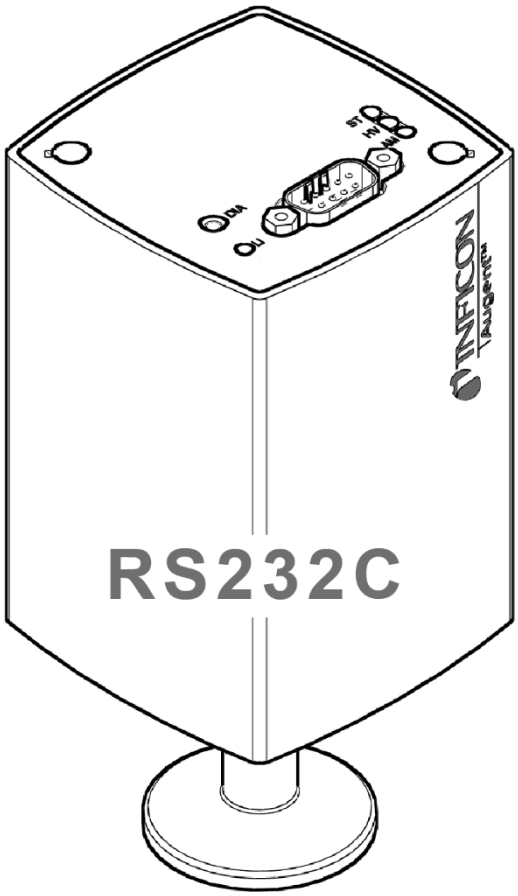
RS232C

Serial Interface

Augent™ OPG550



OPG550: P3 V02 Protocol and Commands

Product: Augent™ OPG550

Subject: P3 V02 Protocol and Commands

Appl. Version: OPG550_APPL_00.00.03

Content

1 Introduction

The serial interface allows the communication of the digital INFICON OPG550 Gauge with a PC or another appropriate controller.

2 Electrical connection

The RS232 communication is done via a 9D-Sub connection with a baudrate of 115200. The Pinouts of the 9D-Sub male connector is described in the manual TINB59.

3 Communication

3.1 Communication Mode

The communication between a master and a slave is done in master-slave and blocking mode. This means:

- There are no spontaneous messages from a slave to a master. A slave can only respond to requests from a master.
- It is not possible to process several requests at the same time. The master must always wait for the response of the slave until it sends the next request to the slave.

3.2 Message Frame

The exchange of data takes place with so-called message frames. A message frame has the following structure.

	Address	Device ID	Header					APDU						CRC	
Byte	0	1	2			3	4	5	6	7	8	9	10	10+n	10+n+1
Byte order	-	-	-	-	-	High Byte	Low Byte	-	High Byte	Low Byte	High Byte	Low Byte	-	Low Byte	High Byte
Bit	-	-	7 … 4	3 … 1	0	-	-	-	-	-	-	-	-	-	-
	ADDR	ID	VER	RES	ACK	LEN		CMD	PID		IDX		DATA	CRC	

ADDR	A distinction must be made between the following interfaces: • RS232: This byte is always 0x00 • RS485: This byte is set to the receiver address of this message frame.
ID	The device ID represents the INFICON device class. The following device classes are important for OPG550. • Master: The master has the Device ID 0x00 • OPG500 slave: The OPG550 slave has the Device ID 0x0B. The device ID is set to the the sender ID of this message frame.
HEADER.VER	This 4 bits holds the Protocol version. The version is 2.
HEADER.RES	This 3 bits are reserved and must be set to 0.
HEADER.ACK	This bit is the acknowledge bit of the previous message transfer. In concrete terms, this means that the ACK bit for frames sent by the master is always 0. The ACK bit for frames sent by the slave is always 1.
HEADER.LEN	Number of bytes in APDU (Application Protocol Data Unit).

<table>
<tr><td>APDU.CMD</td><td>This byte represents the command. The following commands are supported :
Read Request (0x01):
A Read Request is sent from the master to master slave.
Read Response (0x02):
A Read Response is sent from the slave to the master in case of a preceding Read Request.
Write Request (0x03):
A Write Request is sent from the master to master slave
Write Response (0x04):
A Write Response is sent from the slave to the master in case of a preceding Write Request.</td></tr>
<tr><td>APDU.PID</td><td>The PID is a unique number, which describes a certain parameter or command.</td></tr>
<tr><td>APDU.IDX</td><td>The Index can be used to support fragmented commands. However, this protocol does not support fragmented commands and must therefore always be set to 0x0000.</td></tr>
<tr><td>APDU.DATA</td><td>Data contains the user data. The number of bytes can be calculated as follows:
Number of Bytes = HEADER.LEN – 1 (APDU.CMD) – 2 (APDU.PID) – 2 (APDU.IDX)

Example:
We assume that a uint32_t value is to be transferred. The value is: 4’282’742’784 (0xFF457800). The Byte order is as follows :

<table>
<tr><td>Byte</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td></tr>
<tr><td>Values</td><td>IDX: Low Byte</td><td>0xFF</td><td>0x45</td><td>0x78</td><td>0x00</td><td>CRC: High Byte</td></tr>
</table>
</td></tr>
<tr><td>CRC</td><td>The CRC contains a 16-Bit CRC. It is calculated over the whole message (Address + Device ID + Header + APDU). The following must be taken into account:
CRC polynominal: 0x1021
CRC initial vaue: 0xFFFF
Input reflected: true
Result reflected: true
High and low byte are transmitted reverse order (Position 10+n: Low-Byte, Position 10+n+1 High-Byte).</td></tr>
</table>

3.3 Maximum Transmission Unit

The <Maximum Transmission Unit (MTU)> is the size of the largest <Message Frame> that can be transmitted in a single transaction. The protocol P3 V02 would allow a MTU of 65'542 bytes.

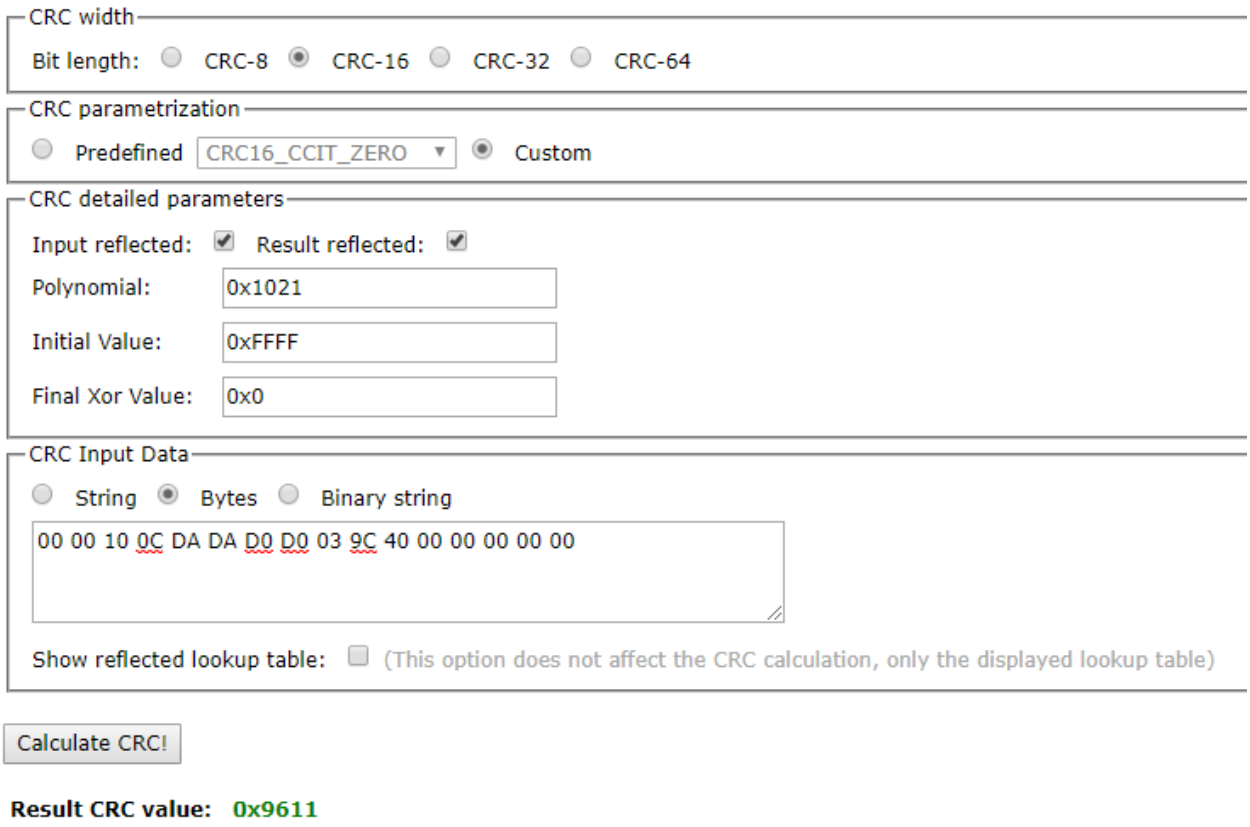
To save memory, the size of the <Response Message Frame> on the device was limited to 1224 bytes. That of the <Command Message Frames> was limited to 64.

4 CRC-Calculation

For the development of the protocol the following online CRC calculator can offer support.

www.sunshine2k.de/coding/javascript/crc/crc_js.html

For the P302 protocol the calcualtor has to be configured as follows:



5 Errors

5.1 Error list

If a communication error occurs during transmission the PID is set to 0xFFFF and an error byte is added. The following errors may occur.

Error Code	Short Description	Description
0	Application error.	For more information see the error history.
1	Access violation	This error occurs when a user wants to execute a command for which he has no rights.
2	Parameter out of limits	The parameter value to be written is outside the lower or upper limit.
3	Parameter not found	The parameter to be written or read does not exist.
4	Data length error	
5	Wrong password	The password is wrong.
6	Fatal EEPROM error	
7	Timeout	
8	-	-
9	Not in setup mode	
100	CRC	The checksum received does not match the one calculated internally.
101	Wrong command	The received command does not correspond to a READ REQUEST or a WRITE REQUEST (see APDU.CMD).
102	Acknowledge is set.	The acknowledge bit of the received message is set. However, it should not be set.
103	Acknowledge is not set	The acknowledge bit of the received message is not set. However, it should be set.
104	Wrong Protocol version	The protocol version received does not correspond to the internal protocol version.

5.2 Error History

In the case of an application error (Error Code 0) a more detailed error description can be found in the <Error History>.

The last N errors are stored in the <Error History>. N can be get with command *Get <Error History> size* (see chapter 9.2).

The number of errors stored in the <Error History> can be get with command *Get <Number of Errors>* (see chapter 9.3).

The error number, an error description and a possible solution can be get with the command *Get <Error>* (chapter 9.4).

6 Application

The following algorithms are implemented in the OPG550.

1. Spectrum Measurement (SPEC)
2. Leak Detection Rate of Rise (RoR)
3. Residual Gas Detection (RGD)

At the same time only one of the algorithms can be active.

6.1 Spectrum Measurement (SPEC)

The Algorithm does the following steps:

1. Get the current plasma status.
2. Switch the plasma off.
3. Measure the background spectrum.
4. Switch the plasma on.
5. Measure spectrum.
6. Calculate spectrum output.
7. Check for more spectra to measure. If so jump to 5. If not jump to 8.
8. Switch plasma on or off depending on the status on 1.

6.2 Leak Detection Rate of Rise (RoR)

The Algorithm does the following steps:

1. Get the current plasma status.
2. Switch plasma ON if OFF
3. Adjust integration time
4. Measure spectrum
5. Calculate spectrum output and Augent Numbers (Emission Slope Numbers)
6. Check for more spectra to measure. If so jump to 4. If not jump to 7
7. Switch plasma ON or OFF depending on the status on 1

6.3 Residual Gas Detection (RGD)

The Algorithm does the following steps:

1. Get the current plasma status.
2. Switch plasma ON if OFF
3. Adjust integration time
4. Switch the plasma OFF
5. Measure the background spectrum
6. Switch the plasma ON
7. Measure spectrum
8. Calculate spectrum output
9. Check for more spectra to measure. If so jump to 5. If not jump to 8
10. Switch plasma ON or OFF depending on the status on 1

6.4 Data Storage

Each algorithm X stores the last <N> records. N depends on the active algorithm and can be queried with the command <Get Buffer Size (X)> belonging to the algorithm X.

The command <Get Number of Spectra (X)> is used to get the captured number of spectra. The command <Get Meta Data (X)> is used to get the corresponding meta data (absolute time, delta time, integration time, …). The command <Get Spectrum (X)> can be used to read a specific wavelength range of a specific spectrum. If a new measurement is started all data will be deleted.

The following figure (Figure 1) shows the memory at time t = n.

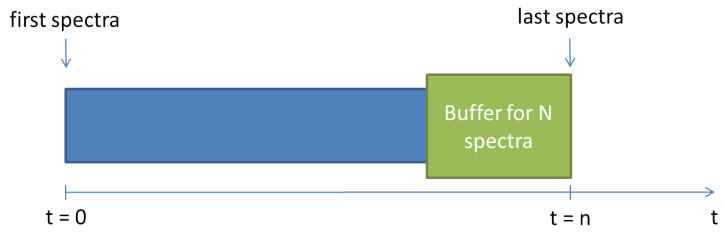


Figure 1: Memory at time t = n

The following figure (Figure 2) shows the memory situation at the time t = n + 1, after the recording of another spectrum.

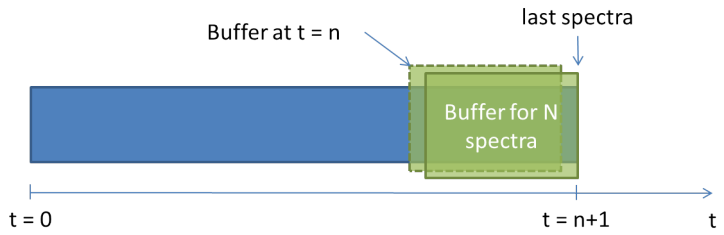


Figure 2: Memory at time t = n + 1

7 Command overview

PID	Description	Remark
General Information		
10000	Get Manufacturer Name	Read the manufacturer name of the device.
10001	Get Product Name	Read the product name of the device.
10002	Get Serial Number	Read the serial number of the device.
10003	Get Bootloader Version	Read the bootloader firmware version.
10004	Get Application Version	Read the application firmware version.
10005	Get SHA Number	Read the SHA number.
Stauts and Error		
11000	Get Self Diagnostic Status	Read the Self Diagnostic Status.
11001	Get Error History size	Read the size of the Error History buffer (maximum number of errors in Error History).
11002	Get Number of Errors	Read the number of errors stored in the error history.
11003	Get Error	Read the error.
11004	Clear Error History	Clear all errors in the Error History.
Plasma		
12000	Set Plasma Interlock ON or OFF	Activate or deactivate plasma interlock.
12001	Get Plasma Interlock State	Read the current state of the plasma interlock.
12002	Set Plasma ON or OFF	Activate or deactivate the plasma.
12003	Get Plasma State	Read the current state of the plasma.
Spectrometer		
13000	Get Number of Pixels	Read the number of pixels of the spectrometer.
13001	Get Wavelength	Read the wavelength of each pixel.
Total Pressure		
14000	Get Total Pressure	Read the total pressure value.

