Communications Protocol

OPUS 200

OPUS 200i

OPUS 300

OPUS 300i

OPUS 208

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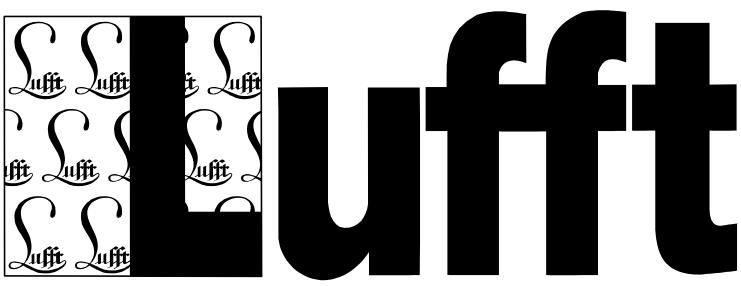

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Version history

Version	Date	Name	Change
1.0	31.07.2003	BR	First edition
1.1	16.07.2004	BR	Additions to monitor commands, IRS-21 data formats
1.2	11.10.2004	BR	Additions to IRS-21 road surface states
1.3	08.11.2004	EES	OPUS types supplemented, configuration alarm suppression added
1.4	23.11.2004	EES	Binary protocol command online data enquiry added (only affects the 208)
1.5	29.11.2004	EES	Binary configuration OPUS 200 address 17: large display added
1.6	19.01.2005	BR	FBZ coding “TLS” described incorrectly, was #367=97 should have been: #367=96
1.7	13.06.2005	BEL	Additional Opus types (Opus10/compact/4K)
1.8	08.09.2006	BR	EEPROM assignment extended ref. pre-alarms, incorrect area data for alarms corrected, table of OPUS types relocated, additional info. for offline request + monitor operation, identification of configuration fields deemed critical, communication logs amended

Preliminary Remarks:

Limits of the Guarantee

The methods and settings described in this document enable the data logger to be configured well beyond the standard settings. The selection of unreasonable settings can lead to the loss of the specified measurement accuracy and even equipment failure. Lufft reserves the right to limit the product guarantee when the procedures described herein are applied.

Nomenclature

OPUS 200: The concept OPUS 200 is used in this document as a synonym for the equipment family consisting of OPUS 200 (i), OPUS 300 (i), and OPUS 208. Where only the specific product OPUS 200 is meant, then this is identified in the text.

OPUS Master: By OPUS Master is meant that OPUS 200 through which the command is fed (independent of the type of connection: RS-232 direct, modem or GSM modem).

Data format and byte order in the communication protocol:

LONG:	LowLowByte LowHighByte HighLowByte HighHighByte
INT:	LowByte HighByte
SHORT:	LowByte HighByte
CHAR:	Byte
FLOAT:	According to IEEE format (4 bytes)

Online enquiry: supplies as its result the last memory value of any measurement channel of an OPUS 200.

Offline enquiry: supplies as its result part or the whole memory content of the OPUS 200 for the corresponding channel.

Memory value: recorded measurement value. Can be a measurement value, average, maximum or minimum value or a sum, depending on the setting in the OPUS 200.

Physical Connection and Hardware Structure

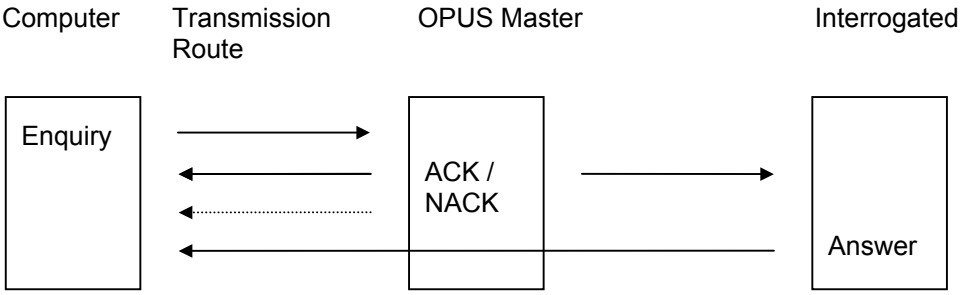
The control of one or several OPUS 200's in a network takes place via the RS-232 interface of any OPUS 200 in the network. The baud rate factory setting is 19200 baud with 8 data bits, one stop bit and no parity (**8N1**).
All OPUS 200's in the network are addressed and interrogated via the RS-232 interface. The address corresponds to the ID of the corresponding OPUS 200. The baud rate and the ID of the OPUS 200 are shown on the OPUS 200 display directly after reset.

Software Protocol

The configuration and interrogation of the OPUS 200 units can take place via the monitor operation (suitable for manual input) or via a binary protocol. In the binary protocol the control sends an enquiry to a specific OPUS, whereby the enquiry is routed through an identifier to the corresponding OPUS in the network.

Communication in the Binary Protocol

Communication Principle



The computer sends the instruction in binary protocol via the transmission route to the OPUS Master. If the syntax of the telegram is correct the OPUS Master sends an Acknowledge telegram back to the computer and forwards the telegram via the networking interface on the addressed OPUS 200 (for broadcast telegrams to all OPUS 200‘s in the network). If the syntax of the telegram is incorrect the OPUS Master rejects the telegram and sends a NACK telegram back to the computer. The interrogated OPUS processes the telegram and responds in accordance with the telegram.

Scanning of the Network

In order that the OPUS 200‘s available in a network can be accessed, their identifier (ID = CAN address) must be known. The procedure for interrogation of the ID‘s of all OPUS 200‘s available in a network is called scanning.

The enquiry to the OPUS 200 is sent to broadcast address (0), which is the same for all OPUS instruments and therefore is also answered by them all. The OPUS 200‘s send their answers with their identifier in the live data back to the sender. In order to avoid a build-up of telegrams or overwriting, the reply telegrams are sent with a random time delay. The data received in this way is forwarded to the PC.

PC	OPUS Master	OPUS
Construct RS-232 telegram; ⇒ Send telegram;	Read target address (Broadcast);⇒ Construct CAN telegram; Send CAN telegram; ⇐ (N)ACK telegram to PC	CAN telegram in mailbox Receive broadcast; Read data; Construct CAN telegram; ⇓
Build administration structures;	⇐ Receive telegram; Construct RS-232 telegram; Send telegram;	⇐ Send CAN telegram;
If ACK: Scan ready	<= If scanning time completed, then send an ACK to signal the end of the scanning procedure	

Enquiry telegram

Byte	1	2	3	4
Scan network	&	S	c	c

cc: Sum of the digits of all preceding bytes as INT

Reply telegrams
- (N)ACK telegram from the Opus Master
- Send CAN address (multiple)
- (N)ACK telegram from the Opus Master (scanning completed)

Byte	1	2	3	4	5
ACK telegram	$	&	S	c	c
NACK telegram	#	&	S	c	c

cc: Sum of the digits of all preceding bytes as unsigned short

Byte	1	2	3	4	5	6	7
Send CAN address	&	S	x	x	t	c	c

xx: ID, CAN address of the OPUS 200
t: Instrument type, e.g. 1: OPUS 200, 2: OPUS 200i, 3: OPUS 300, 4: OPUS 300i...
cc: Sum of the digits of all preceding bytes as unsigned short

Read Configuration

The configuration is stored in the OPUS 200 in a non-volatile EEPROM. The EE data enquiry is sent direct to the address of the OPUS 200 in question. The OPUS Master changes the enquiry into a CAN telegram and places it on the bus. The OPUS in question sends a (N)ACK back to the OPUS Master. The number of bytes to be expected is sent with the ACK. The data is then transferred in blocks of size TRANSFERBLOCKLEN (i.e. 128; for more details see Content of the OPUS 200 Binary Configuration). The last 2 bytes of such a block are the CRC on the preceding TRANSFERBLOCKLEN - 2 bytes.
The last block is filled up to TRANSFERBLOCKLEN - 2 + CRC.

The address of the OPUS Master is given in the CAN telegram of the enquiry.

