Command
3	variable	calibration status 1 = calibration active 0 = calibration NOT active (measuring, warmup, etc.)
4	variable	online data I <i>for INCAs with continuous measurement config. (odd T-no., e. g. T101)</i> 1 = measurement data of continuously measured sensors of active channel is online and updated <i>for INCAs with discontinuous measurement config. (even T-no., e. g. T100)</i> 1 = measurement data of all sensors of active channel is online and updated
5	variable	online data II <i>only for INCAs with continuous measurement config. (odd T-no., e. g. T101)</i> 1 = measurement data of discontinuously measured sensors of active channel is online and updated
6	variable	state of INCA process gas analyzer 0=warmup, 1=purge with gas, 2=drain condensate, 3=measurement, 4=changing channel, 5=calibration purge gas, 6=calibration gas I, 7=calibration gas II, 8=test mode, 9= stop mode, 10=error (fatal error, analyzer stopped)
7	variable	seconds in state time in seconds since last state change (→ see word 6)
8	variable	seconds till next state change time in seconds until next state change (→ see word 6) REMARK: for INCAs with continuous measurement config. this value is set to zero
9	variable	seconds till discontinuous data time in seconds until discontinuous measured sensors are updated
10	variable	active channel currently measuring channel (valid range: 1-10)
11	variable	EC-measurement not active In current measurement cycle the EC-measurement (z. B. H ₂ S) is skipped 1=measurement is skipped triggered by command 0x0035 or through INCACtrl setting "skip H ₂ S-measurement" (data from last measurement is output until next measurement)
12	variable	μPulse stable μPulse-system is stabilized. If data is online and updated (→ see words 4 and 5) the current value is output. To validate functionality of μPulse-system
13	variable	fatal error error code for fatal error, if set (→ see word 6)
14	variable	sensor-error (first sensor is output first) (0=no error) 1=CO ₂ , 2=CH ₄ , 3=H ₂ S, 4=O ₂ (EC), 5=H ₂ , 6=O ₂ (Para.), 7=SG, 8=CH ₄ , 9=C ₂ +
15	variable	sensor-error code Error code to previous sensor-error (→ see word 14) <i>Exception:</i> If sensor-error is set, but code is 0, then sensor could not be activated on startup
16	variable	slave-error (0=no error) 1=IO, 2=Flow, 3=B-IO
17	variable	slave-error code Error code to previous slave-error (→ see word 16) <i>Exception:</i> If slave-error is set, bur code is 0, then slave could not be activated on startup.