Operating Mode

19000	Get Mode	Read the current Operating Mode.
19001	Set Mode <Manaul>	Set Operating Mode to <Manaul>.
19002	Set Mode <Automatic SPEC>	Set Operating Mode to <Automatic SPEC>.
19003	Set Mode <Automatic ROR>	Set Operating Mode to <Automatic ROR>.
19004	Set Mode <Automatic RGD>	Set Operating Mode to <Automatic RGD>.

Spectrum Measurement (SPEC) Algorithm

20000	Set SPEC ON or OFF	Activate or deactivate the SPEC measurement.
20001	Get SPEC State	Read the current state of the SPEC measurement.
20002	Get SPEC buffer size	Read the size of the SPEC buffer (maximum number of SPEC SPEC records stored).
20003	Get number of SPEC records	Read the number SPEC records captured.
20004	Get SPEC record	Read a SPEC record.

Leak Detection Rate of Rise (RoR) Algorithm.

21000	Set Leak Detection RoR ON or OFF	Activate or deactivate the RoR measurement.
21001	Get Leak Detection RoR State	Read the current state of the RoR measurement.
21002	Get RoR buffer size	Read the size of the RoR buffer (maximum number of RoR records stored).
21003	Get number of RoR records	Read the number RoR records captured.
21004	Get RoR record	Read a RoR record.

Residual Gas Detection (RGD) Algorithm

22000	Set RGD ON or OFF	Activate or deactivate the RGD measurement.
22001	Get RGD State	Read the current state of the RGD measurement.
22002	Get RGD buffer size	Read the size of the RGD buffer (maximum number of RGD records stored).
22003	Get number of RGD records	Read the number RGD records captured.
22004	Get RGD record	Read a RGD record.

Analog Output

30000	Get Mode	Read current analog output mode.
30001	Get Voltage	Read current analog output target voltage.
30010	Set Mode <None>	Set analog output voltage to 0.0 V.
30011	Set Mode <Manual>	Set manual output voltage from 0 … 10 V.
30012	Set Mode <Total Pressure>	Set analog output voltage dependent on total pressure value.
30013	Set Mode <Total Pressure Switch>	Set analog output as switch function with two setpoints based on total pressure value.
30014	Set Mode <SPEC Power>	Set analog output voltage dependent on intensity signal at specific wavelength.
30015	Set Mode <SPEC Power Switch>	Set analog output as switch function with two setpoints based on intensity signal at specific wavelength.
30016	Set Mode <ROR Augent Number>	Set analog output voltage dependent on Augent number.
30017	Set Mode <ROR Augent Number Switch>	Set analog output as switch function with two setpoints based on Augent number.
30018	Set Mode <ROR Pressure Rise	Set analog output voltage dependent on the actual pressure rise value.
30019	Set Mode <ROR Pressure Rise Switch>	Set analog output as switch function with two setpoints based on actual pressure rise value.
30020	Set Mode <RGD Power>	Set analog output voltage dependent on intensity signal at specific wavelength.
30021	Set Mode <RGD Power Switch>	Set analog output as switch function with two setpoints based on intensity signal at specific wavelength.
30022	Set Mode <RGD Partial Pressure>	Set analog output voltage dependent on partial pressure of a specific gas.
30023	Set Mode <RGD Partial Pressure Switch>	Set analog output as switch function with two setpoints based on gas partial pressure value.

8 Commands: General Information

8.1 Get <Manufacturer Name>

This command reads the name of the manufacturer of the device.

8.1.1 Command

PID			Remark
	Read	Write	
10000	X	-	

8.1.2 Request Data

Request Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						
-							

8.1.3 Response Data

Response Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						
Manufacturer name	n	0	31	[-]	DATA [0 … n-1]	String	

8.1.4 Example: Get <Manufacturer Name> (INFICON AG)

Read Request

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX	CRC	CRC
->	0x00	0x00	0x20	0x00	0x05	0x01	0x27	0x10	0x00	0x00	0x53	0x68

Read Response

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX
<-	0x00	0x0B	0x21	0x00	0x0F	0x02	0x27	0x10	0x00	0x00

DATA[0]	DATA[1]	DATA[2]	DATA[3]	DATA[4]	DATA[5]	DATA[6]	DATA[7]	DATA[8]	DATA[9]	CRC	CRC
0x49	0x4E	0X46	0X49	0X43	0x4F	0x4E	0x20	0x41	0x47	0x7F	0x5A
I	N	F	I	C	O	N		A	G		

8.2 Get <Product Name>

This command reads the name of the product of the device.

8.2.1 Command

PID			Remark
	Read	Write	
10001	X	-	

8.2.2 Request Data

Request Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						
-							

8.2.3 Response Data

Response Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						
Product name	n	0	31		DATA [0 … n-1]	String	

8.2.4 Example: Get <Product Name> (OPG550)

Read Request

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX	CRC	CRC
->	0x00	0x00	0x20	0x00	0x05	0x01	0x27	0x11	0x00	0x00	0x8F	0x32

Read Response

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX
<-	0x00	0x0B	0x21	0x00	0x0B	0x02	0x27	0x11	0x00	0x00

DATA[0]	DATA[1]	DATA[2]	DATA[3]	DATA[4]	DATA[5]	CRC	CRC
0x4F	0x50	0x47	0x35	0x35	0x30	0x20	0xB3
O	P	G	5	5	0		

8.3 Get <Serial Number>

This command reads the serial number of the device.

8.3.1 Command

PID	Read	Write	Remark
10002	X	-	

8.3.2 Request Data

Request Data	Size [bytes]	Min.	Max.	Unit	DATA Location	DATA Type	Remark
-							

8.3.3 Response Data

Response Data	Size [bytes]	Min.	Max.	Unit	DATA Location	DATA Type	Remark
Serial number	n	0	31		DATA [0 … n-1]	String	

8.3.4 Example: Read <Serial Number> (1234)

Read Request

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX	CRC	CRC
->	0x00	0x00	0x20	0x00	0x05	0x01	0x27	0x12	0x00	0x00	0xEB	0xDD

Read Response

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX
<-	0x00	0x0B	0x21	0x00	0x09	0x02	0x27	0x12	0x00	0x00

DATA[0]	DATA[1]	DATA[2]	DATA[3]	CRC	CRC
0x31	0x32	0x33	0x34	0xA5	0x25
1	2	3	4		

8.4 Get <Bootloader Version>

This command reads the bootloader firmware version.

8.4.1 Command

PID			Remark
	Read	Write	
10003	X	-	

8.4.2 Request Data

Request Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						
-							

8.4.3 Response Data

Response Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						
Firmware Version	13	13	13	[-]	DATA [0 … 12]	String	Structure of the Version is: COMPATIBILITY.RELEASE.DEVELOPMENT.BUILD

8.4.4 Example: Read <Bootloader Version> (01.00.02.0006)

Read Request

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX	CRC	CRC
->	0x00	0x00	0x20	0x00	0x05	0x01	0x27	0x13	0x00	0x00	0x37	0x87

Read Response

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX
<-	0x00	0x0B	0x21	0x00	0x12	0x02	0x27	0x13	0x00	0x00

DATA[0]	DATA[1]	DATA[2]	DATA[3]	DATA[4]	DATA[5]	DATA[6]	DATA[7]	DATA[8]	DATA[9]	DATA[10]	DATA[11]	DATA[12]
0x30	0x31	0x2E	0x30	0x30	0x2E	0x30	0x32	0x2E	0x30	0x30	0x30	0x36
0	**1**	**.**	**0**	**0**	**.**	**0**	**2**	**.**	**0**	**0**	**0**	**6**

CRC	CRC
0xB2	0xDF

8.5 Get <Application Version>

This command reads the application firmware version.

8.5.1 Command

PID	Read	Write	Remark
10004	X	-	

8.5.2 Request Data

Request Data	Size [bytes]	Min.	Max.	Unit	DATA Location	DATA Type	Remark
-							

8.5.3 Response Data

Response Data	Size [bytes]	Min.	Max.	Unit	DATA Location	DATA Type	Remark
Firmware Version	13	13	13	[-]	DATA [0 … 12]	String	Structure of the Version is: COMPATIBILITY.RELEASE.DEVELOPMENT.BUILD

8.5.4 Example: Read <Application Version> (00.00.01.9999)

Read Request

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX	CRC	CRC
->	0x00	0x00	0x20	0x00	0x05	0x01	0x27	0x14	0x00	0x00	0x32	0x0B

Read Response

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX
<-	0x00	0x0B	0x21	0x00	0x12	0x02	0x27	0x14	0x00	0x00

DATA[0]	DATA[1]	DATA[2]	DATA[3]	DATA[4]	DATA[5]	DATA[6]	DATA[7]	DATA[8]	DATA[9]	DATA[10]	DATA[11]	DATA[12]
0x30	0x30	0x2E	0x30	0x30	0x2E	0x30	0x31	0x2E	0x39	0x39	0x39	0x39
0	**0**	**.**	**0**	**0**	**.**	**0**	**1**	**.**	**9**	**9**	**9**	**9**

CRC	CRC
0x4B	0xAE

8.6 Get <SHA Number>

Get <SHA Number>.

8.6.1 Command

PID	Read	Write	Remark
10005	X	-	

8.6.2 Request Data

Request Data	Size [bytes]	Min.	Max.	Unit	DATA Location	DATA Type	Remark
-							

8.6.3 Response Data

Response Data	Size [bytes]	Min.	Max.	Unit	DATA Location	DATA Type	Remark
SHA Number	13	13	13	[-]	DATA [0 … 12]	String	Structure of the Version is: COMPATIBILITY.RELEASE.DEVELOPMENT.BUILD

8.6.4 Example: Read <SHA Number>

Read Request

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX	CRC	CRC
->	0x00	0x00	0x20	0x00	0x05	0x01	0x27	0x15	0x00	0x00	0xEE	0x51

Read Response

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX
<-	0x00	0x0B	0x21	0x00	0x2D	0x02	0x27	0x15	0x00	0x00

DATA[0]	DATA[1]	DATA[2]	DATA[3]	DATA[4]	DATA[5]	DATA[6]	DATA[7]	DATA[8]	DATA[9]	DATA[10]	DATA[11]	DATA[12]
0x61	0x36	0x39	0x30	0x61	0x34	0x64	0x33	0x35	0x35	0x31	0x61	0x63
a	6	9	0	a	4	d	3	5	5	1	a	c

DATA[13]	DATA[14]	DATA[15]	DATA[16]	DATA[17]	DATA[18]	DATA[19]	DATA[20]	DATA[21]	DATA[22]	DATA[23]	DATA[24]	DATA[25]
0x65	0x37	0x65	X038	0x62	0x62	0x65	0x66	0x64	0x65	0x63	0x33	0x63
e	7	d	8	b	b	e	f	d	e	c	3	c

DATA[26]	DATA[27]	DATA[28]	DATA[29]	DATA[30]	DATA[31]	DATA[32]	DATA33]	DATA[34]	DATA[35]	DATA[36]	DATA[37]	DATA[38]
0x61	0x30	0x37	0x62	0x65	0x34	0x31	0x62	0x39	0x30	0x33	0x32	0x37
a	0	7	b	e	4	1	b	9	0	3	2	7

DATA[39]	CRC	CRC
0x38	0x58	0xB4
8		

9 Commands: Status and Error

9.1 Get <Self Diagnostic Status>

This command reads the <Self Diagnostic Status> of the device.

9.1.1 Command

PID			Remark
	Read	Write	
11000	X	-	

9.1.2 Request Data

Request Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						
-							

9.1.3 Response Data

Response Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						
Status	1	0	255	[-]	DATA [0]	uint8_t	0 : OK 1 : Service soon 2 : Device failure

9.1.4 Example: Get <Self Diagnostic Status> (0)

Read Request

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX	CRC	CRC
->	0x00	0x00	0x20	0x00	0x05	0x01	0x2A	0xF8	0x00	0x00	0xBF	0x2C

Read Response

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX
<-	0x00	0x0B	0x21	0x00	0x06	0x02	0x2A	0xF8	0x00	0x00

DATA[0]	CRC	CRC
0x00	0xFE	0xB9
0		

9.2 Get <Error History> size

This command reads the size of the <Error History> buffer (maximum number of errors in <Error History>).

9.2.1 Command

PID			Remark
	Read	Write	
11001	X	-	

9.2.2 Request Data

Request Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						
-							

9.2.3 Response Data

Response Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						
Size	4	0	4294967295	[-]	DATA [0 … 3]	uin32_t	4

9.2.4 Example: Get <Error History> size (10)

Read Request

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX	CRC	CRC
->	0x00	0x00	0x20	0x00	0x05	0x01	0x2A	0xF9	0x00	0x00	0x63	0x76

Read Response

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX
<-	0x00	0x0B	0x21	0x00	0x09	0x02	0x2A	0xF9	0x00	0x00

DATA[0]	DATA[1]	DATA[2]	DATA[3]	CRC	CRC
0x00	0x00	0x00	0x0A	0x0A	0xEC

Size = 10

9.3 Get <Number of Errors>

This command reads the <Number of Errors> stored in the <Error History>.

9.3.1 Command

PID			Remark
	Read	Write	
11002	X	-	

9.3.2 Request Data

Request Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						
-							

9.3.3 Response Data

Response Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						
Number of Errors	4	0	4294967295	[-]	DATA [0 … 3]	uin32_t	4

9.3.4 Example: Get <Number of Errors> (2)

Read Request

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX	CRC	CRC
->	0x00	0x00	0x20	0x00	0x05	0x01	0x2A	0xFA	0x00	0x00	0x07	0x99

Read Response

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX
<-	0x00	0x0B	0x21	0x00	0x09	0x02	0x2A	0xFA	0x00	0x00

DATA[0]	DATA[1]	DATA[2]	DATA[3]	CRC	CRC
0x00	0x00	0x00	0x02	0x2C	0xC8

Number of Errors : 2

9.4 Get <Error>

This command reads the error consiting of <Combined Error Number>, <Error Description> and possible <Error Solution>.

9.4.1 Command

PID			Remark
	Read	Write	
10005	X	-	

9.4.2 Request Data

Request Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						
Index n	4	1	4294967295	[-]	DATA [0 … 3]	uint32_t	1 : Most recent error. The maximum value depends on the Error History buffer size.

9.4.3 Response Data

Response Data	Size [bytes]	Min.	Max.	Unit	DATA Location	DATA Type	Remark
Combined Error Number	4	0	4294967295	[-]	DATA [0 … 3]	uin32_t	
Error Description	nd	1	xxxx	[-]	[4 … 4+nd]	String	String is terminated with '\0'.
Error Solution	ns	1	xxxx	[-]	[4+nd+1 … 4+nd+1+ns]	String	String is terminated with '\0'.