PC	OPUS Master	OPUS
Construct RS-232 telegram; ⇒ Send RS-232 telegram; A max. of 2 (N)ACK come to this telegram.	Read target address(OPUS); ⇒ Construct CAN telegram; Insert OPUS Master address Send CAN telegram; ⇐ (N)ACK telegram to PC	CAN telegram in mailbox Receive request; Read data; ⇓
	⇐Forward OPUS (N)ACK telegram to PC	Send (N)ACK with number of e2 bytes ⇐
Read EE Data and fill data structure accordingly;	⇐ CAN Telegrams in mailbox Receive EE data Construct RS-232 telegram; Send RS-232 telegram;	Transfer E2 in blocks ⇐ Send CAN telegrams to OPUS Master; After a block wait for the ACK and repeat the block if necessary.

Enquiry telegram

Byte	1	2	3	4	5	6	7	8
Request EE data	?	E	x	x	x	x	c	c

cc: Sum of the digits of all preceding bytes as INT

Reply telegrams
- (N)ACK telegram from the Opus Master
- Read Ack telegram E2
- Send EE data
- Receive (N)ACK telegram EE data at end of block (from the computer to the OPUS 200!)
- Send EE data
- ...

Byte	1	2	3	4	5
ACK telegram	$	?	E	c	c
NACK telegram	#	?	E	c	c

cc: Sum of the digits of all preceding bytes as unsigned short

Byte	1	2	3	4	5	6	7
Read ACK telegram E2	$	?	E	x	x	c	c

xx: Number of valid bytes in the EEPROM, from here the number of blocks can be calculated
cc: Sum of the digits of all preceding bytes as unsigned short

Byte	1	2	3	4	5
Receive (N)ACK telegram EE data	$ (#)	?	E	c	c

cc: Sum of the digits of all preceding bytes as unsigned short

Write Configuration

The EE data is sent direct to the address of the OPUS in question. First a telegram is sent to the OPUS, which prepares the OPUS for the imminent transmission and informs how much data is to be sent (number of e2 bytes without crc or others). If this number does not agree with the number of EE data of this OPUS (different software status etc.), a NACK is sent back to the OPUS Master.
If the OPUS is ready it answers with an ACK telegram and the new configuration is transferred in blocks. After each block a (N)ACK is sent to the PC and the last block is repeated if necessary.

PC	OPUS Master	OPUS
Construct RS-232 telegram; ⇒ Send RS-232 telegram;	Read target address (OPUS); ⇒ Construct CAN telegram; Insert OPUS Master address; Send CAN telegram; ⇐ (N)ACK telegram to PC	CAN telegram in mailbox Receive request; Check if reported data quantity = EE data quantity; ⇓
If ACK then send EE data; If NACK then repeat;	⇐ Send ACK telegrams from OPUS to PC	Prepare OPUS; Construct CAN telegram (N)ACK; ⇐ Send CAN telegram to OPUS Master
Send required quantity of blocks ⇒	Read target address (OPUS); ⇒ Construct CAN telegram; Insert OPUS Master address; Send CAN telegram; ⇐ Send (N)ACK telegrams;	CAN telegram in mailbox Receive EE data configuration; Construct CAN telegram (N)ACK after each block; ⇓
If ACK then end; If NACK repeat last block	⇐ Receive CAN telegram in mailbox request; Construct RS-232 telegram;	⇐ Send CAN telegram to OPUS Master;

	Send RS-232 telegram.	

Online Request for Measurement Data

The controller sends at cyclical intervals a request telegram to each of the connected OPUS 200 instruments. If the OPUS 200 to which the serial interface is connected has received the telegram correctly then it sends back an ACK telegram. If an error was detected then it sends back a NACK telegram.
If the telegram was received correctly it is forwarded to the relevant OPUS 200 which then sends the current values back to the controller.
The float measurement values are shown in linear form on a standardised value range of 0 - 65520, where 0 corresponds to the minimum value and 65520 the maximum value of the configured sensor. Values above 65520 serve as error codes. In order that the measurement values can be counted back correctly, the controller must know the configuration of the OPUS 200.
The enquiries must be synchronous.
The OPUS instruments do not themselves initiate any reports.

Telegram Format

Request telegram

Byte	1	2	3	4	5	6	7	8
Online data request	?	N	x	x	x	x	c	c

x : OPUS 200 address as LONG
cc: Sum of the digits of all preceding bytes as INT

Reply telegrams
- (N)ACK telegram from the Opus Master
- Data reply telegram

Byte	1	2	3	4	5
ACK telegram	$	?	N	c	c
NACK telegram	#	?	N	c	c

cc: Sum of the digits of all preceding bytes as unsigned short

Byte	1	2	3	4	5	6	7	8	9	10	11	12
Online data reply for up to 4 measurement values	?	N	v1	v1	v2	v2	v3	v3	v4	v4	c	c
A 2nd telegram follows for more than 4 measurement values	?	N	v5	v5	v6	v6	c	c	-	-	-	-

v1v1 - vnvn: Maximum n measurement values, each as unsigned short. Quantity independent of channel configuration and quantity of active channels in the data logger.
If the OPUS only supplies the average or sum values over the storage interval for 2 channels, then only 2 measurement values v1 and v2 are sent. If in addition the minimum or maximum or both values are supplied over the storage interval the quantity increases to 4 or 6 measurement values. The sequence of the measurement values is Min before Max before Average.

cc: Sum of the digits of all preceding bytes as unsigned short

Special Case: Intelligent Road Sensor (OPUS 200 only)
The EEPROM address 367 of the OPUS 200 configured for IRS21 defines whether 6 or 7 sensor values (the extra value is radar) are supplied on the online data request. If the value is = 98 then 6 sensor values are supplied, if the value is != 98 then 7 values are supplied. The coding for the state of the road is determined at the same time with this storage position, See below for the meanings.

Reply telegram

Byte	1	2	3	4	5	6	7	8	9	10	11	12
Online data reply for up to 4 measurement values	?	N	v1	v1	v2	v2	v3	v3	v4	v4	c	c
A 2nd telegram follows for more than 4 measurement values	?	N	v5	v5	v6	v6	v7	v7	c	c	-	-

6 value format :

1. Value: v1v1 Road temperature (0..65520 == -50°C..150°C)
2. Value: v2v2 External temperature 1 (0..65520 == -50°C..150°C)
3. Value: v3v3 External temperature 2 (0..65520 == -50°C..150°C)
4. Value: v4v4 Freezing temperature (0..65520 == -25°C..0°C)
5. Value: v5v5 Water film height (0..65520 == 0.. 2000 (sensor type 98) / 10000 µm (sensor type 97))
6. Value: v6v6 Road condition (no scaling, see table)

7 value format:

1. Value: v1v1 Road temperature (0..65520 == -50°C..150°C)
2. Value: v2v2 External temperature 1 (0..65520 == -50°C..150°C)
3. Value: v3v3 External temperature 2 (0..65520 == -50°C..150°C)
4. Value: v4v4 Freezing temperature (0..65520 == -25°C..0°C)
5. Value: v5v5 Radar (0..255, no scaling)
6. Value: v6v6 Water film height (0..65520 == 0.. 2000 (sensor type 98) / 10000 µm (sensor type 97))*
7. Value: v7v7 Road condition (no scaling, see table)

*For sensor type 98 this value is 0..65520 scaled corresponding to 0..2000µm water film height; for sensor type 97 this value is 0..65520 scaled corresponding to 0..10000µm.

cc: Sum of the digits of all preceding bytes as INT

Road conditions (depending on the coding, address 367 in the EEPROM):
For #367=0

0	Dry
1	Damp
2	Wet
3	Ice
4	Frost / Snow
5	Residual salt
6	Freezing
>6	Undefined

For #367=98 (“ROSA” coding)

0	Undefined
1	Dry
2	Damp
3	Wet
4	Frost
5	Snow
6	Ice

States 4 (Wet + Salty) and 8 (Dripping salt) are not generated by OPUS 200

For #367=96 (“TLS coding”)

0	Meaning as per TLS 2002 FG3 DE type 70
32	Meaning as per TLS 2002 FG3 DE type 70
64	Meaning as per TLS 2002 FG3 DE type 70

67 Meaning as per TLS 2002 FG3 DE type 70
65 Meaning as per TLS 2002 FG3 DE type 70
66 Meaning as per TLS 2002 FG3 DE type 70
255 Meaning as per TLS 2002 FG3 DE type 70

In addition, IRS21 diagnostic data can also be requested (from IRS21 V2.4, OPUS 200 V4.0).
This data is only available for configuration to sensor type 97.