18	variable	Calibration error – error encoded bitwise (if bit=1 → error) bit 0: error “Cal. Flow Gas” – no flow of calibration gas during last calibration bit 1: error “Cal. Flow Air” – no flow of ambient air during last calibration bit 2: error “Cal. setting” – wrong calibration settings (wrong gas) bit 3: error “Cal. time” – Zero-point calibration is requested first
19	variable	sensor „Cal. setting“ – sensor causing the error bitwise encoded (if bit=1 → error) → <i>see next data set</i> (→ <i>see word 20</i>)
20	variable	sensor „Cal. time“ – sensor causing the error bitwise encoded (if bit=1 → error) bit 0: CO ₂ , bit 1: CH ₄ , bit 2: H ₂ S, bit 3: O ₂ (EC), bit 4: H ₂ , bit 5: O ₂ (par.), bit 6: SG, bit 7: CH ₄ , bit 8: C ₂ +
21	variable	runtime error - bitwise encoded (if bit=1 → error) bit 0: error “Flow Gas” – no gas flow (process or calibration gas) bit 1: error “Flow Air” – no air flow (ambient air) bit 2: error “PWM IR1” – error heater control NDIR1 bit 3: error “Tmp. IR1” – error temperature NDIR1 bit 4: error “AD IR1” – error heater stability NDIR1 bit 5: error “PWM IR2” – error heater control NDIR2 bit 6: error “Tmp. IR2” – error temperature NDIR2 bit 7: error “AD IR2” – error heater stability NDIR2 bit 8: error “Tmp. cool” – error temperature gas cooler bit 9: error “PWM cool” – error cooler control gas cooler bit 10: error “Tmp. case” – error temperature enclosure bit 11: error “PWM PI-1” – error PI-control 1 (e. g. enclosure heater) bit 12: error “PWM PI-2” – error PI-control 2 (e. g. enclosure heater)
22	variable	service-request “calibration sensor” (1) if >0, then calibration requested for sensor (→ <i>see display output</i>)
23	variable	service-request “calibration sensor” (2) if >0, then calibration requested for sensor (→ <i>see display output</i>)
24	variable	service-request “usage sensor” (1) if >0, then sensor signal is too low (→ <i>see display output</i>)
25	variable	service-request “age sensor” (1) if >0, then sensor age has been reached (→ <i>see display output</i>)
26	variable	service-request “check” (1) if >0, then a visual inspection should be performed (→ <i>see manual</i>)
27	variable	“Startup-Mode” active “Startup-Mode” activated through command 0x0035. All measurement data is updated and output at all times
28	variable	“Sensor Overload”-Alarm Out of range measurement on given channel value > 0 (1-10) = alarm for channel „value“ 0 = no alarm active With this alarm „sensor-error“ (→ <i>see word 14</i>) is set with the notifying sensor
29	variable	Test measurement 0 = no test measurement active 1 = test measurement through purge gas input 2 = test measurement through cal. gas input 1 3 = test measurement through cal. gas input 2
30	variable	Pressure for air-pump (in mbar); if P1 available, value >0, when pump running; invalid code (e.g. no pump or flow-detection): -32.0 +-0.1
31	variable	Pressure for gas-pump (in mbar); if P2 available, value >0, when pump running; invalid code (e.g. no pump or flow-detection): -32.0 +-0.1
32-43	variable	RESERVE – to be defined
44	calculated	check sum CRC16 (see comment below)

* if communicating through a fieldbus-gateway *Anybus Communicator* no checksum is required. The checksum is calculated by the fieldbus-gateway itself and the transmitted to together with the requested command data to the analyzer.

2.5.10 Command: 0x0031 - Start measurement

COMMAND LENGTH

3 words (not counting CRC16)

DESCRIPTION

Command to start a measurement on a specific channel (channel switching) or to restart measurement when in stop mode. The requested channel is passed as a parameter.

- Channel
Channel to be measured

REMARK:

When issuing this command on a continuously configured device (at least one sensor is continuous), the analyzer will first switch to the purge state. Depending on the configuration this state may take several minutes until the system will start its measurement.

Version firmware: V1.02 und newer

Version fieldbus-gateway: V2.06 und newer

COMMAND REQUEST

Word	Value (hexadecimal)	Description
1	0x0002	length of request no. of words following this word (not counting checksum)
2	0x0031	command
3	variable	channel value between 0 and 9 (or maximum no. of available channels) 0= chnl. 1, 1=chnl. 2, ...
4*	calculated	check sum CRC16 (see comment below)

Example for a command request (byte wise hexadecimal notation, bytes of words are "swapped" -> Little-Endian-Format):

0x02 0x00 0x31 0x00 0x01 0x00 (0x0F 0x48*)

Start measurement: Channel 2

* if communicating through a fieldbus-gateway *Anybus Communicator* no checksum is required. The checksum is calculated by the fieldbus-gateway itself and the transmitted to together with the requested command data to the analyzer.

COMMAND RESPONSE

The request is always confirmed by the INCA process gas analyzer. With that confirmation it is possible to verify the success of the communication between the remote station and the INCA process gas analyzer.