9.4.4 Example: Get error (1)

Read Request

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX
->	0x00	0x00	0x20	0x00	0x09	0x01	0x2A	0xFB	0x00	0x00

DATA[0]	DATA[1]	DATA[2]	DATA[3]	CRC	CRC
0x00	0x00	000	0x01	0xAF	0x15

Read Response

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX
<-	0x00	0x0B	0x21	0x00	0x62	0x02	0x2A	0xFB	0x00	0x00

DATA[0]	DATA[1]	DATA[2]	DATA[3]	DATA[4]	DATA[5]	DATA[6]	DATA[7]	DATA[8]	DATA[9]	DATA[10]	DATA[11]	DATA[12]
0x00	0x00	0x00	0xC8	0x53	0x70	0x65	0x63	0x74	0x72	0x75	0x6D	0x20
Combined Error Number : 200				S	p	e	c	t	r	u	m	

DATA[13]	DATA[14]	DATA[15]	DATA[16]	DATA[17]	DATA[18]	DATA[19]	DATA[20]	DATA[21]	DATA[22]	DATA[23]	DATA[24]	DATA[25]
0x4D	0x65	0x61	0x73	0x75	0x72	0x65	0x6D	0x65	0x6E	0x74	0x20	0x61
M	e	a	s	u	r	e	m	e	n	t		a

DATA[26]	DATA[27]	DATA[28]	DATA[29]	DATA[30]	DATA[31]	DATA[32]	DATA33]	DATA[34]	DATA[35]	DATA[36]	DATA[37]	DATA[38]
0x6C	0x67	0x6F	0x72	0x69	0x74	0x68	0x6D	0x20	0x69	0x73	0x20	0x73
l	g	o	r	i	t	h	m		i	s		s

DATA[39]	DATA[40]	DATA[41]	DATA[42]	DATA[43]	DATA[44]	DATA[45]	DATA[46]	DATA[47]	DATA[48]	DATA[49]	DATA[50]	DATA[51]
0x74	0x69	0x6C	0x6C	0x20	0x61	0x63	0x74	0x69	0x76	0x65	0x2E	0x00
t	i	l	l		a	c	t	i	v	e	.	'\0'

DATA[52]	DATA[53]	DATA[54]	DATA[55]	DATA[56]	DATA[57]	DATA[58]	DATA[59]	DATA[60]	DATA[61]	DATA[62]	DATA[63]	DATA[64]
0x53	0x74	0x6F	0x70	0x20	0x74	0x68	0x65	0x20	0x53	0x70	0x65	0x63
S	t	o	p		t	h	e		S	p	e	c

DATA[65]	DATA[66]	DATA[67]	DATA[68]	DATA[69]	DATA[70]	DATA[71]	DATA[72]	DATA[73]	DATA[74]	DATA[75]	DATA[76]	DATA[77]
0x74	0x72	0x75	0x6D	0x20	0x4D	0x65	0x61	0x73	0x75	0x72	0x65	0x6D
t	r	u	m		M	e	a	s	u	r	e	m

DATA[78]	DATA[79]	DATA[80]	DATA[81]	DATA[82]	DATA[83]	DATA[84]	DATA[85]	DATA[86]	DATA[87]	DATA[88]	DATA[89]	DATA[90]
0x65	0x6E	0x74	0x20	0x61	0x6C	0x67	0x6F	0x72	0x69	0x74	0x68	0x6D
e	n	t		a	l	g	o	r	i	t	h	m

DATA[91]	DATA[92]	CRC	CRC
0x2E	0x00	0xEF	0x6C
.	'\0'		

9.5 Set clear <Error History> ON

This command clears the <Error History>.

9.5.1 Command

PID	Read	Write	Remark
11004	-	X	

9.5.2 Request Data

Request Data	Size [bytes]	Min.	Max.	Unit.	DATA Location	DATA Type	Remark
Mode	1	1	1	[-]	DATA[0]	uint8_t	1 : Clear Error History.

9.5.3 Response Data

Response Data	Size	Min.	Max.	Unit.	DATA Location	DATA Type	Remark
	[bytes]						
-							

9.5.4 Example: Set clear <Error History> ON

Write Request

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX
->	0x00	0x00	0x20	0x00	0x06	0x03	0x2A	0xFC	0x00	0x00

DATA[0]	CRC	CRC
0x01	0x0D	0x8E
Mode = 1		

Write Response

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX	CRC	CRC
<-	0x00	0x0B	0x21	0x00	0x05	0x04	0x2A	0xFC	0x00	0x00	0xF8	0x41

10 Commands: Plasma

10.1 Set <Plasma Interlock> ON or OFF

This command switches the <Plasma Interlock> ON or OFF. When the <Plasma Interlock> is on and the pressure is above a certain limit, the <Plasma> is switched off.

10.1.1 Command

PID			Remark
	Read	Write	
12000	-	X	

10.1.2 Request Data

Request Data	Size	Min.	Max.	Unit.	DATA Location	DATA Type	Remark
	[bytes]						
Mode	1	0	1	[-]	DATA[0]	uint8_t	0 : Switch Plasma Interlock OFF. 1 : Switch Plasma Interlock ON.

10.1.3 Response Data

Response Data	Size [bytes]	Min.	Max.	Unit.	DATA Location	DATA Type	Remark
-							

10.1.4 Example: Set <Plasma Interlock> ON

Read Request

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX
->	0x00	0x00	0x20	0x00	0x06	0x03	0x2E	0xE0	0x00	0x00

DATA[0]	CRC	CRC
0x01	0x88	0xF7
Mode = 1		

Write Response

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX	CRC	CRC
<-	0x00	0x0B	0x21	0x00	0x05	0x04	0x2E	0xE0	0x00	0x00	0x22	0x13

10.2 Get <Plasma Interlock> status

This command reads current state of the <Plasma Interlock>.

10.2.1 Command

PID			Remark
	Read	Write	
12001	X	-	

10.2.2 Request Data

Request Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						
-							

10.2.3 Response Data

Response Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						
Status	1	0	1	[-]	DATA [0]	uint8_t	0 : Not active 1 : Active

10.2.4 Example: Get <Plasma Interlock> status (1)

Read Request

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX	CRC	CRC
->	0x00	0x00	0x20	0x00	0x05	0x01	0x2E	0xE1	0x00	0x00	0xD8	0x47

Read Response

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX
<-	0x00	0x0B	0x21	0x00	0x06	0x02	0x2E	0xE1	0x00	0x00

DATA[0]	CRC	CRC
0x01	0xA5	0xBF
1		

10.3 Set <Plasma> ON or OFF

This command switches the <Plasma> on or off.

10.3.1 Command

PID	Read	Write	Remark
12002	-	X	

10.3.2 Request Data

Request Data	Size [bytes]	Min.	Max.	Unit.	DATA Location	DATA Type	Remark
Mode	1	0	1	[-]	DATA[0]	uint8_t	0 : Switch Plasma OFF. 1 : Switch Plasma ON.

10.3.3 Response Data

Response Data	Size [bytes]	Min.	Max.	Unit.	DATA Location	DATA Type	Remark
-							

10.3.4 Example: Set <Plasma> ON

Read Request

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX
->	0x00	0x00	0x20	0x00	0x06	0x03	0x2E	0xE2	0x00	0x00

DATA[0]	CRC	CRC
0x01	0xFE	0xCE
Mode = 1		

Write Response

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX	CRC	CRC
<-	0x00	0x0B	0x21	0x00	0x05	0x04	0x2E	0xE2	0x00	0x00	0x9A	0xA6

10.4 Get <Plasma> Status

This command reads the current state of the Plasma.

10.4.1 Command

PID			Remark
	Read	Write	
12003	X	-	

10.4.2 Request Data

Request Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						
-							

10.4.3 Response Data

Response Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						
Status	1	0	2	[-]	DATA [0]	uint8_t	0 : Plasma OFF 1 : Plasma ON, but not ignited yet 2 : Plasma ON and ignited

10.4.4 Example: Get <Plasma> status (0)

Read Request

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX	CRC	CRC
->	0x00	0x00	0x20	0x00	0x05	0x01	0x2E	0xE3	0x00	0x00	0x60	0xF2

Read Response

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX
<-	0x00	0x0B	0x21	0x00	0x06	0x02	0x2E	0xE3	0x00	0x00

DATA[0]	CRC	CRC
0x00	0x5A	0x97
0		

11 Commands: Spectrometer

11.1 Get <Number of Pixels>

This command reads the <Number of Pixels> of the spectrometer.

11.1.1 Command

PID			Remark
	Read	Write	
13000	X	-	

11.1.2 Request Data

Request Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						
-							

11.1.3 Response Data

Response Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						
Number of Pixels	2	0	65535	[-]	DATA [0 … 1]	uint16_t	

11.1.4 Example: Get <Number of Pixels> (288)

Read Request

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX	CRC	CRC
->	0x00	0x00	0x20	0x00	0x05	0x01	0x32	0xC8	0x00	0x00	0x68	0x8C

Read Response

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX
<-	0x00	0x0B	0x21	0x00	0x07	0x02	0x32	0xC8	0x00	0x00

DATA[0]	DATA[1]	CRC	CRC
0x01	0x20	0x14	0x10

288

11.2 Get <Pixel Wavelength>

This command reads the <Pixel Wavelength>.

11.2.1 Command

PID	Read	Write	Remark
13001	X	-	

11.2.2 Request Data

Request Data	Size [bytes]	Min.	Max.	Unit	DATA Location	DATA Type	Remark
Start Pixel Number	2	1	288	[-]	Data [0 … 1]		
Number of Pixels	2	0	288	[-]	Data [2 … 3]		

11.2.3 Response Data

Response Data	Size [bytes]	Min.	Max.	Unit	DATA Location	DATA Type	Remark
Wavelength	n	0	65535	[1/100 nm]	DATA [0 … 1]	uint16_t	

11.2.4 Example: Get <Pixel Wavelength> (1, 1)

Read Request

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX
->	0x00	0x00	0x20	0x00	0x09	0x01	0x32	0xC9	0x00	0x00

DATA[0]	DATA[1]	DATA[2]	DATA[3]	CRC	CRC
0x00	0x01	0x00	0x01	0x46	0xD8
Start Pixel Number : 1		Number of Pixels : 1			

Read Response

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX
<-	0x00	0x0B	0x21	0x00	0x09	0x02	0x32	0xC9	0x00	0x00

DATA[0]	DATA[1]	DATA[2]	DATA[3]	CRC	CRC
0x00	0x00	0x7D	0x60	0x64	0xC0
Wavelength : 32096 (320.96nm)					

12 Commands: Total Pressure

12.1 Get Total Pressure

This command reads the total pressure.

12.1.1 Command

PID			Remark
	Read	Write	
14000	X	-	

12.1.2 Request Data

Request Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						
Data Unit	1	0	3	[-]	DATA [0]	uint8_t	0 : mbar 1 : Torr 2 : Pascal 3 : micron

12.1.3 Response Data

Response Data	Size [bytes]	Min.	Max.	Unit	DATA Location	DATA Type	Remark
Total pressure	4	-3.40282347e+38	3.40282347e+38	[x]	DATA [0 … 3]	float	Unit depends on argument 1 of request data.

12.1.4 Example: Get Total Pressure (1500 mbar)

Read Request

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX	DATA[0]	CRC	CRC
->	0x00	0x00	0x20	0x00	0x06	0x01	0x36	0xB0	0x00	0x00	0x00	0x21	0xD5

Read Response

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX
<-	0x00	0x0B	0x21	0x00	0x09	0x02	0x36	0xB0	0x00	0x00

DATA[0]	DATA[1]	DATA[2]	DATA[3]	CRC	CRC
0x44	0xBB	0x7F	0xFE	0x37	0x0F

P = 1.499999755859375E3 mbar

13 Commands: Operating Mode

13.1 Get Mode

This command reads the <Operating Mode> mode.

13.1.1 Command

PID			Remark
	Read	Write	
19000	X	-	

13.1.2 Request Data

Request Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						

13.1.3 Response Data

Response Data	Size [bytes]	Min.	Max.	Unit	DATA Location	DATA Type	Remark
Mode	1	0	3	[-]	DATA[0]	uint8_t	0 : Manual 1 : Automatic SPEC 2 : Automatic ROR 3 : Automatic RGD

13.2 Set Mode <Manual>

This command sets the Operating Mode to the mode <Manual>. An algorithm is controlled with the commands described in chapters 14 to 16.

13.2.1 Command

PID	Read	Write	Remark
19001	-	X	

13.2.2 Request Data

Request Data	Size [bytes]	Min.	Max.	Unit	DATA Location	DATA Type	Remark

13.2.3 Response Data

Response Data	Size [bytes]	Min.	Max.	Unit	DATA Location	DATA Type	Remark

13.3 Set Mode <Automatic SPEC>

This command sets the Operating Mode to the mode <Automatic SPEC>. If the pressure drops below a certain limit the <Spectrum Measurement (SPEC)> algorithm is started.

13.3.1 Command

PID	Read	Write	Remark
19002	-	X	

13.3.2 Request Data

Request Data	Size [bytes]	Min.	Max.	Unit	DATA Location	DATA Type	Remark
Pressure Trip Point Low	4	-3.40282347e+38	20.0	[mbar]	DATA [0 … 3]	float	
Hysteresis of Trip Point Low	4	0.0	100.0	[%]	DATA [4 … 7]	float	
Integration Time	4	270	60000000	[us]	DATA [8 … 11]	uint32_t	

13.3.3 Response Data

Response Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						

13.4 Set Mode <Automatic ROR>

This command sets the Operating Mode to the mode <Automatic ROR>. If the pressure drops below a certain limit the <Leak Detection Rate of Rise (ROR)> algorithm is started.

13.4.1 Command

PID	Read	Write	Remark
19003	-	X	

13.4.2 Request Data

Request Data	Size [bytes]	Min.	Max.	Unit	DATA Location	DATA Type	Remark
Pressure Trip Point Low	4	-3.40282347e+38	20.0	[mbar]	DATA [0 … 3]	float	
Hysteresis of Trip Point Low	4	0.0	100.0	[%]	DATA [4 … 7]	float	
Gas Number	1	0	6	[us]	DATA [8]	uint8_t	see Chapter 15.1

13.4.3 Response Data

Response Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						

13.5 Set Mode <Automatic RGD>

This command sets the Operating Mode to the mode <Automatic RGD>. If the pressure drops below a certain limit the <Residual Gas Detection (RGD)> algorithm is started.