Request telegram

Byte	1	2	3	4	5	6	7	8
Online data request	?	Q	x	x	x	X	c	c

x : OPUS200 address as LONG
cc: Sum of the digits of all preceding bytes as unsigned SHORT

Reply telegram
- (N)ACK telegram from the Opus Master (see above)
- Data reply telegram

Byte	1	2	3	4	5	6	7	8	9	10	11	12
Online data reply for up to 4 measurement values	?	Q	v1	v1	v2	v2	v3	v3	v4	v4	c	c
A 2nd telegram follows for more than 4 measurement values	?	Q	v5	v5	c	c	-	-	-	-	-	-

v1 – v5: 5 measurement values, each as unsigned short.

Diagnose Data Format

1. Value (v1v1): Multi-frequency F51 (no scaling)
2. Value (v2v2): Multi-frequency F1000 (no scaling)
3. Value (v3v3): Radar standard value (no scaling)
4. Value (v4v4): Radar adaptation value
5. Value (v5v5): GFT-ADC (conductivity ADC) (no scaling)

In general these values can only be interpreted by service technicians of the Lufft Company.

Offline Request for Measurement Data

The offline data request is channel-related and is prepared with the telegram “Prepare offline request” to the OPUS Master. The OPUS Master saves the target address of the OPUS and forwards the telegram on. The OPUS in question reads the requested channel number from the telegram and stores the OPUS master address for further communication. If the OPUS Master sends an ACK to the PC, then the PC sends the telegram “Offline request date”. The OPUS in question sends an ACK with the quantity of blocks to be transmitted and then sends the required data in blocks to the OPUS Master which forwards them directly to the PC. After each block the OPUS waits for a (N)ACK in order to send the next block or to repeat the last one. The size of the blocks is according to the transfer block length (see binary configuration table for the corresponding devices). The data in the transmission blocks is organised in the OPUS 200 memory blocks. OPUS 200 memory blocks are always transmitted complete.

PC	OPUS Master	OPUS
Construct RS-232 telegram; ⇒ Send RS-232 telegram; (? 1..8 x x x x c c)	Read target address (OPUS); ⇒ Construct CAN telegram; Insert OPUS Master address; Send CAN telegram; ⇐(N)ACK telegram to PC ($/# b b c c)	CAN telegram in mailbox Receive request; Read out channel number Store OPUS Master address

If ACK then send date. ⇓		
Send telegram; (? T y m d H M S c c) ; ⇒ A max. of 2 (N)ACK telegrams come	Construct CAN telegram; ⇒ Send CAN telegram; ⇐ Send (N)ACK telegram; ($/# b b c c)	CAN telegram in mailbox Receive request; Search for data; ⇓
	⇐ Send ACK telegrams from OPUS to PC ($/# b b c c)	Send ACK with quantity of blocks that are required. ⇐
Send a (N)ACK after each block. ($/# b b c c)	⇐ CAN telegram in mailbox Receive request; Construct RS-232 telegram; Send RS-232 telegram;	Transmit data in blocks ⇐ Send CAN telegrams to OPUS Master; After a block wait for the ACK and if necessary repeat the block.

Data Format of an OPUS 200 Memory Block

An OPUS offline data block consists of a 32-byte header and a maximum of 180 measurement values of 2 bytes. The header contains the channel information, the recorded time of the first measurement value in the data block, the quantity of measurement values in the data block and the recording rate in ms (corresponds to the time interval of the measurement values). Unfilled measurement values in the data block are filled with the identity 0xFFFF.
If the OPUS records minimum and maximum values additionally, then the sequence of data is as follows:
First measurement value: minimum value (if configured); second measurement value: maximum value (if configured), third measurement value: average value (if configured). The data format of the IRS-21 offline data corresponds to the Format 6 values of the online enquiry, but all the data is supplied in channel 1. The diagnosis data is supplied in channel 2 (6 values), the sixth data value is not used. Otherwise the format is the same here as for the online enquiry.

Address	Name	Type	Description
0	Identity	unsigned short	0xFFFF (channel 1, 3, 5, 7), 0xFFFE (channel 2, 4, 6, 8)
2	RTC date	char[8]	YYYY MM DD (ASCII)
10	RTC time	char[8]	HH MM SS ZZ (ASCII)
18	Recording rate	unsigned long	in milliseconds (from EEPROM)
22	Measurement value quantity	unsigned short	in measurement values
24	Channel configuration	unsigned short	Summary from EEPROM
26	Extensions	char[4]	For future purposes
30	CRC	unsigned short	CRC sum over the header up till CRC and the data block
32..391	Measurement data	unsigned short[180]	

The measurement value quantity is the number of **measurement values** and not the number of measurements. For example, there are 3 measurement values in the block for min, max and average values.

Command List: Binary Protocol Commands

Request / Instruction telegrams:

Telegram	Format										Explanation
Wakeup signal	+										Signal sent to awaken a sleeping OPUS
Broadcast											
Scan network	&	S	c	c							Interrogate network about OPUS. c = Check sum;
Set time	&	T	y	m	d	H	M	S	c	c	Set hour and date;
Heartbeat (alive) telegram	&	H	c	c							Telegram for the central actor
Alarm telegram	&	B	c	c							Alarm telegram
Group alarm telegram	&	G	n	c	c						Group alarm telegram n: Group
Reset telegram	&	R	s	c	c						Reset telegram s = 0 Reset s = 1 Mute (no further alarm to be triggered till reset)
Group reset telegram	&	L	n	c	c						Group actor of alarm group n reset
ZA: Set time	&	Z	v	v	v	v	c	c			Vvvv –Timeout value in ms
Request telegrams:											
Online data request (200/300)	?	N	x	x	x	x	c	c			
Online data request (208)	?	N	k	x	x	x	x	c	c		k = channel 1...8 (ASCII)
Prepare offline data request	?	1..8	x	x	x	x	c	c			Channel 1..8 (ASCII) ; Sets the target address in the OPUS Master
Offline data request date	?	T	y	m	d	H	M	S	c	c	Transfer request start time
	?	P	1..6	x	x	x	x	c	c		Particle / Pump (208) Byk
Request EE data	?	E	x	x	x	x	c	c			
EE+TLS data	?	B	x	x	x	x	c	c			
Request E2 CRC	?	C	x	x	x	x	c	c			
Read E2 char	?	Z	v	v	x	x	x	x	c	c	v = e2 address
Read E2 word	?	I	v	v	x	x	x	x	c	c	v = e2 address
Read E2 long	?	L	v	v	x	x	x	x	c	c	v = e2 address
Read E2 float	?	F	v	v	x	x	x	x	c	c	v = e2 address
Number of DE channels (micks)	?	M	x	x	x	x	c	c			
TLS data (micks)	?	D	z	x	x	x	x	c	c		
Online_2	?	O									
Online IRS21 diagnosis	?	Q									
Instruction telegrams											
Prepare to send EE data	%	E	d	d	x	x	x	x	c	c	dd = number of bytes to be expected
Send EE data (configuration)	%	R	+ 8 byte data				c	c			Send max. 8 bytes data, because the CAN telegrams can only transport max. 8 bytes.
Delete memory	%	1..8	x	x	x	x	c	c			Channels 1..8 (ASCII)
Set master ID	%	M	z	x	x	x	x	c	c		Set master ID
Set target address	%	O	x	x	x	x	c	c			x = Target address
Send extended E2 (micks)	%	T	x	x	x	x	c	c			
208 compatibility (Byk)	%	P	1..6	0..1	x	x	x	x	c	c	1..6 Channel 1..2 Level
Write E2 char	%	Z	v	v	C	c	c				v = e2 address; C = value

Write E2 word	%	I	v	v	S	S	c	c			S = value
Write E2 long	%	L	v	v	L	L	L	L	c	c	L = value
Write E2 float	%	F	v	v	F	F	F	F	c	c	F = value
OPUS reset	*%*	*%*	*x*	*x*	*x*	*x*	*c*	*c*			*Trigger software reset*
Ack telegram	$	b	b	c	c						Acknowledge telegram b = Command for which the Ack is sent out
Nack telegram	#	b	b	c	c						Not acknowledge telegram b = Command for which the Nack is sent out