2.5.11 Command: 0x0035 - Start measurement II (with options)

COMMAND LENGTH

9 words (not counting CRC16)

DESCRIPTION

Command to start a measurement on a specific channel (channel switching) or to restart measurement when in stop mode. Multiple parameters can be passed as options for the measurement:

- Channel:
Channel to be measured
- Channel change time:
Duration in minutes for pre-purging the analyzer and the sample gas pipes running to the analyzer with "fresh" process gas. If the sample point is several meters away, it is recommended to increase that value.
- Auto-Stop:
The "Auto-Stop"-function allows to start measurements and to automatically switch to Stop-Mode after a certain amount of measurements (discontinuous configurations) or after a specific time (continuous configurations). In Stop-Mode the system does not measure. Pumps- and sensor-lifetimes are increased and no process gas is used.
- EC-measurement:
Allows to trigger or prevent measurements using certain electrochemical sensors to increase sensor-lifetime. (valid for electrochemical H₂- and/or H₂S-sensor, in some configurations also O₂-sensors)
- Startup-Mode:
The "Startup-Mode" allows to start measurements updating the measured data at all times. No limitations for outputting data. Startup-Mode is automatically deactivated at the end of the measurement cycle.

Version firmware: V1.08 und newer

Version fieldbus-gateway: V2.10 und newer

COMMAND REQUEST

→see following page

COMMAND REQUEST

Word	Value (hexadecimal)	Description
1	0x0008	length of request no. of words following this word (not counting checksum)
2	0x0035	command
3	variable	channel value between 1 and 10 (or maximum no. of available channels) 1= chnl. 1, 2=chnl. 2, ...
4	variable	channel change time in minutes value between 1 and 30 REMARK: only valid for next requested measurement
5	variable	Auto-Stop of measurement (0 = no STOP requested) value between 0-240 - for cont. configurations: value in minutes - for disc. configurations: no. of measurements of all channels e. g. when 6 channels a no. of 6 would perform 1 measurement per channel and then go to Stop-Mode
6	variable	EC-measurement (H ₂ S and H ₂ ; O ₂ depends on configuration and setup) value 1 (ON) or 0 (OFF, skip the EC measurement) REMARK: only valid for next requested measurement
7	variable	Startup-Mode (1=active): for this requested measurement (incl. purging and channel change), all measurement data is updated on outputs at all times. REMARK: only valid for next requested measurement
8-9	variable	RESERVE – to be defined
10*	calculated	check sum CRC16 (see comment below)

Example for a command request (byte wise hexadecimal notation, bytes of words are “swapped “ -> Little-Endian-Format):

0x08 0x00 0x35 0x00 0x01 0x00 0x02 0x00 0x1E 0x00 0x01 0x00 0x00 0x00
0x00 0x00 0x00 0x00 (0x31 0x1D*)

Start measurement: 1 - channel 1
Channel change time: 2 - 2 minutes
Auto-Stop: 30 - after 30 minutes or after 30 measurements
EC-measurement: 1 - yes
Startup-Mode: 0 - no

* if communicating through a fieldbus-gateway *Anybus Communicator* no checksum is required. The checksum is calculated by the fieldbus-gateway itself and the transmitted to together with the requested command data to the analyzer.

COMMAND RESPONSE

The request is always confirmed by the INCA process gas analyzer. With that confirmation it is possible to verify the success of the communication between the remote station and the INCA process gas analyzer.

2.5.12 Command: 0x0036 - Stop measurement

COMMAND LENGTH

2 words (not counting CRC16)

DESCRIPTION

Command to stop measurement

After issuing the command the system will purge ambient air for 5 minutes and the turn off all valves (inputs) and turn of the pumps.

“Start measurement”-commands through H-Bus or display-menu, will restart the measurement.

Version firmware: V1.08 und newer

Version fieldbus-gateway: V2.06 und newer

COMMAND REQUEST

Word	Value (hexadecimal)	Description
1	0x0001	length of request no. of words following this word (not counting checksum)
2	0x0036	command
3*	calculated	check sum CRC16 (see comment below)

Example for a command request (byte wise hexadecimal notation, bytes of words are “swapped “ -> Little-Endian-Format):

0x01 0x00 0x36 0x00 (0x16 0x10*)

* if communicating through a fieldbus-gateway *Anybus Communicator* no checksum is required. The checksum is calculated by the fieldbus-gateway itself and the transmitted to together with the requested command data to the analyzer.