13.5.1 Command

PID			Remark
	Read	Write	
19004	-	X	

13.5.2 Request Data

Request Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						
Pressure Trip Point Low	4	-3.40282347e+38	20.0	[mbar]	DATA [0 … 3]	float	
Hysteresis of Trip Point Low	4	0.0	100.0	[%]	DATA [4 … 7]	float	
Gas Number	1	0	6	[us]	DATA [8]	uint8_t	see Chapter 16.1

13.5.3 Response Data

Response Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						

14 Commands: Spectrum Measurement (SPEC)

14.1 Set <Spectrum Measurement (SPEC)> ON or OFF

This command activates or deactivates the <SPEC> measurement:

14.1.1 Command

PID			Remark
	Read	Write	
20000	-	X	

14.1.2 Request Data

Request Data	Size [bytes]	Min.	Max.	Unit.	DATA Location	DATA Type	Remark
Mode	1	0	1	[-]	DATA [0]	uin8_t	0 : Switch <SPEC> OFF 1 : Switch <SPEC> ON
Number of Spectra	4	0	4294967295	[-]	DATA [1 … 4]	uint32_t	0 : endless >0 : Number of spectra
Integration Time	4	270	60000000	[us]	DATA [5 … 8]	uint32_t	

If Mode is set to <0> the parameters <Number of Spectra> and <Integration Time> have no effect.

14.1.3 Response Data

Response Data	Size [bytes]	Min.	Max.	Unit.	DATA Location	DATA Type	Remark
-							

14.1.4 Example: Set <Spectrum Measurement> ON (100, 1000)

Write Request

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX
->	0x00	0x00	0x20	0x00	0x0E	0x03	0x4E	0x20	0x00	0x00

DATA[0]	DATA[1]	DATA[2]	DATA[3]	DATA[4]	DATA[5]	DATA[6]	DATA[7]	DATA[8]	CRC	CRC
0x01	0x00	0x00	0x00	0x64	0x00	0x00	0x03	0xE8	0xB9	0x05
Mode = 1	Number of Spectra = 100				Integration Time = 1'000us					

Write Response

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX	CRC	CRC
<-	0x00	0x0B	0x21	0x00	0x05	0x04	0x4E	0x20	0x00	0x00	0x5C	0x80

14.2 Get <Spectrum Measurement (SPEC)> Status

This command reads the status of the <Spectrum Measurement (SPEC)>.

14.2.1 Command

PID			Remark
	Read	Write	
20001	X	-	

14.2.2 Request Data

Request Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						
-							

14.2.3 Response Data

Response Data	Size [bytes]	Min.	Max.	Unit	DATA Location	DATA Type	Remark
Status	1	0	1	[-]	DATA [0]	uint8_t	0 : Not selected 1 : Not active (IDLE) 2 : Active (SETUP) 3 : Active (CAPTURE BACKGROUND) 4 : Active (CAPTURE SPECTRUM) 5 : Active (CLEANUP) 255 : Not active (ERROR)

14.2.4 Example: Get <Spectrum Measurement (SPEC)> status (1)

Read Request

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX	CRC	CRC
->	0x00	0x00	0x20	0x00	0x05	0x01	0x4E	0x21	0x00	0x00	0xA6	0xD4

Read Response

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX
<-	0x00	0x0B	0x21	0x00	0x06	0x02	0x4E	0x21	0x00	0x00

DATA[0]	CRC	CRC
0x01	0xCF	0x25
1		

14.3 Get <Spectrum Measurement (SPEC)> record buffer size

This command reads the size of the <SPEC> record buffer.

14.3.1 Command

PID			Remark
	Read	Write	
20002	X	-	

14.3.2 Request Data

Request Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						
-							

14.3.3 Response Data

Response Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						
Size	4	0	4294967295	[-]	DATA [0 … 3]	uin32_t	4

14.3.4 Example: Get <SPEC> record buffer size (111)

Read Request

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX	CRC	CRC
->	0x00	0x00	0x20	0x00	0x05	0x01	0x4E	0x22	0x00	0x00	0xC2	0x3B

Read Response

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX
<-	0x00	0x0B	0x21	0x00	0x09	0x02	0x4E	0x22	0x00	0x00

DATA[0]	DATA[1]	DATA[2]	DATA[3]	CRC	CRC
0x00	0x00	0x00	0x6F	0x2E	0x9F

Size = 111

14.4 Get number of <Spectrum Measurement (SPEC)> records

This command reads the number of captured <SPEC> records.

14.4.1 Command

PID			Remark
	Read	Write	
20003	X	-	

14.4.2 Request Data

Request Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						
-							

14.4.3 Response Data

Response Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						
Number of records	4	0	4294967295	[-]	DATA [0 … 3]	uin32_t	4

14.4.4 Example: Get number of <SPEC> recrods (31)

Read Request

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX	CRC	CRC
->	0x00	0x00	0x20	0x00	0x05	0x01	0x4E	0x23	0x00	0x00	0x1E	0x61

Read Response

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX
<-	0x00	0x0B	0x21	0x00	0x09	0x02	0x4E	0x23	0x00	0x00

DATA[0]	DATA[1]	DATA[2]	DATA[3]	CRC	CRC
0x00	0x00	0x00	0x1F	0x7C	0x73

Number of records = 31

14.5 Get <Spectrum Measurement (SPEC)> record

This command reads one <Spectrum Measurement (SPEC)> record.

14.5.1 Command

PID	Read	Write	Remark
20004	X	-	

14.5.2 Request Data

Request Data	Size [bytes]	Min.	Max.	Unit	DATA Location	DATA Type	Remark
Record ID	4	0	4294967295	[-]	DATA [0 … 3]	uin32_t	
Start Pixel Number	2	1	288	[-]	DATA [4 … 5]	uint16_t	The spectrometer used has a maximum number of 288 pixels.
Number of Pixels	2	0	288	[-]	DATA [6 … 7]	uint16_t	The spectrometer used has a maximum number of 288 pixels.

14.5.3 Response Data

Response Data	Size [bytes]	Min.	Max.	Unit	DATA Location	DATA Type	Remark
Record ID	4	0	4294967295	[-]	DATA [0 … 3]	uin32_t	
Time	4	0	4294967295	[ms]	DATA [4 … 7]	uin32_t	
Integration Time	4	0	4294967295	[us]	DATA [4 … 7]	uin32_t	
Spectrum Power	n	0	4294967295	[1/10 counts/sec]	DATA[8 …]	uin32_t	Array of uint32_t

14.5.4 Example: Get <SPEC> record (1, 1, 288)

Read Request

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX
->	0x00	0x00	0x20	0x00	0x0D	0x01	0x4E	0x24	0x00	0x00

DATA[0]	DATA[1]	DATA[2]	DATA[3]	DATA[4]	DATA[5]	DATA[6]	DATA[7]	CRC	CRC
0x00	0x00	0x00	0x01	0x00	0x01	0x01	0x20	0xE2	0x76
Record ID = 1				Pixel number start = 1		Number of Pixels = 288			

Read Response

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX
<-	0x00	0x0B	0x21	0x04	0x91	0x02	0x4E	0x24	0x00	0x00

DATA[0]	DATA[1]	DATA[2]	DATA[3]	DATA[4]	DATA[5]	DATA[6]	DATA[7]	DATA[8]	DATA[9]	DATA[10]	DATA[11]
0x00	0x00	0x00	0x01	0x00	0x00	0x00	0x02	0x00	0x00	0x03	0xE8
Record ID = 1				Time = 2ms				Integration Time = 1'000us			

DATA[12]	DATA[13]	DATA[14]	DATA[15]	...	DATA[1160]	DATA[1161]	DATA[1162]	DATA[1163]	CRC	CRC
0x00	0x06	0xDD	0xD0	...	0x00	0x04	0xE2	0x00	0x21	0xE8
Spectrum Power Pixel 1 : 45'000.0 counts/sec				...	Spectrum Power Pixel 288 : 32'000.0 counts/sec					

15 Commands: Leak Detection Rate of Rise (ROR)

15.1 Set <Leak Detection Rate of Rise (ROR)> ON or OFF

This command activates or deactivates the <ROR> measurement. The following table shows all possible gases which can be used with this algorithm.

Gas Number	Description	Wavelength [nm]
0	Sensitive to whole spectrum	-
1	Oxygen	777
2	Argon	812
3	Nitrogen	822
4	Nitrogen	870
5	Nitrogen	337
6	Hydrogen	656

15.1.1 Command

PID			Remark
	Read	Write	
21000	-	X	

15.1.2 Request Data

Request Data	Size [bytes]	Min.	Max.	Unit.	DATA Location	DATA Type	Remark
Mode	1	0	1	[-]	DATA [0]	uin8_t	0 : Switch <RoR> OFF 1 : Switch <RoR> ON
Number of Spectra	4	0	4294967295	[-]	DATA [1 … 4]	uint32_t	0 : endless >0 : Number of spectra
Gas Number	1	0	6	[us]	DATA [5]	uint8_t	

If Mode is set to <0> the parameters <Number of Spectra> and <Gas Number> have no effect.

15.1.3 Response Data

Response Data	Size [bytes]	Min.	Max.	Unit.	DATA Location	DATA Type	Remark
-							

15.1.4 Example: Set <Leak Detection Rate of Rise (ROR)> ON (100, 0)

Write Request

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX
->	0x00	0x00	0x20	0x00	0x0B	0x03	0x52	0x08	0x00	0x00

DATA[0]	DATA[1]	DATA[2]	DATA[3]	DATA[4]	DATA[5]	CRC	CRC
0x01	0x00	0x00	0x00	0x64	0x00	0xF5	0x22
Mode = 1	Number of Spectra = 100				Gas = 0		

Write Response

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX	CRC	CRC
<-	0x00	0x0B	0x21	0x00	0x05	0x04	0x52	0x08	0x00	0x00	0x30	0x11

15.2 Get <Leak Detection Rate of Rise (ROR)> Status

This command reads the status of the <Leak Detection Rate of Rise (RoR)>.

15.2.1 Command

PID			Remark
	Read	Write	
21001	X	-	

15.2.2 Request Data

Request Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						
-							

15.2.3 Response Data

Response Data	Size [bytes]	Min.	Max.	Unit	DATA Location	DATA Type	Remark
Status	1	0	1	[-]	DATA [0]	uint8_t	0 : Not selected 1 : Not active (IDLE) 2 : Active (SETUP) 3 : Active (CAPTURE SPECTRUM) 4 : Active (CLEANUP) 255 : Not active (ERROR)

15.2.4 Example: Get <Leak Detection Rate of Rise (ROR)> status (1)

Read Request

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX	CRC	CRC
->	0x00	0x00	0x20	0x00	0x05	0x01	0x52	0x09	0x00	0x00	0xCA	0x45

Read Response

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX
<-	0x00	0x0B	0x21	0x00	0x06	0x02	0x52	0x09	0x00	0x00

DATA[0]	CRC	CRC
0x01	0x34	0x8C
1		

15.3 Get <Leak Detection Rate of Rise (ROR)> record buffer size

This command reads the size of the <RoR> record buffer.

15.3.1 Command

PID			Remark
	Read	Write	
21002	X	-	

15.3.2 Request Data

Request Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						
-							

15.3.3 Response Data

Response Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						
Size	4	0	4294967295	[-]	DATA [0 … 3]	uin32_t	4

15.3.4 Example: Get <ROR> record buffer size (212)

Read Request

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX	CRC	CRC
->	0x00	0x00	0x20	0x00	0x05	0x01	0x52	0x0A	0x00	0x00	0xAE	0xAA

Read Response

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX
<-	0x00	0x0B	0x21	0x00	0x09	0x02	0x52	0x0A	0x00	0x00

DATA[0]	DATA[1]	DATA[2]	DATA[3]	CRC	CRC
0x00	0x00	0x00	0xD4	0x03	0x49

Size = 212

15.4 Get number of <Leak Detection Rate of Rise (ROR)> records

This command reads the number of captured <ROR> records.

15.4.1 Command

PID			Remark
	Read	Write	
21003	X	-	

15.4.2 Request Data

Request Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						
-							

15.4.3 Response Data

Response Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						
Number of records	4	0	4294967295	[-]	DATA [0 … 3]	uin32_t	4

15.4.4 Example: Get number of <ROR> recrods (11)

Read Request

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX	CRC	CRC
->	0x00	0x00	0x20	0x00	0x05	0x01	0x52	0x0B	0x00	0x00	0x72	0xF0

Read Response

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX
<-	0x00	0x0B	0x21	0x00	0x09	0x02	0x52	0x0B	0x00	0x00

DATA[0]	DATA[1]	DATA[2]	DATA[3]	CRC	CRC
0x00	0x00	0x00	0x0B	0xAC	0xF8

Number of records = 11

15.5 Get <Leak Detection Rate of Rise (ROR)> record

This command reads one <Leak Detection Rate of Rise (ROR)> record. Command

PID			Remark
	Read	Write	
21004	X	-	

15.5.1 Request Data

Request Data	Size [bytes]	Min.	Max.	Unit	DATA Location	DATA Type	Remark
Record ID	4	0	4294967295	[-]	DATA [0 … 3]	uin32_t	
Start Pixel Number	2	1	288	[-]	DATA [4 … 5]	uint16_t	The spectrometer used has a maximum number of 288 pixels.
Number of Pixels	2	0	288	[-]	DATA [6 … 7]	uint16_t	The spectrometer used has a maximum number of 288 pixels.
Start Gas Number	2	1	6	[-]	DATA [8 … 9]	uint16_t	
Number of Gases	2	0	6	[-]	DATA [10 … 11]	uint16_t	

15.5.2 Response Data

Response Data	Size [bytes]	Min.	Max.	Unit	DATA Location	DATA Type	Remark
Record ID	4	0	4294967295	[-]	DATA [0 … 3]	uin32_t	
Time	4	0	4294967295	[ms]	DATA [4 … 7]	uin32_t	
Integration Time	4	0	4294967295	[us]	DATA [8 … 11]	uin32_t	
Pressure Rise	n	-3.40282347e+38	3.40282347e+38	[mTorr/min]	DATA [12 … 15]	float	
Spectrum Intensity	n	0	65535	[counts]	DATA [16 …]	uin16_t	Array of uint16_t
Augent Numbers	n	-32768	32767	[1/100]	DATA […]	int16_t	Array of int16_t

15.5.3 Example: Get <ROR> record (31, 1, 288, 1, 6)

Read Request

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX
->	0x00	0x00	0x20	0x00	0x11	0x01	0x52	0x0C	0x00	0x00

DATA[0]	DATA[1]	DATA[2]	DATA[3]	DATA[4]	DATA[5]	DATA[6]	DATA[7]	DATA[8]	DATA[9]	DATA[10]	DATA[11]
0x00	0x00	0x00	0x1F	0x00	0x01	0x01	0x20	0x00	0x01	0x00	0x06
Record ID = 31				Pixel Number Start = 1		Number of Pixels = 288		Gas Number Start = 1		Number of Gases = 6	

CRC	CRC
0xBC	0xF7

Read Response

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX
<-	0x00	0x0B	0x21	0x02	0x61	0x02	0x52	0x0C	0x00	0x00

DATA[0]	DATA[1]	DATA[2]	DATA[3]	DATA[4]	DATA[5]	DATA[6]	DATA[7]	DATA[8]	DATA[9]	DATA[10]	DATA[11]
0x00	0x00	0x00	0x1F	0x00	0x00	0x3B	0x11	0x00	0x08	0x9F	0xEB
Record ID = 31				Time = 15'121ms				Integration Time = 565'227us			

DATA[12]	DATA[13]	DATA[14]	DATA[15]
0x00	0x00	0x00	0x1F
Pressure Rise = 0.0			

DATA[16]	DATA[17]	…	DATA[590]	DATA[591]	DATA[592]	DATA[593]	…	DATA[602]	DATA[603]	CRC	CRC
0x5E	0x90	…	0x15	0x79	0xFF	0x7E	…	0xFE	0xA8	0x7A	0xBB
Intensity Pixel 1 : 24'208 counts			Intensity Pixel 288 : 5'497 counts		Augent Number 1: -1.30		…	Augent Number 6: -3.44			

16 Commands: Residual Gas Detection (RGD)

16.1 Set <Residual Gas Detection (RGD)> ON or OFF

This command activates or deactivates the <RGD> measurement. The following table shows all possible gases which can be used with this algorithm.