Reply telegrams

Telegram	**Format**										**Explanation**
Send CAN address	&	S	x	x	t	c	c				x = OPUS identity; t = Type
Send online data	?	N	4-8 byte data						c	c	1-2 telegrams with 4-12 total bytes
Send offline data	d	d	d	d	d	d	d	d			Multiple telegrams come until data is transferred
Send EE data	d	d	d	d	d	d	d	d			Multiple telegrams come until data is transferred
Send E2 CRC	?	C	k	k	c	c					k = E2CRC 16
Read E2 char	?	Z	C	c	c						C = value
Read E2 word	?	I	i	i	c	c					i = value
Read E2 long	?	L	l	l	l	l	c	c			l = value
Read E2 float	?	F	f	f	f	f	c	c			f = value
Number of DE channels	?	M	a	c	c						A = number of DE channels
ACK telegram	$	b	b	c	c						b =command for which the ACK was issued
NACK telegram	#	b	b	c	c						b = command for which the NACK was issued
Read E2 ACK telegram	$	b	b	x	x	c	c				b = command for which the ACK was issued; x = number of e2 bytes
Read ACK telegram offline	$	b	b	x	x	c	c				b = command for which the NACK was issued; x = number of blocks to be sent.
Particle / Pump OPUS 208 byk	?	P	1. .6	0. .1	c	c					1..6 channel 1..2 level

List of Error Values

The following error codes are defined:

Description	Value	
Value overflow	0xFFF3	The input range of the sensor was exceeded, or no sensor is connected
Conf error	0xFFF4	An unreasonable configuration was detected
CRC error	0xFFF5	The check sum via E2 is incorrect
Invalid channel	0xFFF6	Invalid channel data
Invalid Value	0xFFFD	

Communication in Monitor Mode

The monitor mode serves for interactive readout and adjustment of the binary configuration (E2) of the datalogger and in addition provides simple test and service routines. Neither online nor offline measurement requests are possible in this mode.

Switching an OPUS into Monitor Mode

All commands are completed with *ENTER*.

Start monitor mode	!X	X = ID of the OPUS module
Quit monitor mode	ESC	

E.g.: !287<ENTER>
Switches the OPUS with the ID 287 into monitor mode. If no signals are received on the interface for 20 seconds the monitor mode is automatically left.
The commands described below can be set in monitor mode.

If the OPUS ID is unknown then this can be requested by entering !<ENTER>.
The command !0 is not allowed and is blocked by current firmware versions.

Command List: Monitor Commands

All commands are completed with *ENTER*.

Meaning	**Command**	**Comments**
Read E2 signal	ERS Y	Y = E2 address
Read E2 word	ERI Y	
Read E2 long	ERL Y	
Read E2 float	ERF Y	
Set E2 signal	ES Y V	V = value
Set E2 word	EI Y V	
Set E2 long	EL Y V	
Set E2 float	EF Y V	
Read clock	CLR	Readout time
Set clock date	CLSD x	Set date to x x: dd.mm.yy
Set clock time	CLST x	Set hour to x x: hh:mm:ss
Set relay	RS n	Set relay of channel n
Clear relay	RC n	Reset relay of channel n
Toggle relay	RT n	Toggle relay of channel n
Read entire port	PER n	Readout port n
Read pin	PR n x	Readout of pin x on port n
Set pin	PS n x	Setting of pin x on port n
Clear pin	PC n x	Deletion of pin x on port n
Delete memory	MC x	Deletes the measured data memory of channel x
Switch off measured value simulation	SI x	Switches off measured value simulation on channel x, x>0
Measured value simulation	SI x y	Simulates measured value y on channel x, x>0, y float
Display contrast setting	SK V	V 0..255 (OPUS 208 only)
	CIL	ADGetULI
	CIR	ADGetVREF
	CIG	ADGetGUB
	CT	Events
	CR x	Convert_raw_data, channel x, x>0

Trigger OPUS reset	%%	Restarts the OPUS

The OPUS must be reset for the changes on E2 to take effect.

Special Monitor Commands for the Intelligent Road Sensor
The following additional monitor commands can be set at the monitor of an OPUS 200 that has a road sensor connected:

Setting the target ID in the OPUS 200	FID x	All commands sent go to the IRS-21 with ID x; default: ID 0, whereby all connected IRS-21's reply; the ID is not recorded, i.e. after a reset it is 0 again
Reading an IRS-21 E2 point	FER x	Reads the value of E2 point x from the IRS-21
Setting an IRS-21 E2 point	FES x y	Writes value y to E2 point x
Reading an IRS-21 E2 block	FRB x y	Reads y E2 values from address x from the IRS-21
Output of the hardware and software versions	FVV	
Resetting the IRS-21	FRT	
Turn on ASCII protocol	FAP x	From OP200 V 5.1 and IRS-21 V2.4, x=0 off, x=1 on. Turning off the ASCII protocol in the IRS-21 increases the operational security of the measurement data request through the OPUS 200

The monitor commands are sent to the IRS-21 with the ID that was set with the command FID. If the ID is 0, all the IRS-21's that are connected to the bus reply. N.B.: The second character of the IRS-21 monitor commands is never checked, FVV gives the same output as FWV.

Table: OPUS 200 Binary Configuration

Equipment parameters				
Address	**Name**	**Type**	**Range**	**Description**
1	Identity	unsigned short	1.. 65 534	OPUS serial number Only 16 bits are used as the ID
3	OPUS Master identity. Allocated automatically on configuration	unsigned char	1.. 255	If this OPUS is the OPUS Master, then the OPUS Master ID is inserted in the return address
4	Opus type	unsigned char	see OPUS types table	Opus types, in this case 1,2,3 or 4
5	Current no.	unsigned short	0 .. 999	Current number in production month
7	Month Year	unsigned short	100 .. 1299	mmyy
9	Project number	unsigned short	1 .. 9999	Year Project no.
11	Parts list	unsigned char	0..9	Parts list no.
12	Electrical diagram	unsigned char	0 .. 9	Electrical diagram no.
13	Hardware version	unsigned char	0 .. 9	HW serial no.
14	Software version	unsigned char	0 .. 99	SW serial No.
15	E2 version	unsigned char	0 .. 255	E2 version
16	Operating mode	unsigned char	0 = Off 1 = Sleep 2 = Normal	Off: Means just that. Sleep: Awakens on receipt of telegrams. Normal: Always awake (for high sampling rates or when a permanent display is desired)

17	Communication type	unsigned char	0 = RS-232 1 = Modem 2 = GSM modem 3 = Radio modem 4 = Large display	Direct, modem, GSM modem, radio modem
18	Initstring	char[32]		Modem initialisation
50	Endstring	char[32]		Reset modem
82	Pin	unsigned short	0 .. 9999	GSM Mo. PIN
84	Free field	unsigned char		
85	Free field	unsigned char		
86	Enquiry interval	unsigned char	Default 10	Interval at which check is carried out whether the GSM is still installed
87	Free field	unsigned char		
88	CAN baud rate	unsigned char	1: 50000 2: 25000 3: 15000 4: 10000 5: 5000 Default: 50000	CAN baud rate
89	RS-232 baud rate	unsigned char	2: 57600 4: 28800 6: 19200 8: 14400 12: 9600 24: 4800 48: 2400 Default: 19200	Division factor Calculation: 115200 / baud rate
90	Transfer block length	unsigned short	1.. ?	Block length of the data transfer
92	AD_filter	unsigned short	1..?	AD setting
94	telephone_1	unsigned char [16]		Telephone number for alarm
110	telephone_2	unsigned char [16]		Alternative telephone number for alarm
126	Free field	unsigned char [16]		
142	Free field	unsigned char [16]		
158	Free field	unsigned char[160]		
318	general_pad	unsigned char[49]		Spare field
367	FBZ coding	unsigned char	0, 97, 98	Lufft, TLS, FBZ-ROSA