COMMAND RESPONSE

The request is always confirmed by the INCA process gas analyzer. With that confirmation it is possible to verify the success of the communication between the remote station and the INCA process gas analyzer.

2.5.13 Command: 0x0040 - Read firmware-version

COMMAND LENGTH

2 words (not counting CRC16)

DESCRIPTION

Read firmware version.

The returned value is formatted in a word (2 bytes).

Example:

A returned value of 100 is equivalent to version 1.00 (V1.00).

Version firmware: V1.02 und newer

Version fieldbus-gateway: V2.06 und newer

COMMAND REQUEST

Word	Value (hexadecimal)	Description
1	0x0001	length of request no. of words following this word (not counting checksum)
2	0x0040	command
3*	calculated	check sum CRC16 (see comment below)

Example for a command request (byte wise hexadecimal notation, bytes of words are “swapped “ -> Little-Endian-Format):

0x01 0x00 0x40 0x00 (0x30 0x70*)

* if communicating through a fieldbus-gateway *Anybus Communicator* no checksum is required. The checksum is calculated by the fieldbus-gateway itself and the transmitted to together with the requested command data to the analyzer.

COMMAND RESPONSE

Word	Value (hexadecimal)	Description
1	0x0002	length of request no. of words following this word (not counting checksum)
2	0x0040	command
3	variable	version firmware version encoded in one word – see example
4*	calculated	check sum CRC16 (see comment below)

* if communicating through a fieldbus-gateway *Anybus Communicator* no checksum is required. The checksum is calculated by the fieldbus-gateway itself and the transmitted to together with the requested command data to the analyzer.

2.5.14 Command: 0x0050 - Start calibration gas 1

COMMAND LENGTH

2 words (not counting CRC16)

DESCRIPTION

Starts a calibration on calibration gas input 1. The settings (gas concentration and calibration points) must be set with INCACtrl beforehand and stored in the analyzer.

Version firmware: V1.02 und newer

Version fieldbus-gateway: V2.06 und newer

COMMAND REQUEST

Word	Value (hexadecimal)	Description
1	0x0001	length of request no. of words following this word (not counting checksum)
2	0x0050	command
3*	calculated	check sum CRC16 (see comment below)

Example for a command request (byte wise hexadecimal notation, bytes of words are “swapped “ -> Little-Endian-Format):

0x01 0x00 0x50 0x00 (0x3D 0xB0*)

* if communicating through a fieldbus-gateway *Anybus Communicator* no checksum is required. The checksum is calculated by the fieldbus-gateway itself and the transmitted to together with the requested command data to the analyzer.

COMMAND RESPONSE

The request is always confirmed by the INCA process gas analyzer. With that confirmation it is possible to verify the success of the communication between the remote station and the INCA process gas analyzer.

2.5.15 Command: 0x0051 - Kalibrierabweichung lesen

COMMAND LENGTH

2 words (not counting CRC16)

DESCRIPTION

This command returns the zero-calibration drift and the last two span-calibration drifts together with the time of the last span-calibration in seconds.

Conversion factor (CF) und decimal place (DP):

- see command 0x0012

Example: zero-point drift: a returned value of 120 is equivalent to 1,2%

Version firmware: V1.02 und newer

Version fieldbus-gateway: V2.06 und newer

COMMAND REQUEST

Word	Value (hexadecimal)	Description
1	0x0001	length of request no. of words following this word (not counting checksum)
2	0x0051	command
3*	calculated	check sum CRC16 (see comment below)

Example for a command request (byte wise hexadecimal notation, bytes of words are "swapped" -> Little-Endian-Format):

0x01 0x00 0x51 0x00 (0x3C 0x20*)

* if communicating through a fieldbus-gateway *Anybus Communicator* no checksum is required. The checksum is calculated by the fieldbus-gateway itself and the transmitted to together with the requested command data to the analyzer.