Gas Number	Description	Wavelength [nm]
0	Sensitive to whole spectrum	-
1	Hydrogen	656
2	Helium	501
3	Nitrogen	337
4	Oxygen	775
5	Argon	809
6	Ammonia	335

16.1.1 Command

PID			Remark
	Read	Write	
22000	-	X	

16.1.2 Request Data

Request Data	Size [bytes]	Min.	Max.	Unit.	DATA Location	DATA Type	Remark
Mode	1	0	1	[-]	DATA [0]	uin8_t	0 : Switch <RGD> OFF 1 : Switch <RGD> ON
Number of Spectra	4	0	4294967295	[-]	DATA [1 … 4]	uint32_t	0 : endless >0 : Number of spectra
Gas Number	1	0	6	[us]	DATA [5]	uint8_t	

If Mode is set to <0> the parameters <Number of Spectra> and <Gas Number> have no effect.

16.1.3 Response Data

Response Data	Size [bytes]	Min.	Max.	Unit.	DATA Location	DATA Type	Remark
-							

16.1.4 Example: Set <Residual Gas Detection (RGD)> ON (100, 0)

Write Request

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX
->	0x00	0x00	0x20	0x00	0x0B	0x03	0x55	0xF0	0x00	0x00

DATA[0]	DATA[1]	DATA[2]	DATA[3]	DATA[4]	DATA[5]	CRC	CRC
0x01	0x00	0x00	0x00	0x64	0x00	0xCD	0xB5
Mode = 1	Number of Spectra = 100				Gas = 0		

Write Response

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX	CRC	CRC
<-	0x00	0x0B	0x21	0x00	0x05	0x04	0x55	0xF0	0x00	0x00	0xE7	0x0C

16.2 Get < Residual Gas Detection (RGD)> Status

This command reads the status of the <Residual Gas Detection (RGD)>.

16.2.1 Command

PID			Remark
	Read	Write	
22001	X	-	

16.2.2 Request Data

Request Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						
-							

16.2.3 Response Data

Response Data	Size [bytes]	Min.	Max.	Unit	DATA Location	DATA Type	Remark
Status	1	0	1	[-]	DATA [0]	uint8_t	0 : Not selected 1 : Not active (IDLE) 2 : Active (SETUP) 3 : Active (CAPTURE BAKCGROUND) 4 : Active (CAPTURE SPECTRUM) 5 : Active (CLEANUP) 255 : Not active (ERROR)

16.2.4 Example: Get <Residual Gas Detection (RGD)> status (1)

Read Request

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX	CRC	CRC
->	0x00	0x00	0x20	0x00	0x05	0x01	0x55	0xF1	0x00	0x00	0x1D	0x58

Read Response

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX
<-	0x00	0x0B	0x21	0x00	0x06	0x02	0x55	0xF1	0x00	0x00

DATA[0]	CRC	CRC
0x01	0x1B	0x2E
1		

16.3 Get <Residual Gas Detection (RGD)> record buffer size

This command reads the size of the <RGD> record buffer.

16.3.1 Command

PID			Remark
	Read	Write	
22002	X	-	

16.3.2 Request Data

Request Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						
-							

16.3.3 Response Data

Response Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						
Size	4	0	4294967295	[-]	DATA [0 … 3]	uin32_t	4

16.3.4 Example: Get <RGD> record buffer size (108)

Read Request

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX	CRC	CRC
->	0x00	0x00	0x20	0x00	0x05	0x01	0x55	0xF2	0x00	0x00	0x79	0xB7

Read Response

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX
<-	0x00	0x0B	0x21	0x00	0x09	0x02	0x55	0xF2	0x00	0x00

DATA[0]	DATA[1]	DATA[2]	DATA[3]	CRC	CRC
0x00	0x00	0x00	0x6C	0x73	0xA5

Size = 108

16.4 Get number of <Residual Gas Detection (RGD)> records

This command reads the number of captured <RGD> records.

16.4.1 Command

PID	Read	Write	Remark
22003	X	-	

16.4.2 Request Data

Request Data	Size [bytes]	Min.	Max.	Unit	DATA Location	DATA Type	Remark
-							

16.4.3 Response Data

Response Data	Size [bytes]	Min.	Max.	Unit	DATA Location	DATA Type	Remark
Number of records	4	0	4294967295	[-]	DATA [0 … 3]	uin32_t	4

16.4.4 Example: Get number of <RGD> recrods (8)

Read Request

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX	CRC	CRC
->	0x00	0x00	0x20	0x00	0x05	0x01	0x55	0xF3	0x00	0x00	0xA5	0xED

Read Response

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX
<-	0x00	0x0B	0x21	0x00	0x09	0x02	0x55	0xF3	0x00	0x00

DATA[0]	DATA[1]	DATA[2]	DATA[3]	CRC	CRC
0x00	0x00	0x00	0x08	0x84	0x1F

Number of records = 8

16.5 Get <Residual Gas Detection (RGD)> record

This command reads one <Residual Gas Detection (RGD)> record.

16.5.1 Command

PID			Remark
	Read	Write	
22004	X	-	

16.5.2 Request Data

Request Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						
Record ID	4	0	4294967295	[-]	DATA [0 … 3]	uin32_t	
Start Pixel Number	2	1	288	[-]	DATA [4 … 5]	uint16_t	The spectrometer used has a maximum number of 288 pixels.
Number of Pixels	2	0	288	[-]	DATA [6 … 7]	uint16_t	The spectrometer used has a maximum number of 288 pixels.
Start Gas Number	2	1	6	[-]	DATA [8 … 9]	uint16_t	
Number of Gases	2	0	6	[-]	DATA [10 … 11]	uint16_t	

16.5.3 Response Data

Response Data	Size [bytes]	Min.	Max.	Unit	DATA Location	DATA Type	Remark
Record ID	4	0	4294967295	[-]	DATA [0 … 3]	uin32_t	
Time	4	0	4294967295	[ms]	DATA [4 … 7]	uin32_t	
Integration Time	4	0	4294967295	[us]	DATA [4 … 7]	uin32_t	
Spectrum Power	n	0	4294967295	[1/10 counts/sec]	DATA[8 …]	uint32_t	Array of uint32_t
RGD Numbers	n	0	4294967295	[1/100 peak count per million]	DATA[…]	uint32_t	Array of uint32_t
Partial Pressure	n	-3.40282347e+38	3.40282347e+38	[mbar]	DATA[…]	float	Array of float

16.5.4 Example: Get <RGD> record (31, 1, 288, 1, 6)

Read Request

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX
->	0x00	0x00	0x20	0x00	0x11	0x01	0x55	0xF4	0x00	0x00

DATA[0]	DATA[1]	DATA[2]	DATA[3]	DATA[4]	DATA[5]	DATA[6]	DATA[7]	DATA[8]	DATA[9]	DATA[10]	DATA[11]
0x00	0x00	0x00	0x1F	0x00	0x01	0x01	0x20	0x00	0x01	0x00	0x06
Record ID = 31				Pixel number Start = 1		Number of Pixels = 288		Gas Number Start = 1		Number of Gases = 6	

CRC	CRC
0x77	0x5F

Read Response

	ADR	ID	ACK	LEN	LEN	CMD	PID	PID	IDX	IDX
<-	0x00	0x0B	0x21	0x04	0xC1	0x02	0x55	0xF4	0x00	0x00

DATA[0]	DATA[1]	DATA[2]	DATA[3]	DATA[4]	DATA[5]	DATA[6]	DATA[7]	DATA[8]	DATA[9]	DATA[10]	DATA[11]
0x00	0x00	0x00	0x1F	0x00	0x01	0x01	0xE7	0x00	0x07	0x59	0x9D
Record ID = 31				Time = 66'023ms				Integration Time = 481'693us			

DATA[12]	DATA[13]	DATA[14]	DATA[15]	...	DATA[1160]	DATA[1161]	DATA[1162]	DATA[1163]
0x00	0x05	0xFA	0x59	...	0x00	0x00	0x17	0xDE
Spectrum Power Pixel 1 : 39'176.9 counts/sec				...	Spectrum Power Pixel 288 : 611.0 counts/sec			

DATA[1164]	DATA[1165]	DATA[1166]	DATA[1667]	...	DATA[1184]	DATA[1185]	DATA[1186]	DATA[1187]
0x00	0x00	0x00	0x00	...	0x00	0x00	0x00	0x00
RGD Number 1 : 0.0 peak count per million				...	RGD Number 6 : 0.0 peak count per million			

DATA[1188]	DATA[1189]	DATA[1190]	DATA[1691]	...	DATA[1208]	DATA[1209]	DATA[1210]	DATA[1211]	CRC	CRC
0x00	0x00	0x00	0x00	...	0x00	0x00	0x00	0x00	0x84	0x1F
Partial Pressure 1 : 0.0 mbar					Partial Pressure 6 : 0.0mbar					

17 Commands: Analog Output

17.1 Get Mode

This command reads the <Analog Output> mode.

17.1.1 Command

PID			Remark
	Read	Write	
30000	X	–	

17.1.2 Request Data

Request Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						

17.1.3 Response Data

Response Data	Size [bytes]	Min.	Max.	Unit	DATA Location	DATA Type	Remark
Mode	1	0	13	[-]	DATA[0]	uint8_t	0 : None 1 : Manual 2 : Total Pressure 3 : Total Pressure Switch 4 : SPEC Power 5 : SPEC Power Switch 6 : ROR Augent Number 7 : ROR Augent Number Switch 8 : ROR Pressure Rise 9 : ROR Pressure Rise Switch 10 : RGD Power 11 : RGD Power Switch 12 : RGD Partial Pressure 13 : RGD Partial Pressure Switch 255 : Not defined.

17.2 Get Voltage

This command reads the <Analog Output> target voltage value.

17.2.1 Command

PID			Remark
	Read	Write	
30001	X	-	

17.2.2 Request Data

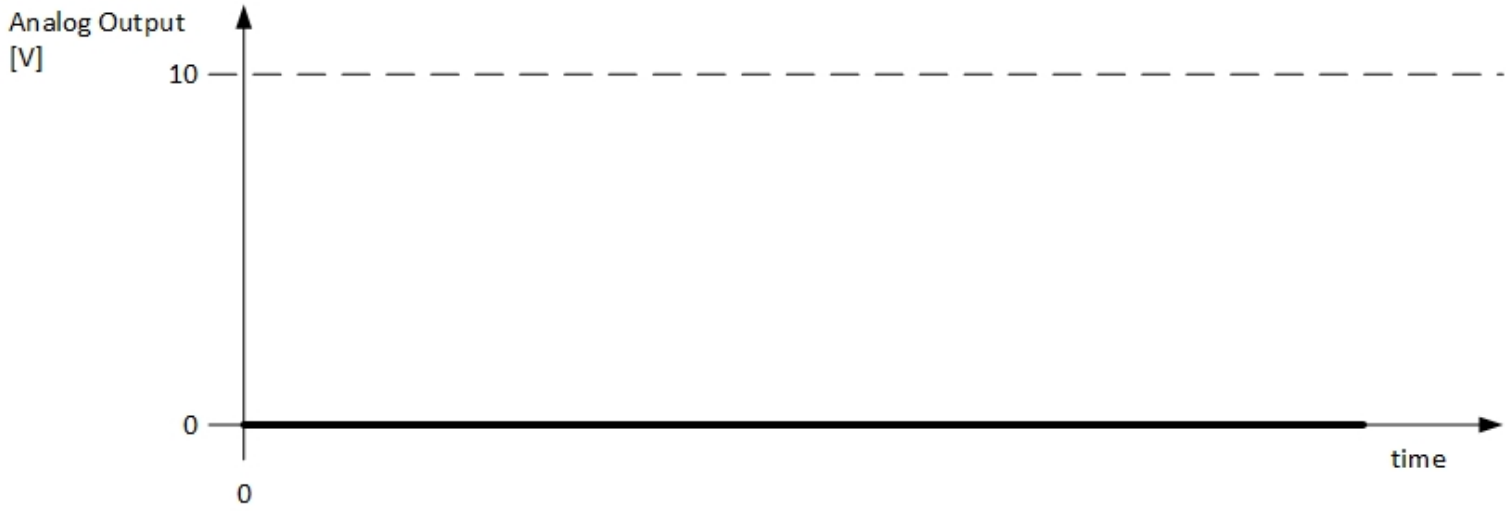
Request Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						

17.2.3 Response Data

Response Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						
Target output voltage.	2	0	10000	[mV]	DATA [0 … 1]	int16_t	

17.3 Set Mode <None>

This command sets the Analog Output to the mode <None>. A constant voltage of 0.0V is set to the output.



17.3.1 Command

PID			Remark
	Read	Write	
30010	-	X	

17.3.2 Request Data

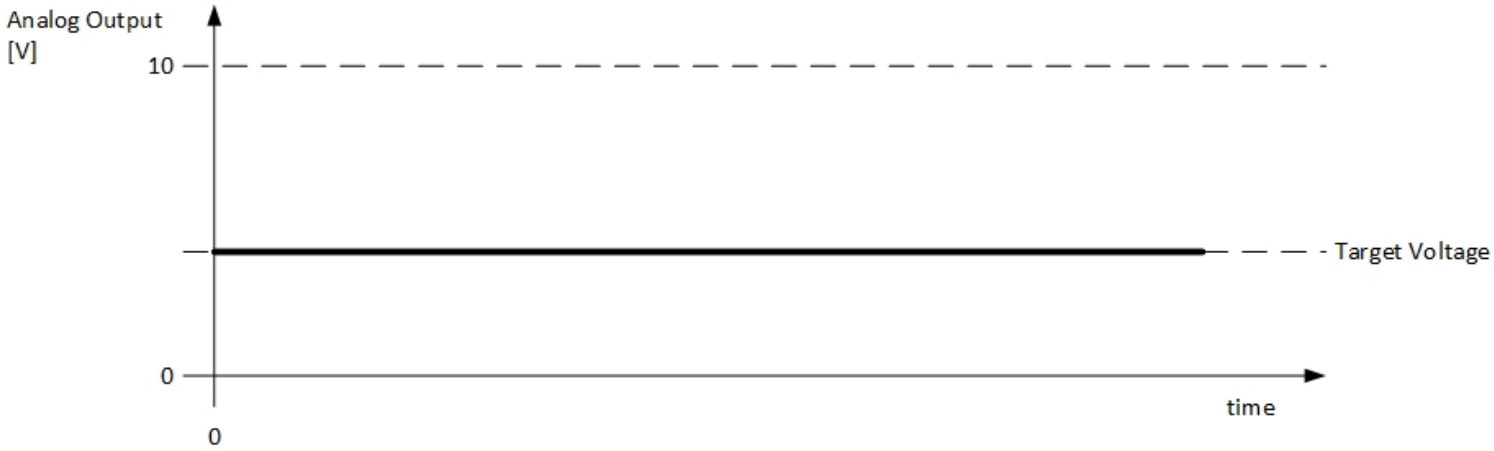
Request Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						

17.3.3 Response Data

Response Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						

17.4 Set Mode <Manual>

This command sets the Analog Output to the mode <Manual>. A constant voltage of x.xV is set to the output.