Channel parameters (2x)				
Input parameters				
368 485	Sensor type	unsigned char	0 Current 1 Voltage 2 Resistance 3 Frequency 4 Pulse 5 PT 100 6 PT 1000 7 NTC 8 THC E 9 THC J 10 THC K 11 THC N 22 THC S 23 THC R 30 THC T ...	Current, voltage, resistance, frequency, pulse
369 486	Sensortype_user	unsigned char	0..255	User-defined sensors
370 487	External comparison point	unsigned char	0 = no ext. comp. 1 = ext. comp. pt.	External comparison point for thermocouples
371 488	Connection type	unsigned char	0 = 4 core cable 1 = 3 core cable	Resistance sensors can be connected in 3 or 4 core cable
372 489	unipolar	unsigned char	0 = bipolar 1 = unipolar	The value range is -x to +x for bipolar and 0 to x for unipolar
373 490	Value ranges	unsigned char	0 = 0-20mA 1 = 4-20mA 16 = 0-20mV 17 = 0-40mV 18 = 0-80mV 19 = 0-100mV 20 = 0-160mV 21 = 0-320mV 22 = 0-640mV 23= -1000mV 24 = 0-10000mV 32 = 0-200 Ohms 33 = 0-2000 Ohms 34 = 0-20000 Ohms 35 = 0-100000 Ohms 48 = 10-1000 Hz 64 = 0-65000 Pulse/recording interval	The possible input ranges for the external sensors. The strange identities result from the fact that the sensor type in highnibble is stored as redundant (it may be useful at some time). The values printed in bold are exclusively required for the preloading of standard sensors (e.g. thermocouple of type J).
374 491	Value range Min. input	float	-Max .. +Max Unit: Current: mA Voltage: mV Resistance: Ohm Frequency: Hertz Pulse: Pulse/recording interval	Smallest physical value supplied by the sensor

378 495	Value range Max. input	float	-Max .. +Max Unit: see above	Largest physical value supplied by the sensor
382 499	Unit	char[2]		Unit of the measurement variable
384 501	Decimal point	unsigned char	0,1,2,3	Decimal places of the display
385 502	Min. display size	float	-Max .. +Max	Smallest value of the measurement variable
389 506	Max. display size	float	-Max .. +Max	Largest value of the measurement variable
393 510	Offset	float	-Max .. +Max	Offset for measurement value
397 514	Response time	unsigned short	0 .. 100 unit ms	Measurement sensor response time in ms
399 516	C12	unsigned short	0 .. Max.	TFF calibration value
401 518	C76	unsigned short	0 .. Max.	TFF calibration value
Output parameters				
403 520	Relay mode	unsigned char	active = 1 central actor = 2 active + central actor = 3 Bit 4 set (0x1x) pre-alarm active	Alarm configuration, alarm, central actor, pre-alarm on / off
404 521	Upper alarm limit alarm_max	unsigned short	0 .. 65520 (0xFFF0)	Alarm limit relay This is the upper value mapped to the communication standard
406 523	Lower alarm limit alarm_min	unsigned short	0 .. 65520 (0xFFF0)	Alarm limit relay This is the lower value mapped to the communication standard
408 525	Alarm hysteresis	unsigned short	0..65520	Hysteresis for the exceeding of alarm limits in the mapping standard
410 527	Alarm time	unsigned char	0 = Recording 1 = Sampling	Alarm on recording or sampling
411 528	Value range output	unsigned char	0 = n. active 1 = 0-20mA 2 = 4-20mA	Set supply output 0 .. 20 / 4 .. 20 mA
412 529	Display range Min.	float	-Max .. +Max unit: corresponding to field unit	Min. measurement range displayed by output instrument
416 533	Display range Max	float	- Max .. +Max unit: corresponding to field unit	Max. measurement range displayed by output instrument
Logging parameters				
420 537	Mode	unsigned char	0 = Off 1 = Online 2 = Offline	Off, Online, Offline operation
421 538	Sampling rate	unsigned short	100 .. 60000	Sampling rate ms
423 540	Recording interval	unsigned long	100 .. 86400000	Recording interval in ms
427 544	Recording mode	unsigned char	1 = AVG 2 = MAX 4 = MIN	Min, Max, Avg and all permutations

			8 = Sum AVG + MAX = 3 AVG + MIN = 5 MAX + MIN = 6 AVG + MAX +MIN = 7 etc...	
428 545	Memory type	unsigned char	0 .. 1	Ring / Start/Stop
429 546	Start year	unsigned char	0..99	Start year Start/Stop
430 547	Start month	unsigned char	1..12	Start month
431 548	Start day	unsigned char	1..31	Start day
432 549	Start hour	unsigned char	0..23	Start hour
433 550	Start minute	unsigned char	0..59	Start minute
434 551	Start second	unsigned char	0..59	Start second
435 552	Sensor breakage current	float	0..22mA	Current output on sensor breakage
439 556	Alarm suppression	unsigned char	1 ... 100	0 .. 99 storage intervals
Additional fields – channel parameters				
440 557	Lower pre-alarm limit (1)	unsigned short	0 .. 65520 (0xFFF0)	This is the lower value mapped to the communication standard
442 559	Upper pre-alarm limit (1)	unsigned short	0 .. 65520 (0xFFF0)	This is the upper value mapped to the communication standard
444 561	Alarm group (1)	unsigned char	0.250	Alarm group number of normal alarm
445 562	Alarm group Pre-alarm (1)	unsigned char	0.250	Alarm group number of pre-alarm
446 563	Type of measurement value formation (1)	unsigned char	n.n.	n.n. e.g. vectorial for wind gauge
447 564	(1)	unsigned short	0 .. 65520 (0xFFF0)	n.n. e.g. lower limit for wind direction output ref. windspeed in the mapping standard
449 568	pad channel	unsigned char [36]		Spare field

Address	**Name**	**Type**	**Range**	**Description**
602-641	Equipment description	char[40]		Text
642-681	Channel description channel 1	char[40]		Text
682-721	Channel description channel 2	char[40]		Text

Table: OPUS 208 Binary Configuration

Equipment parameters:

Address	Content	Type	Range	Description
1-2	Identity	unsigned short	1.. 65 534	OPUS serial number Only 16 bits are used as the ID
3	OPUS Master identity Assigned automatically on configuration	unsigned char	1.. 255	If this OPUS is the OPUS Master, then the OPUS Master ID is inserted in the return address
4	*Opus type*	*unsigned char*	*see OPUS types table*	*Opus type, in this case 10*
5-6	*Current No.*	*unsigned short*	*0 .. 999*	*Current number in production month*
7-8	*Month Year*	*unsigned short*	*100 .. 1299*	*mmyy*
9-10	*Project number*	*unsigned short*	*1 .. 9999*	*Year Project No.*
11	*Parts list*	*unsigned char*	*0..9*	*Parts list No.*
12	*Electrical diagram*	*unsigned char*	*0 .. 9*	*Electrical diagram no.*
13	*Hardware version (TZ)*	*unsigned char*	*0 .. 9*	*HW revision no.*
14	*Software version*	*unsigned char*	*0 .. 99*	*SW version no.*
15	*E2 version*	*unsigned char*	*0 .. 255*	*E2 version*
16	Operating mode	unsigned char	0 = Off 1 = Sleep 2 = Normal	Off: Means just that. Sleep: Awakens on receipt of telegrams. Normal: Always awake (for high sampling rates or when a permanent display is desired)
17	Central actor	unsigned char	0 = Off, 1 = Active from V3.1: 0..0x0F	Central actor active, not active From V3.1 coded differently (in terms of bits): Bit 0..3=1:Group actor (GA) 0..3 active
18	Actor channel (2)	unsigned char	0 .. 4	0 none 1.. 4 alarm output for central actor From V3.1 not used due to assignment via alarm groups
19-20	Display time_ms	unsigned short	1 .. max	Cycle time of display in ms
21	Communication type	unsigned char	0 = RS-232 1 = Modem 2 = GSM modem 3 = Radio modem	Direct, modem, GSM modem, radio modem
22-53	Initstring	char[32]		Modem initialisation

54-85	Endstring	char[32]		Reset modem
86-87	Pin	unsigned short	0 .. 9999	GSM Mo. PIN
88	*Request interval*	*unsigned char*	*Default 10*	*Interval at which check is made as to whether the GSM is still installed*
89	*CAN baud rate*	*unsigned char*	*1 .. ?*	*CAN baud rate*
90	RS-232 baud rate	unsigned char	2: 57600 4: 28800 6: 19200 8: 14400 12: 9600 24: 4800 48: 2400	Division factor Calculation: 115200 / baud rate
91-92	Transfer block length	unsigned short	1.. ?	Block length of the data transfer
93-94	*AD_filter*	*unsigned short*	*1..?*	*AD setting*
95-110	telephone_1	unsigned char [16]		Alarm telephone number
111-126	telephone _2	unsigned char [16]		Alternative telephone number for alarm
127-130	Alarm group output	unsigned char[4]	0..255	From V3.1, group actor, alarm groups of outputs
131-175	pad_allgemein (pad_general)	unsigned char[45]		Spare field
176	Reserved for FBZ	unsigned char		Reserved for FBZ coding or other