COMMAND RESPONSE

→see following page

COMMAND RESPONSE

Word	Value (hexadecimal)	Description
1	0x0009	length of request no. of words following this word (not counting checksum)
2	0x0051	command
3 + 4	variable	Time of last span-calibration in seconds Time is returned as UNIX-time: seconds since 1.1.1970 00:00:00. A value of 0xFFFFFFFF shows, that no calibration has been performed
5	variable	drift zero CO ₂ zero-point drift – CO ₂ CF: 0.01
6	variable	1 st drift span CO ₂ last span drift – CO ₂ CF: 0.01
7	variable	2 nd drift span CO ₂ 2 nd last span drift – CO ₂ CF: 0.01
8	variable	drift zero CH ₄ zero-point drift – CH ₄ CF: 0.01
9	variable	1 st drift span CH ₄ last span drift – CH ₄ CF: 0.01
10	variable	2 nd drift span CH ₄ 2 nd last span drift – CH ₄ CF: 0.01
11*	calculated	check sum CRC16 (see comment below)

* if communicating through a fieldbus-gateway *Anybus Communicator* no checksum is required. The checksum is calculated by the fieldbus-gateway itself and the transmitted to together with the requested command data to the analyzer.

2.5.16 Command: 0x0052 - Start calibration gas 2

COMMAND LENGTH

2 words (not counting CRC16)

DESCRIPTION

Starts a calibration on calibration gas input 2. The settings (gas concentration and calibration points) must be set with INCACtrl beforehand and stored in the analyzer.

Version firmware: V1.02 und newer

Version fieldbus-gateway: V2.06 und newer

COMMAND REQUEST

Word	Value (hexadecimal)	Description
1	0x0001	length of request no. of words following this word (not counting checksum)
2	0x0052	command
3*	calculated	check sum CRC16 (see comment below)

Example for a command request (byte wise hexadecimal notation, bytes of words are “swapped “ -> Little-Endian-Format):

0x01 0x00 0x52 0x00 (0x3C 0xD0*)

* if communicating through a fieldbus-gateway *Anybus Communicator* no checksum is required. The checksum is calculated by the fieldbus-gateway itself and the transmitted to together with the requested command data to the analyzer.

COMMAND RESPONSE

The request is always confirmed by the INCA process gas analyzer. With that confirmation it is possible to verify the success of the communication between the remote station and the INCA process gas analyzer.

2.5.17 Command: 0x0053 - Start calibration purge gas

COMMAND LENGTH

2 words (not counting CRC16)

DESCRIPTION

Starts a calibration on calibration purge gas input. The settings (gas concentration and calibration points) must be set with INCACtrl beforehand and stored in the analyzer – usually preset in factory.

Version firmware: V1.02 und newer

Version fieldbus-gateway: V2.06 und newer

COMMAND REQUEST

Word	Value (hexadecimal)	Description
1	0x0001	length of request no. of words following this word (not counting checksum)
2	0x0053	command
3*	calculated	check sum CRC16 (see comment below)

Example for a command request (byte wise hexadecimal notation, bytes of words are “swapped “ -> Little-Endian-Format):

0x01 0x00 0x53 0x00 (0x3D 0x40*)

* if communicating through a fieldbus-gateway *Anybus Communicator* no checksum is required. The checksum is calculated by the fieldbus-gateway itself and the transmitted to together with the requested command data to the analyzer.

COMMAND RESPONSE

The request is always confirmed by the INCA process gas analyzer. With that confirmation it is possible to verify the success of the communication between the remote station and the INCA process gas analyzer.

3 Caption symbols

Fatal



Highlights an operation or maintenance procedure, condition, statement, etc.

If not strictly observed, could result in injury, death, or long-term health hazards of personnel.

Warning



Highlights an operation or maintenance procedure, condition, statement, etc.

If not strictly observed, could result in injury, damage to or destruction of analyzer or loss of effectiveness.

Important



Highlights an essential operating procedure, condition, statement, etc.