17.4.1 Command

PID			Remark
	Read	Write	
30011	-	X	

17.4.2 Request Data

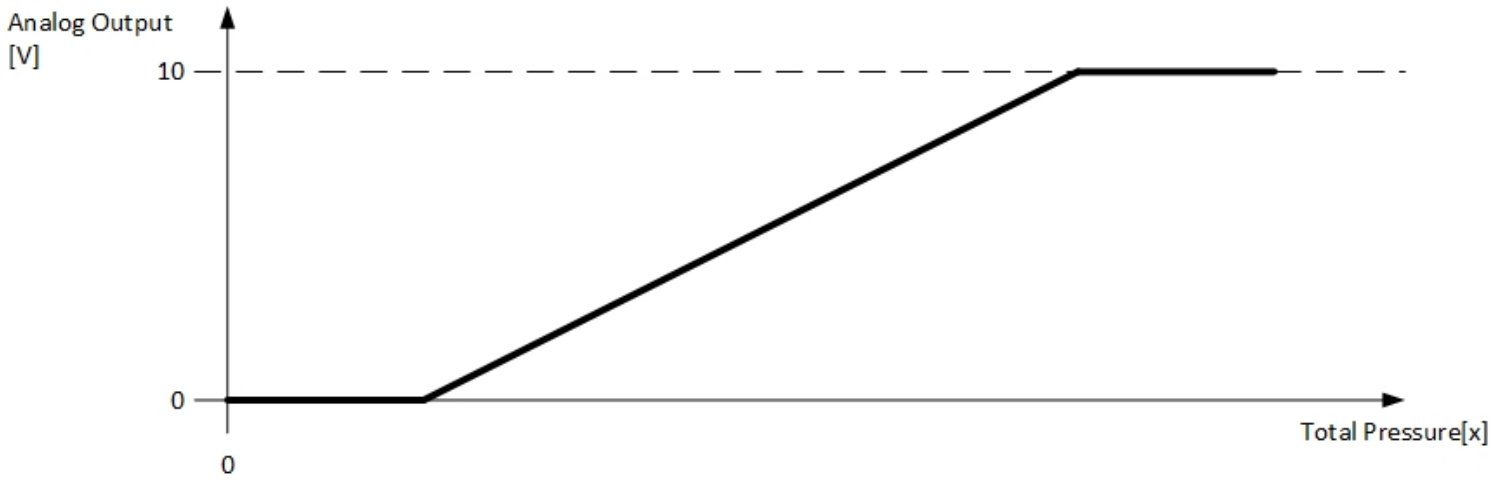
Request Data	Size [bytes]	Min.	Max.	Unit	DATA Location	DATA Type	Remark

17.4.3 Response Data

Response Data	Size [bytes]	Min.	Max.	Unit	DATA Location	DATA Type	Remark
Target voltage	2	0	10000	[mV]	Data [0 … 1]	int16_t	

17.5 Set Mode <Total Pressure>

This command sets the Analog Output to the mode <Total Pressure>. The voltage set to the output depends on the total pressure.



Range	Formula	c			Remark
		mbar	Pascal	Torr	
N	$U = c + log_{10} * p$	10.5	8.5	10.625	p: Total pressure
P	$U = c + 0.6 * log_{10} * p$	6.798	5.598	6.873	p: Total pressure
Q	$U = c + 1.33 * log_{10} * p$	12.66	10	12.826	p: Total pressure
H	$U = c + 0.75 * log_{10} * p$	7.75	6.25	7.844	p: Total pressure

17.5.1 Command

PID	Read	Write	Remark
30012	-	X	

17.5.2 Request Data

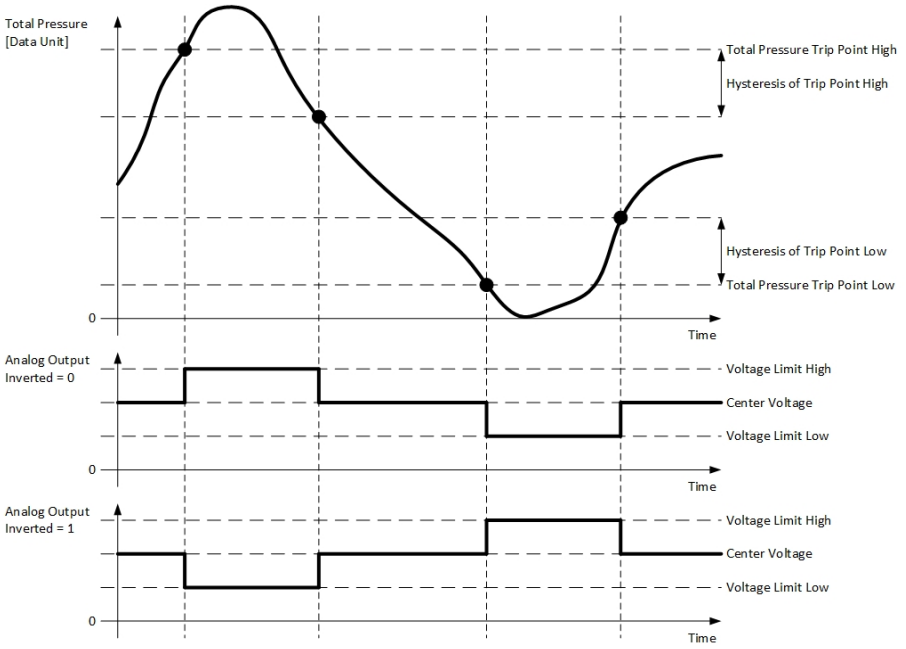
Request Data	Size [bytes]	Min.	Max.	Unit	DATA Location	DATA Type	Remark
Range	1	0	3	[-]	DATA [0]	uint8_t	0 : N 1 : P 2 : Q 3 : H

17.5.3 Response Data

Response Data	Size [bytes]	Min.	Max.	Unit	DATA Location	DATA Type	Remark

17.6 Set Mode <Total Pressure Switch>

This command sets the Analog Output to the mode <Total Pressure Switch>.



The following conditions must be met according to the trip points:

$$U_{TrpPntH} \geq \left(U_{TrpPntH} - abs\left(U_{TrpPntH} * H_{TrpPntH}\right)\right)$$

$$\left(U_{TrpPntH} - abs\left(U_{TrpPntH} * H_{TrpPntH}\right)\right) \geq \left(U_{TrpPntL} + abs\left(U_{TrpPntL} * H_{TrpPntL}\right)\right)$$

$$\left(U_{TrpPntL} + abs\left(U_{TrpPntL} * H_{TrpPntL}\right)\right) \geq U_{TrpPntL}$$

The following conditions must be met according to the output voltage:

$$U_{LimitH} \geq U_{LimitL}$$

Center Voltage:

$$U_{Center} = \frac{U_{LimitHigh} + U_{LimitLow}}{2}$$

17.6.1 Command

PID	Read	Write	Remark
30013	-	X	

17.6.2 Request Data

Request Data	Size [bytes]	Min.	Max.	Unit	DATA Location	DATA Type	Remark
Total Pressure Trip Point Low	4	1E-9	1E3	[mbar]	DATA [0 … 3]	float	The minimum and maximum value is defined in mbar. The Trip point itself is defined by the unit defined by argument <Data Unit>.
Hysteresis of Trip Point Low	4	0.0	100.0	[%]	DATA [4 … 7]	float	
Total Pressure Trip Point High	4	1E-9	1E3	[mbar]	DATA [8 … 11]	float	The minimum and maximum value is defined in mbar. The Trip point itself is defined by the unit defined by argument <Data Unit>.
Hysteresis of Trip Point High	4	0.0	100.0	[%]	DATA [12 … 15]	float	
Voltage Limit Low	2	0	10000	[mV]	DATA [16 … 17]	int16_t	
Voltage Limit High	2	0	10000	[mV]	DATA [18 … 19]	int16_t	
Inverted	1	0	1	[-]	DATA [20]	uint8_t	0 : Analog Output Voltage is not inverted. 1 : Analog Output Voltage is inverted.

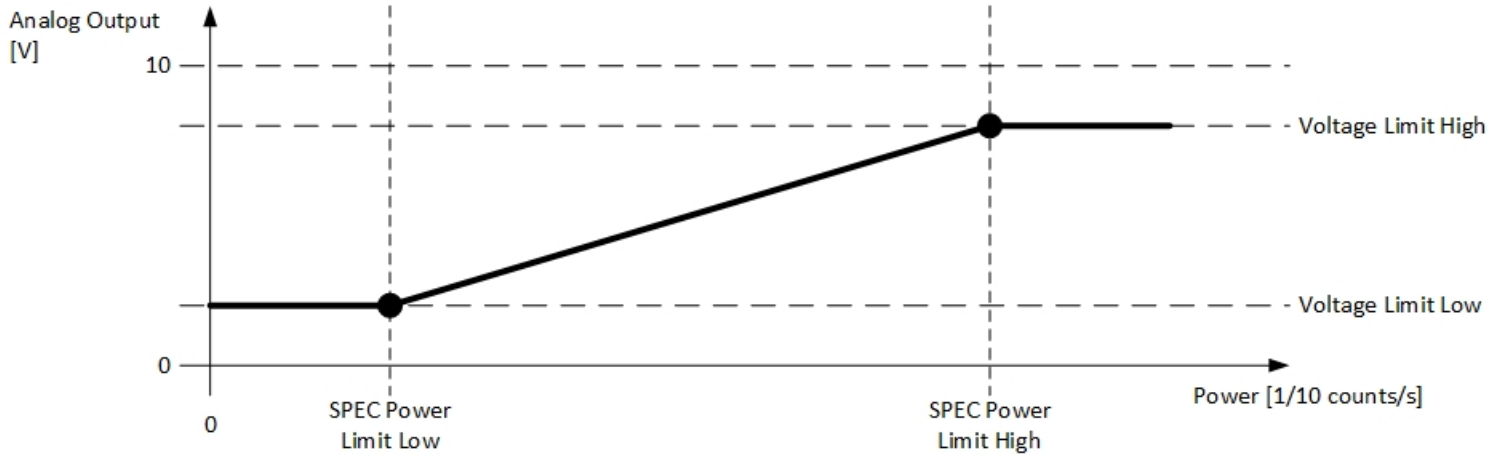
Range	1	0	3	[-]	DATA [21]	uint8_t	0 : N 1 : P 2 : Q 3 : H
Data Unit	1	0	3	[-]	DATA [22]	uint8_t	0 : mbar 1 : Torr 2 : Pascal 3 : micron

17.6.3 Response Data

Response Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						

17.7 Set Mode <SPEC Power>

This command sets the Analog Output to the mode <SPEC Power>.



17.7.1 Command

PID			Remark
	Read	Write	
30014	-	X	

17.7.2 Request Data

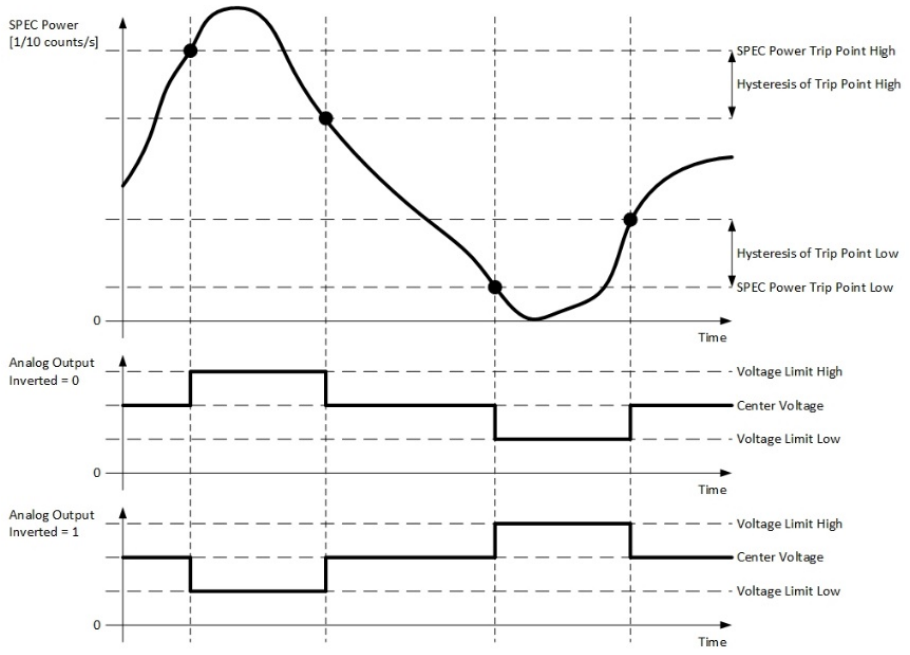
Request Data	Size [bytes]	Min.	Max.	Unit	DATA Location	DATA Type	Remark
SPEC Power Limit Low	4	0	4294967295	[1/10 counts/s]	DATA [0 … 3]	uint32_t	
SPEC Power Limit High	4	0	4294967295	[1/10 counts/s]	DATA [4 … 7]	uint32_t	
Voltage Limit Low	2	0	10000	[mV]	DATA [8 … 11]	int16_t	
Voltage Limit High	2	0	10000	[mV]	DATA [12 … 15]	int16_t	
Wavelength	4	0	4294967295	[1/100 nm]	DATA [16 … 19]	uint32_t	

17.7.3 Response Data

Response Data	Size [bytes]	Min.	Max.	Unit	DATA Location	DATA Type	Remark

17.8 Set Mode <SPEC Power Switch>

This command sets the Analog Output to the mode <SPEC Power Switch>.