Channel parameters (8x)

Input parameters:

K. 1	K. 2	K. 3	K. 4	K. 5	K. 6	K. 7	K. 8	Content	Type	Range	Description
177	257	337	417	497	577	657	737	Sensor type	unsigned char	0 Current 1 Voltage 2 Resistance 5 PT100 6 PT1000 7 NTC5K 8 Thermocouple E 9 Thermocouple J 10 Thermocouple K 11 Thermocouple N 22 Thermocouple S 23 Thermocouple R 30 Thermocouple T 12 Frequency I 13 Frequency U 20 Event I 21 Event U 16 USonic speed 17 USonic direction 18 Comb. speed 19 Comb. direction 24 Digi In 25 NTC 0.3 K 26 TFF-RH (PT1000) 27 TFF-T (PT1000) 28 Leaf wetness 29 Soil humidity 35 Particle counter	Current, voltage, resistance, frequency, pulse **Attention:** In addition, the measuring range must always be set! 35 particle counter with special firmware only

178	258	338	418	498	578	658	738	Sensortype_user	unsigned char	0..255	User-defined sensors
179	259	339	419	499	579	659	739	External comparison point	unsigned char	0 = no ext. comparison 1 = ext. comp. pt.	External comparison point for thermocouples
180	260	340	420	500	580	660	740	Connection type	unsigned char	0 = 4 core cable 1 = 3 core cable	Resistance sensors can be connected in 3 or 4 core cable
181	261	341	421	501	581	661	741	unipolar	unsigned char	0 = bipolar 1 = unipolar	The value range is -x to +x for bipolar and 0 to x for unipolar
182	262	342	422	502	582	662	742	Value ranges	unsigned char	0 = 0-20mA 1 = 4-20mA 16 = 0-20mV 17 = 0-40mV **18 = 0-80mV** 19 = 0-100mV **20 = 0-160mV** **21 = 0-320mV** **22 = 0-640mV** 23= 0-1000mV 32 = 0-200 Ohms 33 = 0-2000 Ohms ?? = 10-1000 Hz ?? = 0-65000 Pulse/recording int.	The possible input ranges for the external sensors. The strange identities result from the fact that the sensor type in highnibble is stored as redundant (it may be useful at some time). The values printed in **bold** are exclusively required for the preloading of standard sensors (e.g. thermocouple of type J).
183-186	263-266	343-346	423-426	503-506	583-586	663-666	743-746	Value range Min. input	float	-Max .. +Max Unit: Current: mA Voltage: mV Resistance: Ohm Frequency: Hertz Pulse: Pulse/recording interval	Smallest physical value supplied by the sensor
187-190	267-270	347-350	427-430	507-510	587-590	667-670	747-750	Value range Max. input	float	-Max .. +Max Unit: see above	Largest physical value supplied by the sensor
191-196	271-276	351-356	431-436	511-516	591-596	671-676	751-756	Unit	char[6]		Unit of the measurement variable
197	277	357	437	517	597	677	757	Decimal point	unsigned char	0,1,2,3	Decimal places of the display

198-201	278-281	358-361	438-441	518-521	598-601	678-681	758-761	Min. display size	float	-Max .. +Max	Smallest value of the measurement variable
202-205	282-285	362-365	442-445	522-525	602-605	682-685	762-765	Max. display size	float	-Max .. +Max	Largest value of the measurement variable
206-209	286-289	366-369	446-449	526-529	606-609	686-689	766-769	Offset	float	-Max .. +Max	Offset for measurement value
210-211	290-291	370-371	450-451	530-531	610-611	690-691	770-771	Response time	unsigned short	0 .. 100 unit ms	Measurement sensor response time in ms
212-213	292-293	372-373	452-453	532-533	612-613	692-693	772-773	C12	unsigned short	0 .. Max.	TFF calibration value
214-215	294-295	374-375	454-455	534-535	614-615	694-695	774-775	C76	unsigned short	0 .. Max.	TFF calibration value

Output parameters:

K. 1	K. 2	K. 3	K. 4	K. 5	K. 6	K. 7	K. 8	Content	Type	Range	Description
216	296	376	456	536	616	696	776	Alarm output	unsigned char	Bit 0 = 1(0): Alarm (not) active Bit 4 set (0x1x) Pre-alarm active	Alarm configuration: Alarm, pre-alarm on / off
217	297	377	457	537	617	697	777	Alarm channel (2)	unsigned char	0 none 1..4 alarm output	Switched alarm output
218-219	298-299	378-379	458-459	538-539	618-619	698-699	778-779	Upper alarm limit alarm_max	unsigned short	0 .. 65280 (0xFF00)	Alarm limit relay This is the upper value mapped to the communication standard
220-221	300-301	380-381	460-461	540-541	620-621	700-701	780-781	Lower alarm limit alarm_min	unsigned short	0 .. 65280 (0xFF00)	Alarm limit relay This is the lower value mapped to the communication standard
222-223	302-303	382-383	462-463	542-543	622-623	702-703	782-783	Alarm hysteresis	unsigned short	0..65520	Hysteresis for the exceeding of alarm limits in the mapping standard
224	304	384	464	544	624	704	784	Alarm time	unsigned char	0 = Recording 1 = Sampling	Alarm on recording or sampling

Logging parameters:

K. 1	K. 2	K. 3	K. 4	K. 5	K. 6	K. 7	K. 8	Content	Type	Range	Description
225	305	385	465	545	625	705	785	Display mode	unsigned char	0 = Off 1 = Active	Display indication off or active
226	306	386	466	546	626	706	786	Mode	unsigned char	0 = Off 1 = Active	Channel off or active
227-228	307-308	387-388	467-468	547-548	627-628	707-708	787-788	Sampling rate	unsigned short	1000 .. 60000	Sampling rate ms
229-232	309-312	389-392	469-472	549-552	629-632	709-712	789-792	Recording interval	unsigned long	1000 .. 86400000	Recording interval in ms
233	313	393	473	553	633	713	793	Recording mode	unsigned char	1 = AVG 2 = MAX 4 = MIN 8 = Sum AVG + MAX = 3 AVG + MIN = 5 MAX + MIN = 6 AVG + MAX + MIN = 7 etc...	Min, Max, Avg and all permutations
234	314	394	474	554	634	714	794	Memory type	unsigned char	0 .. 1	Ring / Start/Stop
235	315	395	475	555	635	715	795	Start year	unsigned char	0..99	Start year Start/Stop
236	316	396	476	556	636	716	796	Start month	unsigned char	1..12	Start month
237	317	397	477	557	637	717	797	Start day	unsigned char	1..31	Start day
238	318	398	478	558	638	718	798	Start hour	unsigned char	0..23	Start hour
239	319	399	479	559	639	719	799	Start minute	unsigned char	0..59	Start minute

240	320	400	480	560	640	720	800	Start second	unsigned char	0..59	Start second
241	321	401	481	561	641	721	801	Alarm delay	unsigned char	0..	Alarm delay in recording intervals
Additional fields – channel parameters											
242	322	402	482	562	642	722	802	Lower pre-alarm limit	unsigned short	0 .. 65520 (0xFFF0)	This is the lower value mapped to the communication standard
244	324	404	484	564	644	724	804	Upper pre-alarm limit	unsigned short	0 .. 65520 (0xFFF0)	This is the upper value mapped to the communication standard
246	326	406	486	566	646	726	806	Alarm group (1)	unsigned char	0.250	Alarm group number of normal alarm
247	327	407	487	567	647	727	807	Alarm group pre-alarm (1)	unsigned char	0.250	Alarm group number of pre-alarm
248	328	408	488	568	648	728	808	Type of measurement value formation (1)	unsigned char	n.n.	n.n. e.g. vectorial for wind gauge
249	329	409	489	569	649	729	809	(1)	unsigned short	0 .. 65520 (0xFFF0)	n.n. e.g. lower limit for wind direction output ref. windspeed in the mapping standard
251-256	331-336	411-416	491-496	571-576	651-656	731-736	811 816	pad channel	unsigned char [6]		Spare field

Equipment description:

Address	Content	Type	Range	Description
817-856	Equipment description	unsigned char [40]		Textual description of unit

Channel description:

K. 1	K. 2	K. 3	K. 4	K. 5	K. 6	K. 7	K. 8	Content	Type	Range	Description
857-896	897-936	937-976	977-1016	1017-1056	1057-196	1097-1136	1137-1176	Channel description	unsigned char [40]		Textual description of channels

(1) from OPUS 208 V3.1
(2) obsolete from OPUS 208 V3.2
Identifies the configuration fields where no further measurements can be taken following modification.