The following conditions must be met according to the trip points:

$$U_{TrpPntH} \geq \left(U_{TrpPntH} - abs\left(U_{TrpPntH} * H_{TrpPntH}\right)\right)$$

$$\left(U_{TrpPntH} - abs\left(U_{TrpPntH} * H_{TrpPntH}\right)\right) \geq \left(U_{TrpPntL} + abs\left(U_{TrpPntL} * H_{TrpPntL}\right)\right)$$

$$\left(U_{TrpPntL} + abs\left(U_{TrpPntL} * H_{TrpPntL}\right)\right) \geq U_{TrpPntL}$$

The following conditions must be met according to the output voltage:

$$U_{LimitH} \geq U_{LimitL}$$

Center Voltage:

$$U_{Center} = \frac{U_{LimitHigh} + U_{LimitLow}}{2}$$

17.8.1 Command

PID	Read	Write	Remark
30015	-	X	

17.8.2 Request Data

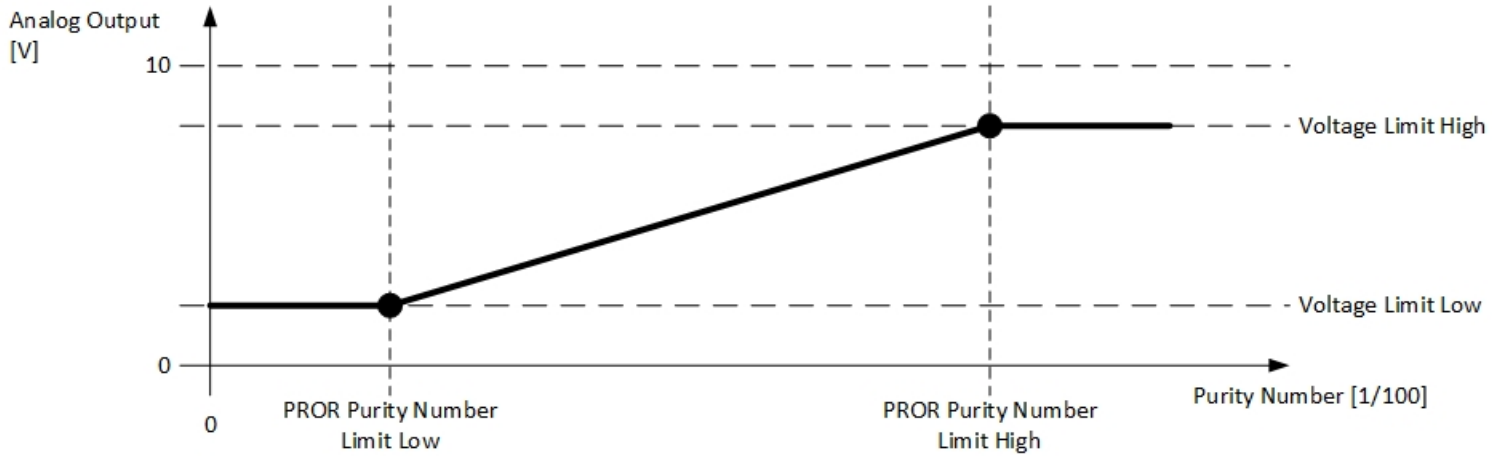
Request Data	Size [bytes]	Min.	Max.	Unit	DATA Location	DATA Type	Remark
SPEC Power Trip Point Low	4	0	4294967295	[1/10 counts/s]	DATA [0 … 3]	uint32_t	
Hysteresis of Trip Point Low	4	0.0	100.0	[%]	DATA [4 … 7]	float	
SPEC Power Trip Point High	4	0	4294967295	[1/10 counts/s]	DATA [8 … 11]	uint32_t	
Hysteresis of Trip Point High	4	0.0	100.0	[%]	DATA [12 … 15]	float	
Voltage Limit Low	2	0	10000	[mV]	DATA [16 … 17]	int16_t	
Voltage Limit High	2	0	10000	[mV]	DATA [18 … 19]	int16_t	
Inverted	1	0	1	[-]	DATA [20]	uint8_t	0 : Analog Output Voltage is not inverted. 1 : Analog Output Voltage is inverted.
Wavelength	4	0	4294967295	[1/100 nm]	DATA [16 … 19]	uint32_t	

17.8.3 Response Data

Response Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						

17.9 Set Mode <ROR Augent Number>

This command sets the Analog Output to the mode <ROR Augent Number>.



17.9.1 Command

PID			Remark
	Read	Write	
30016	-	X	

17.9.2 Request Data

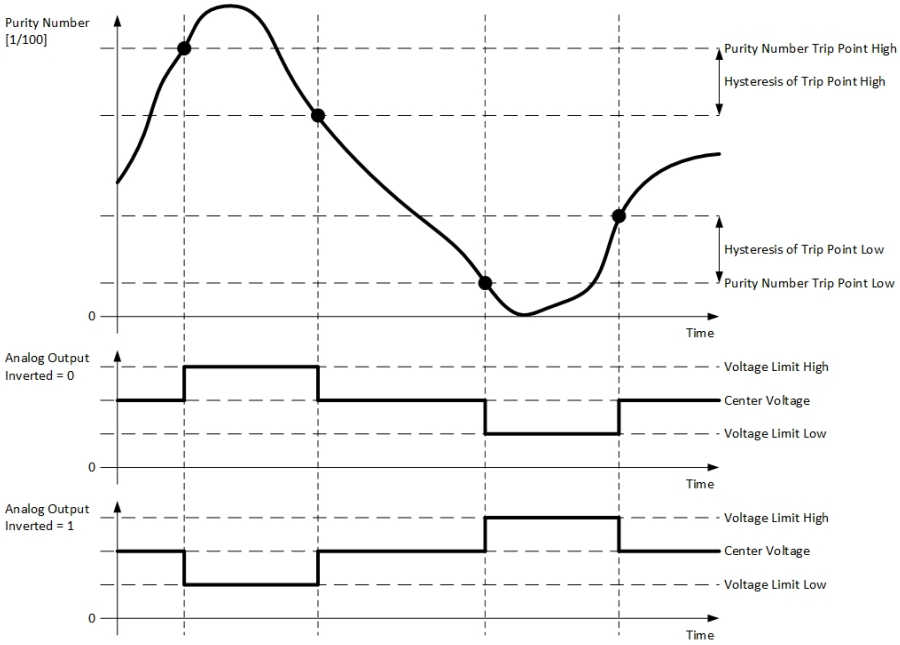
Request Data	Size [bytes]	Min.	Max.	Unit	DATA Location	DATA Type	Remark
Augent Number Limit Low	2	-32768	32767	[1/100]	DATA [0 … 1]	int16_t	
Augent Number Limit High	2	-32768	32767	[1/100]	DATA [2 … 3]	int16_t	
Voltage Limit Low	2	0	10000	[mV]	DATA [4 … 7]	int16_t	
Voltage Limit High	2	0	10000	[mV]	DATA [8 … 11]	int16_t	
Gas Number	2	1	6	[-]	DATA [12 … 13]	uint16_t	see Chapter 15.1

17.9.3 Response Data

Response Data	Size [bytes]	Min.	Max.	Unit	DATA Location	DATA Type	Remark

17.10 Set Mode <ROR Augent Number Switch>

This command sets the Analog Output to the mode <ROR Augent Number Switch>.



The following conditions must be met according to the trip points:

$$U_{TrpPntH} \geq \left(U_{TrpPntH} - abs\left(U_{TrpPntH} * H_{TrpPntH}\right)\right)$$

$$\left(U_{TrpPntH} - abs\left(U_{TrpPntH} * H_{TrpPntH}\right)\right) \geq \left(U_{TrpPntL} + abs\left(U_{TrpPntL} * H_{TrpPntL}\right)\right)$$

$$\left(U_{TrpPntL} + abs\left(U_{TrpPntL} * H_{TrpPntL}\right)\right) \geq U_{TrpPntL}$$

The following conditions must be met according to the output voltage:

$$U_{LimitH} \geq U_{LimitL}$$

Center Voltage:

$$U_{Center} = \frac{U_{LimitHigh} + U_{LimitLow}}{2}$$

17.10.1 Command

PID	Read	Write	Remark
30017	-	X	

17.10.2 Request Data

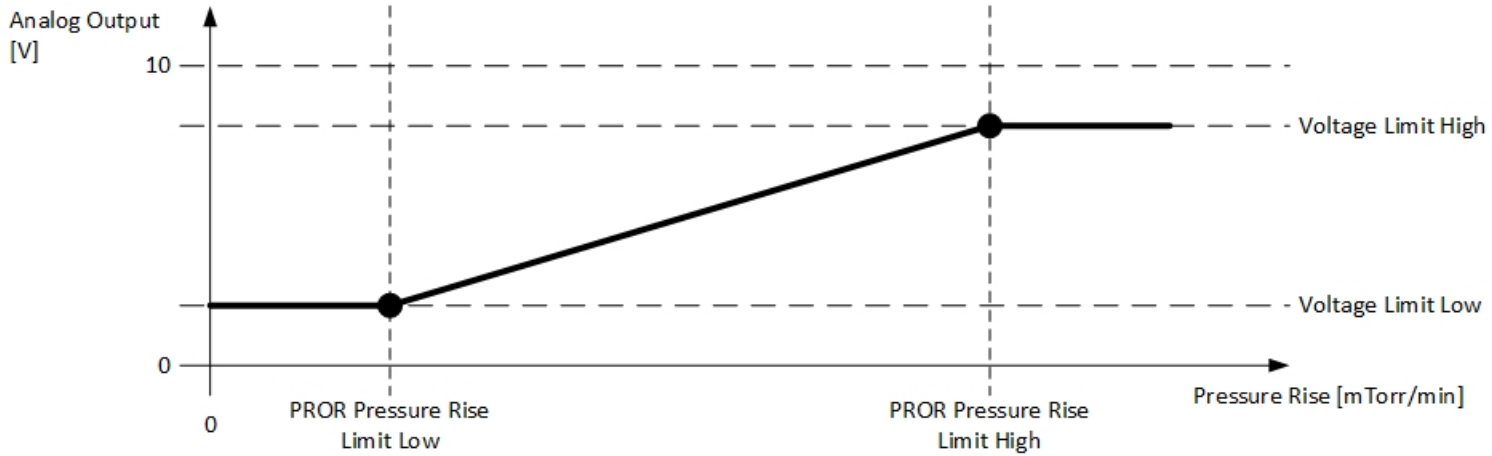
Request Data	Size [bytes]	Min.	Max.	Unit	DATA Location	DATA Type	Remark
Augent Number Trip Point Low	2	-32768	32767	[1/100]	DATA [0 … 1]	int16_t	
Hysteresis of Trip Point Low	4	0.0	100.0	[%]	DATA [2 … 5]	float	
Augent Number Trip Point High	2	-32768	32767	[1/100]	DATA [6 … 7]	int16_t	
Hysteresis of Trip Point High	4	0.0	100.0	[%]	DATA [8 … 11]	float	
Voltage Limit Low	2	0	10000	[mV]	DATA [12 … 13]	int16_t	
Voltage Limit High	2	0	10000	[mV]	DATA [14 … 15]	int16_t	
Inverted	1	0	1	[-]	DATA [16]	uint8_t	0 : Analog Output Voltage is not inverted. 1 : Analog Output Voltage is inverted.
Gas Number	2	1	6	[-]	DATA [17 … 18]	uint16_t	see Chapter 15.1

17.10.3 Response Data

Response Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						

17.11 Set Mode <ROR Pressure Rise>

This command sets the Analog Output to the mode <ROR Pressure Rise>.



17.11.1 Command

PID	Read	Write	Remark
30018	-	X	

17.11.2 Request Data

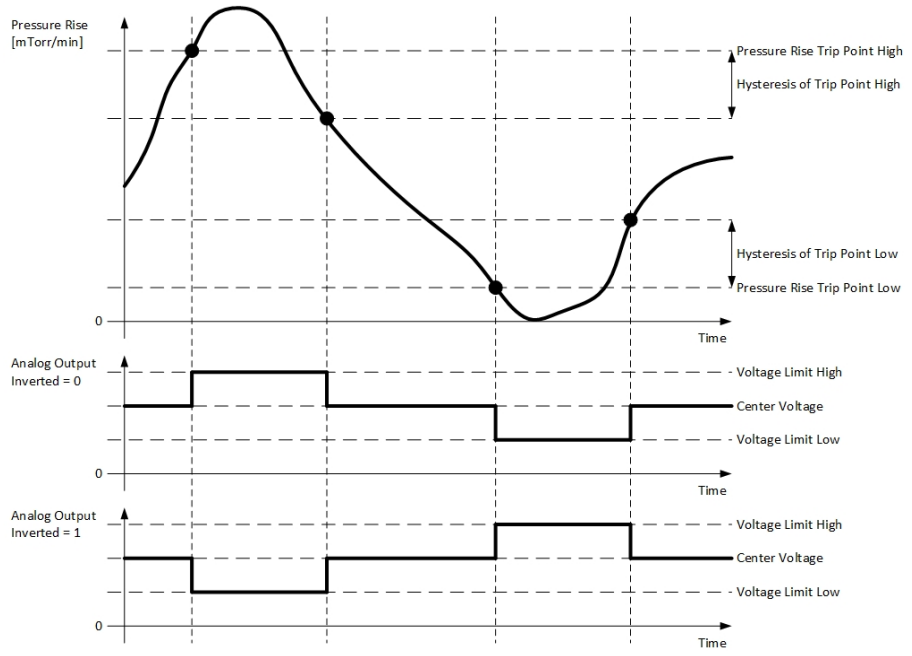
Request Data	Size [bytes]	Min.	Max.	Unit	DATA Location	DATA Type	Remark
Pressure Rise Limit Low	4	-3.40282347E38	+3.40282347E38	[mTorr/min]	DATA [0 … 3]	float	
Pressure Rise Limit High	4	-3.40282347E38	+3.40282347E38	[mTorr/min]	DATA [4 … 7]	float	
Voltage Limit Low	2	0	10000	[mV]	DATA [4 … 7]	int16_t	
Voltage Limit High	2	0	10000	[mV]	DATA [8 … 11]	int16_t	

17.11.3 Response Data

Response Data	Size [bytes]	Min.	Max.	Unit	DATA Location	DATA Type	Remark

17.12 Set Mode <ROR Pressure Rise Switch>

This command sets the Analog Output to the mode <ROR Pressure Rise Switch>.



The following conditions must be met according to the trip points:

$$U_{TrpPntH} \geq \left(U_{TrpPntH} - abs\left(U_{TrpPntH} * H_{TrpPntH}\right)\right)$$

$$\left(U_{TrpPntH} - abs\left(U_{TrpPntH} * H_{TrpPntH}\right)\right) \geq \left(U_{TrpPntL} + abs\left(U_{TrpPntL} * H_{TrpPntL}\right)\right)$$

$$\left(U_{TrpPntL} + abs\left(U_{TrpPntL} * H_{TrpPntL}\right)\right) \geq U_{TrpPntL}$$

The following conditions must be met according to the output voltage:

$$U_{LimitH} \geq U_{LimitL}$$

Center Voltage:

$$U_{Center} = \frac{U_{LimitHigh} + U_{LimitLow}}{2}$$

17.12.1 Command

PID			Remark
	Read	Write	
30019	-	X	

17.12.2 Request Data

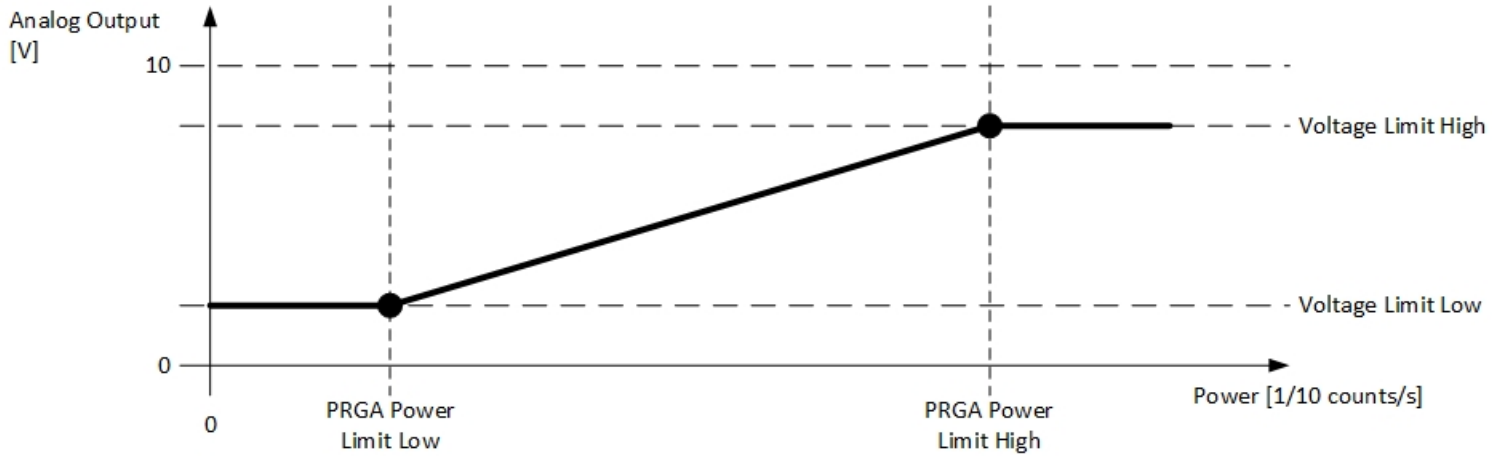
Request Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						
Pressure Rise Trip Point Low	4	-3.40282347E38	+3.40282347E38	[mTorr/min]	DATA [0 … 3]	float	
Hysteresis of Trip Point Low	4	0.0	100.0	[%]	DATA [2 … 5]	float	
Pressure Rise Trip Point High	4	-3.40282347E38	+3.40282347E38	[mTorr/min]	DATA [0 … 3]	float	
Hysteresis of Trip Point High	4	0.0	100.0	[%]	DATA [8 … 11]	float	
Voltage Limit Low	2	0	10000	[mV]	DATA [12 … 13]	int16_t	
Voltage Limit High	2	0	10000	[mV]	DATA [14 … 15]	int16_t	
Inverted	1	0	1	[-]	DATA [16]	uint8_t	0 : Analog Output Voltage is not inverted. 1 : Analog Output Voltage is inverted.

17.12.3 Response Data

Response Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						

17.13 Set Mode <RGD Power>

This command sets the Analog Output to the mode <RGD Power>.



17.13.1 Command

PID			Remark
	Read	Write	
30020	-	X	

17.13.2 Request Data

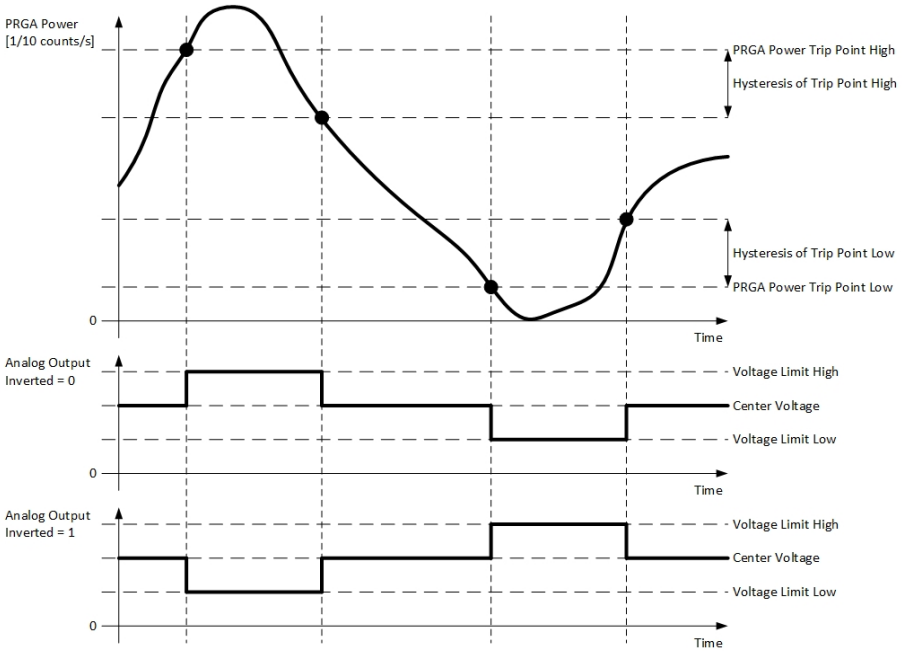
Request Data	Size [bytes]	Min.	Max.	Unit	DATA Location	DATA Type	Remark
RGD Power Limit Low	4	0	4294967295	[1/10 counts/s]	DATA [0 … 3]	uint32_t	
RGD Power Limit High	4	0	4294967295	[1/10 counts/s]	DATA [4 … 7]	uint32_t	
Voltage Limit Low	2	0	10000	[mV]	DATA [8 … 11]	int16_t	
Voltage Limit High	2	0	10000	[mV]	DATA [12 … 15]	int16_t	
Wavelength	4	0	4294967295	[1/100 nm]	DATA [16 … 19]	uint32_t	

17.13.3 Response Data

Response Data	Size [bytes]	Min.	Max.	Unit	DATA Location	DATA Type	Remark

17.14 Set Mode <RGD Power Switch>

This command sets the Analog Output to the mode <RGD Power Switch>.



The following conditions must be met according to the trip points:

$$U_{TrpPntH} \geq \left(U_{TrpPntH} - abs\left(U_{TrpPntH} * H_{TrpPntH}\right)\right)$$

$$\left(U_{TrpPntH} - abs\left(U_{TrpPntH} * H_{TrpPntH}\right)\right) \geq \left(U_{TrpPntL} + abs\left(U_{TrpPntL} * H_{TrpPntL}\right)\right)$$

$$\left(U_{TrpPntL} + abs\left(U_{TrpPntL} * H_{TrpPntL}\right)\right) \geq U_{TrpPntL}$$

The following conditions must be met according to the output voltage:

$$U_{LimitH} \geq U_{LimitL}$$

Center Voltage:

$$U_{Center} = \frac{U_{LimitHigh} + U_{LimitLow}}{2}$$

17.14.1 Command

PID	Read	Write	Remark
30021	-	X	

17.14.2 Request Data

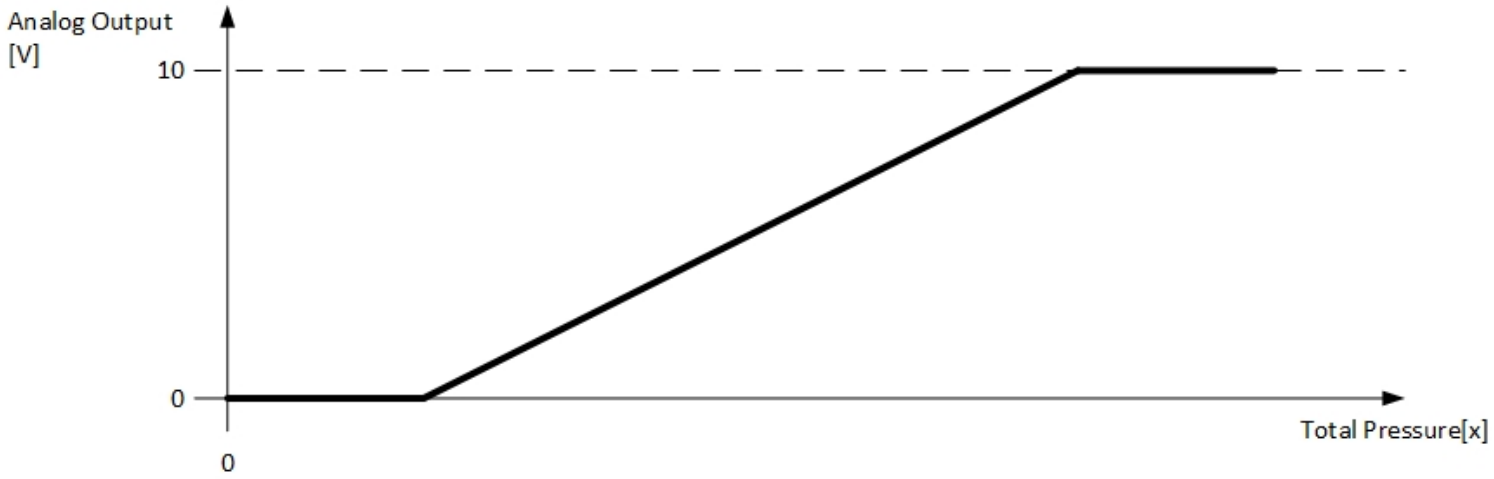
Request Data	Size [bytes]	Min.	Max.	Unit	DATA Location	DATA Type	Remark
RGD Power Trip Point Low	4	0	4294967295	[1/10 counts/s]	DATA [0 … 3]	uint32_t	
Hysteresis of Trip Point Low	4	0.0	100.0	[%]	DATA [4 … 7]	float	
RGD Power Trip Point High	4	0	4294967295	[1/10 counts/s]	DATA [8 … 11]	uint32_t	
Hysteresis of Trip Point High	4	0.0	100.0	[%]	DATA [12 … 15]	float	
Voltage Limit Low	2	0	10000	[mV]	DATA [16 … 17]	int16_t	
Voltage Limit High	2	0	10000	[mV]	DATA [18 … 19]	int16_t	
Inverted	1	0	1	[-]	DATA [20]	uint8_t	0 : Analog Output Voltage is not inverted. 1 : Analog Output Voltage is inverted.
Wavelength	4	0	4294967295	[1/100 nm]	DATA [16 … 19]	uint32_t	

17.14.3 Response Data

Response Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						

17.15 Set Mode <RGD Partial Pressure>

This command sets the Analog Output to the mode <RGD Partial Pressure>.



Formula	c			Remark
	mbar	Pascal	Torr	
$U = c + 1.039 * log_{10} * p$	8.273	6.195	8.403	p: Gas Partial Pressure

17.15.1 Command

PID			Remark
	Read	Write	
30022	-	X	

17.15.2 Request Data

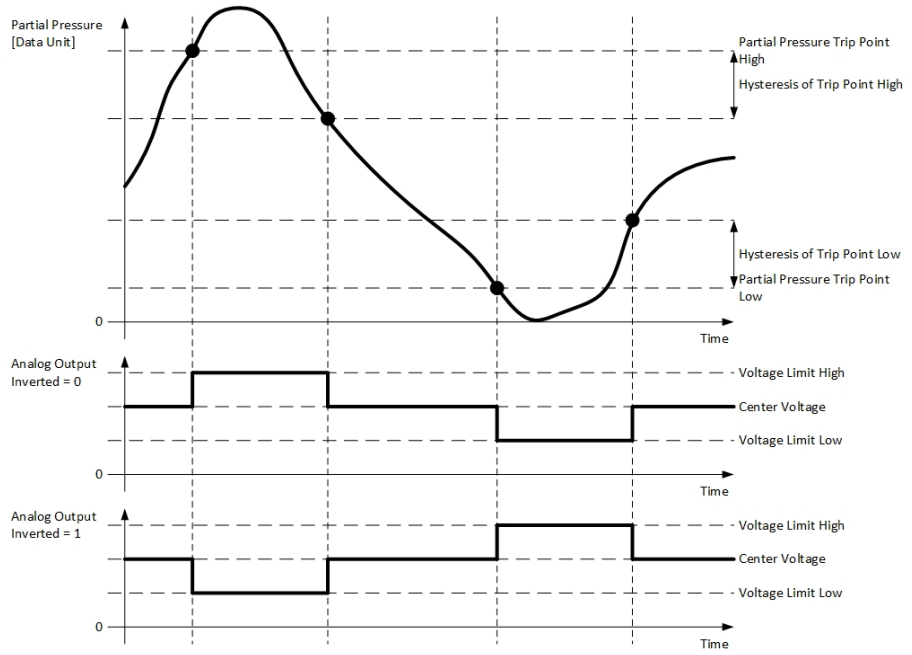
Request Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						
Gas Number	2	1	6	[-]	DATA [0 … 1]	uint16_t	see Chapter 16.1

17.15.3 Response Data

Response Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						

17.16 Set Mode <RGD Partial Pressure Switch>

This command sets the Analog Output to the mode <RGD Partial Pressure Switch>.



The following conditions must be met according to the trip points:

$$U_{TrpPntH} \geq \left(U_{TrpPntH} - abs\left(U_{TrpPntH} * H_{TrpPntH}\right)\right)$$

$$\left(U_{TrpPntH} - abs\left(U_{TrpPntH} * H_{TrpPntH}\right)\right) \geq \left(U_{TrpPntL} + abs\left(U_{TrpPntL} * H_{TrpPntL}\right)\right)$$

$$\left(U_{TrpPntL} + abs\left(U_{TrpPntL} * H_{TrpPntL}\right)\right) \geq U_{TrpPntL}$$

The following conditions must be met according to the output voltage:

$$U_{LimitH} \geq U_{LimitL}$$

Center Voltage:

$$U_{Center} = \frac{U_{LimitHigh} + U_{LimitLow}}{2}$$

17.16.1 Command

PID	Read	Write	Remark
30023	-	X	

17.16.2 Request Data

Request Data	Size [bytes]	Min.	Max.	Unit	DATA Location	DATA Type	Remark
Partial Pressure Trip Point Low	4	-3.40282347E38	+3.40282347E38	[mTorr/min]	DATA [0 … 3]	float	
Hysteresis of Trip Point Low	4	0.0	100.0	[%]	DATA [4 … 7]	float	
Partial Pressure Trip Point High	4	-3.40282347E38	+3.40282347E38	[mTorr/min]	DATA [8 … 11]	float	
Hysteresis of Trip Point High	4	0.0	100.0	[%]	DATA [12 … 15]	float	
Voltage Limit Low	2	0	10000	[mV]	DATA [12 … 13]	int16_t	
Voltage Limit High	2	0	10000	[mV]	DATA [14 … 15]	int16_t	
Inverted	1	0	1	[-]	DATA [16]	uint8_t	0 : Analog Output Voltage is not inverted. 1 : Analog Output Voltage is inverted.
Gas Number	2	1	6	[-]	DATA [17 … 18]	uint16_t	see Chapter 16.1

Data Unit	1	0	3	[-]	DATA [19]	uint8_t	0 : mbar 1 : Torr 2 : Pascal 3 : micron

17.16.3 Response Data

Response Data	Size	Min.	Max.	Unit	DATA Location	DATA Type	Remark
	[bytes]						

Notes

Notes

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