Table: Binary configuration - group actor

Equipment parameters				
Address	**Name**	**Type**	**Range**	**Description**
1	Identity	unsigned short	1.. 65 534	16 bit ID
3	Opus master identity. Assigned automatically on configuration	unsigned char	1.. 255	If this OPUS is the OPUS Master, then the OPUS Master ID is inserted in the return address
4	Opus type	unsigned char	See Table: OPUS Types	Type of Opus, group actor in this case
5	Current no.	unsigned short	0 .. 999	Current no. in production month
7	Month Year	unsigned short	100 .. 1299	mmyy
9	Project number	unsigned short	1 .. 9999	Year Project no.
11	Parts list	unsigned char	0..9	Parts list no.
12	Splan	unsigned char		S-plan no.
13	TZ	unsigned char		Drawing no.
14	Software version	unsigned char		Software serial no.
15	E2 version	unsigned char		EEPROM structure serial no.
16	Mode	unsigned char		Off: Means just that. Sleep: Awakens on receipt of telegrams. Normal: Always awake.
17	BaudCAN	unsigned char	1: 50000 2: 25000 3: 15000 4: 10000 5: 5000 Default: 50000	CAN baud rate
18	BaudRS232	unsigned char	2: 57600 4: 28800 6: 19200 8: 14400 12: 9600 24: 4800 48: 2400 Default: 19200	Division factor Calculation: 115200 / baud rate
19	Central actor timeout	unsigned long	10000..86400000	Alarm is triggered if no heartbeat comes from PC within this time [ms]
23	Central actor quiet	unsigned long	0..600000	Time for muting of alarm on central actor
27	uc alarm group	unsigned char	0..250	Alarm group of the alarm actor
28	uc alarm response	unsigned char	0 as before 1 active after online request	Response at end of online request: 0: Central actor mute 1: Central actor reacts to OPUS alarm telegrams
29	ucHeartbeatMon	unsigned char	0 off 1 on	Monitoring of PC heartbeat during online request on/off. Can be set in SC
30	pad reserve	char[10]	reserve	reserve
40	Descripción	char[40]		Equipment description as text

Table: OPUS Types

Value	Device
1	OPUS 200
2	OPUS 200i
3	OPUS 300
4	OPUS 300i
5	OPUS 10 / OPUS 10 Compact
6	Central actor
7	Group actor
10	OPUS 208
20	Control module
30	CAN-Display
40	Opus10-4k

Log file: OPUS 200 network scan

[PC] Request software telegram
[OM] OPUS-Master telegram
[OP] OPUS telegram

```
[PC] - 26 53 79 00
[OM] - 24 26 53 9D 00
[OP] - 26 53 B8 0A 01 3C 01
[OM] - 24 26 53 9D 00
```

Log file: OPUS 200 read EEPROM (block)

[PC] Request software telegram
[OM] OPUS-Master telegram
[OP] OPUS telegram

```
[PC] - 3F 45 B8 0A 00 00 46 01
[OM] - 24 3F 45 A8 00
[OP] - 24 3F 45 D1 02 7B 01
[OP] - B8 0A 02 01 6B 00 30 01 B0 26 07 05 01 3E 12 02 00 20 20 20 20 20 20
20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
20 20 20 20 20 20 20 20 00 00 00 00 00 00 00 06 80 00 00 40 20 20 20 20 20
20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
20 20 20 39 0D
[PC] - 24 3F 45 A8 00
[OP] - 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
20 20 20 A5 DB
[PC] - 24 3F 45 A8 00
[OP] - 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 00 01 14 00 02 01 13 00 00
00 00 00 E0 1A
[PC] - 24 3F 45 A8 00
[OP] - 00 C8 42 57 6D 00 00 00 00 00 00 00 7A 44 00 00 00 00 05 00 6F 06 C1
07 00 FD FF FD FF 00 00 00 00 00 00 00 00 00 00 7A 44 01 60 EA E0 93 04 00
01 00 00 00 00 00 00 00 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
20 20 20 20 20 20 20 20 14 1C 00 02 01 00 00 00 00 00 00 F0 7F 47 6C 6D 01
00 00 00 7D 48
[PC] - 24 3F 45 A8 00
[OP] - 00 00 C0 4C 46 00 00 00 00 05 00 6F 06 C1 07 00 FD FF FD FF 00 00 00
00 00 00 00 00 00 00 7A 44 01 60 EA E0 93 04 00 08 00 00 00 00 00 00 00 20
20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 31
20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
20 20 20 13 4B
[PC] - 24 3F 45 A8 00
[OP] - 20 20 20 20 20 20 20 20 20 20 20 52 61 64 69 61 63 69 F3 6E 20 53 6F
6C 61 72 20 31 33 30 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
20 20 20 50 6C 75 76 69 6F 6D 65 74 72 6F 20 20 20 20 20 20 20 20 20 20 20
20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 FF FF FF FF FF FF FF
FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
FF FF FF D5 D4
[PC] - 24 3F 45 A8 00
```

Log file: OPUS 200 write EEPROM (block)

[PC] Request software telegram
[OM] OPUS-Master telegram
[OP] OPUS telegram

```
[PC] - 25 45 D1 02 B8 0A 00 00 FF 01
[OM] - 24 25 45 8E 00
[OP] - 24 25 45 8E 00
[PC] - 25 52 B8 0A 02 01 6B 00 30 01 D8 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 B0 26 07 05 01 3E 12 02 AC 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 00 20 20 20 20 20 20 20 57 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 00 00 00 00 00 00 00 97 00
[OM] - 24 25 52 9B 00
[PC] - 25 52 06 80 00 00 40 20 20 20 9D 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 39 0D 7D 01
[OM] - 24 25 52 9B 00
[OP] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
```

```
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 A5 DB B7 02
[OM] - 24 25 52 9B 00
[OP] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 00 01 14 00 02 01 CF 00
[OM] - 24 25 52 9B 00
[PC] - 25 52 13 00 00 00 00 00 E0 1A 84 01
[OM] - 24 25 52 9B 00
[OP] - 24 25 52 9B 00
[PC] - 25 52 00 C8 42 57 6D 00 00 00 45 02
[OM] - 24 25 52 9B 00
[PC] - 25 52 00 00 00 00 7A 44 00 00 35 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 00 00 05 00 6F 06 C1 07 B9 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 00 FD FF FD FF 00 00 00 6F 04
[OM] - 24 25 52 9B 00
[PC] - 25 52 00 00 00 00 00 00 00 7A F1 00
[OM] - 24 25 52 9B 00
[PC] - 25 52 44 01 60 EA E0 93 04 00 7D 03
[OM] - 24 25 52 9B 00
[PC] - 25 52 01 00 00 00 00 00 00 00 78 00
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
```

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[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 14 1C 00 02 01 00 EA 00
[OM] - 24 25 52 9B 00
[PC] - 25 52 00 00 00 00 00 F0 7F 47 2D 02
[OM] - 24 25 52 9B 00
[PC] - 25 52 6C 6D 01 00 00 00 7D 48 16 02
[OM] - 24 25 52 9B 00
[OP] - 24 25 52 9B 00
[PC] - 25 52 00 00 C0 4C 46 00 00 00 C9 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 00 05 00 6F 06 C1 07 00 B9 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 FD FF FD FF 00 00 00 00 6F 04
[OM] - 24 25 52 9B 00
[PC] - 25 52 00 00 00 00 00 00 7A 44 35 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 01 60 EA E0 93 04 00 08 41 03
[OM] - 24 25 52 9B 00
[PC] - 25 52 00 00 00 00 00 00 00 20 97 00
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 CD 59 5D 02
[OM] - 24 25 52 9B 00
[OP] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 52 61 64 69 61 B8 02
[OM] - 24 25 52 9B 00
[PC] - 25 52 63 69 F3 6E 20 53 6F 6C F2 03
[OM] - 24 25 52 9B 00
[PC] - 25 52 61 72 20 31 33 30 20 20 3E 02
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 50 6C 75 76 69 E7 02
[OM] - 24 25 52 9B 00
[PC] - 25 52 6F 6D 65 74 72 6F 20 20 4D 03
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
```

```
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 20 20 20 20 20 77 01
[OM] - 24 25 52 9B 00
[PC] - 25 52 20 20 20 FF FF FF FF FF D2 05
[OM] - 24 25 52 9B 00
[PC] - 25 52 FF FF FF FF FF FF FF FF 6F 08
[OM] - 24 25 52 9B 00
[PC] - 25 52 FF FF FF FF FF FF FF FF 6F 08
[OM] - 24 25 52 9B 00
[PC] - 25 52 FF FF FF FF FF FF FF FF 6F 08
[OM] - 24 25 52 9B 00
[PC] - 25 52 FF FF FF FF FF FF D5 D4 1A 08
[OM] - 24 25 52 9B 00
[OP] - 24 25 52 9B 00
```

Log file: OPUS 200 / OPUS 208 online request

2 OPUS 200 with different channel configurations are interrogated
1 OPUS 208 channels 2,4,6,8
[PC] Request software telegram
[OM] OPUS-Master telegram
[OP1] OPUS 200 1 (ID166) telegram
[OP2] OPUS 200 2 (ID2744) telegram
[OP3] OPUS 208 (ID20016) telegram

```
[PC]  - 3F 4E A6 00 00 00 33 01
[OM]  - 24 3F 4E B1 00
[OP1] - 3F 4E 0D 9F 0D 9F 0D 9F 9A 69 94 03
[OP1] - 3F 4E 65 6A 5C 01
[PC]  - 3F 4E B8 0A 00 00 4F 01
[OM]  - 24 3F 4E B1 00
[OP2] - 3F 4E 8F 02 00 00 1E 01
[PC]  - 3F 4E 32 30 4E 00 00 3D 01
[OM]  - 24 3F 4E B1 00
[OP3] - 3F 4E EE 2D A8 01
[PC]  - 3F 4E 34 30 4E 00 00 3F 01
[OM]  - 24 3F 4E B1 00
[OP3] - 3F 4E E6 2D A0 01
[PC]  - 3F 4E 36 30 4E 00 00 41 01
[OM]  - 24 3F 4E B1 00
[OP3] - 3F 4E E8 2D A2 01
[PC]  - 3F 4E 38 30 4E 00 00 43 01
[OM]  - 24 3F 4E B1 00
[OP3] - 3F 4E 0E 2E C9 00
```

Log file: OPUS 200 / OPUS 208 offline request

a) OPUS 200 channel 2, without request date, default transfer block size (128 bytes)
[PC] Request software telegram
[OM] OPUS-Master telegram
[OP] OPUS 200 telegram

```
[PC] - 3F 32 A6 00 00 00 17 01
[OM] - 24 3F 32 95 00
[PC] - 3F 54 00 00 00 00 00 00 93 00
[OM] - 24 3F 54 B7 00
[OP] - 24 3F 54 02 00 B9 00
[OP] - FE FF 32 30 30 36 30 39 30 38 31 33 30 33 30 30 30 30 60 EA 00 00 3C
00 22 06 35 5A 62 07 05 21 D5 69 D5 69 D5 69 F5 69 F5 69 F5 69 65 69 DB 69
DB 69 30 6A 4B 68 DC 68 DB 69 FB 6A 6B 6A 30 6B FC 69 16 6B 17 69 37 6A A7
68 E2 68 E2 69 02 6A 52 68 C8 68 59 68 E2 68 38 67 AE 68 53 66 74 66 53 66
53 66 54 64 39 66 A9 65 FE 65 18 66 39 66 53 66 E3 66 18 66 8E 66 39 66 74
66 53 66 5F EA
[PC] - 24 3F 54 B7 00
[OP] - 74 66 53 66 53 66 E4 65 04 66 E4 64 AF 65 A9 64 1F 65 59 66 AF 66 59
66 CF 67 FD FF FD FF FD FF FD FF FD FF FD FF FD FF FD FF FD FF FD FF FD FF
FD FF FD FF FD FF FD FF FD FF FD FF FD FF FD FF FD FF FD FF FD FF FD FF FD
FF FD FF FD FF FD FF FD FF FD FF FD FF FD FF FD FF FD FF FD FF FD FF FD FF
FD FF FD FF FD FF FD FF FD FF FD FF FD FF FD FF FD FF FD FF FD FF FD FF FD
FF FD FF CF D5
[OM] - 24 3F 54 B7 00
```

b) OPUS 208 channel 2, request from 2006-09-08 13:02:40, default transfer block size (128 bytes)
[PC] Request software telegram
[OM] OPUS-Master telegram
[OP] OPUS 208 telegram

```
[PC] - 3F 32 30 4E 00 00 EF 00
[OM] - 24 3F 32 95 00
[PC] - 3F 54 06 09 08 0D 02 28 E1 00
[OM] - 24 3F 54 B7 00
[OP] - 24 3F 54 04 00 BB 00
[OP] - FE FF 32 30 30 36 30 39 30 38 31 33 30 32 34 30 30 30 10 27 00 00 96
00 02 01 00 00 00 00 00 00 EE 2D EE 2D EE 2D EE 2D EF 2D EF 2D EF 2D EF 2D
EF 2D EE 2D EF 2D F0 2D F0 2D F0 2D EF 2D F0 2D EF 2D F0 2D F0 2D F1 2D F1
2D F1 2D F1 2D F1 2D F1 2D F1 2D F1 2D F2 2D F2 2D F2 2D F2 2D
F2 2D F2 2D F2 2D F2 2D F3 2D F2 2D F3 2D F2 2D F2 2D F3 2D F3 2D F3 2D F3
2D F4 2D 86 12
[PC] - 24 3F 54 B7 00
[OP] - F3 2D F4 2D F4 2D F4 2D F3 2D F3 2D F4 2D F4 2D F5 2D F5 2D F5 2D F5
2D F5 2D F5 2D F7 2D F5 2D F5 2D F4 2D F6 2D F5 2D F5 2D F6 2D F5 2D F6 2D
F6 2D F6 2D F6 2D F7 2D F6 2D F7 2D F7 2D F6 2D F6 2D F7 2D F7 2D F7 2D F7
2D F7 2D F7 2D F6 2D F7 2D F6 2D F7 2D F6 2D F5 2D F5 2D F6 2D F5 2D F6 2D
F4 2D F6 2D F6 2D F6 2D F5 2D F4 2D F4 2D F5 2D F5 2D F4 2D F4 2D F4 2D F4
2D F4 2D ED 0C
[PC] - 24 3F 54 B7 00
[OP] - F4 2D F4 2D F5 2D F5 2D F4 2D F5 2D F5 2D F5 2D F6 2D F5 2D F5 2D F5
2D F5 2D F5 2D F5 2D F6 2D F5 2D F6 2D F6 2D F6 2D F6 2D F5 2D F5 2D F6 2D
F5 2D F6 2D F6 2D F7 2D F7 2D F6 2D F5 2D F5 2D F5 2D F6 2D F6 2D F5 2D F5
2D F5 2D F5 2D F5 2D FE FF 32 30 30 36 30 39 30 38 31 33 32 37 34 30 30 30
10 27 00 00 20 00 02 01 00 00 00 00 00 00 F5 2D F6 2D F5 2D F6 2D F6 2D F7
2D F6 2D 28 0D
[PC] - 24 3F 54 B7 00
[OP] - F6 2D F5 2D F6 2D F6 2D F6 2D F6 2D F7 2D F5 2D F6 2D F5 2D F6 2D F5
2D F5 2D F6 2D F6 2D F6 2D F6 2D F6 2D F7 2D F7 2D F6 2D F6 2D F6 2D F6 2D
F5 2D FD FF FD FF FD FF FD FF FD FF FD FF FD FF FD FF FD FF FD FF FD FF FD
FF FD FF FD FF FD FF FD FF FD FF FD FF FD FF FD FF FD FF FD FF FD FF FD FF
FD FF FD FF FD FF FD FF FD FF FD FF FD FF FD FF FD FF FD FF FD FF FD FF FD
```

```
FF FD FF 8F 33
[PC] - 24 3F 54 B7 00
```