Brunata Optuna H (775)

Communication description

Edition 1.1

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Brunata a/s is a Danish owned company.
We have more than 90 years of experience within developing and producing meters, heat cost allocators, consumption accounts, meter services and latest substations.
Today meters are often remotely read with access to the internet.
We have a quality control system fulfilling DS/EN ISO 9001 and 14001.

Brunata

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1 Introduction

The M-Bus (Meter Bus) is a new European standard for remote reading of meters. It can be used for all types of consumption meters and for various sensors and actuators.
This document does not deal with the M-Bus protocol in detail. Further information about this can be found on the Internet at www.m-bus.com. The RS-485 and RS-232 communication module is a serial interface for communication with external
devices, e.g. a PC.

2 Communication interfaces

Optuna H is equipped with five communication interfaces:

- Optical ZVEI.
- M-BUS: M-Bus communication is over a two-wire line.
- RS-485: The module board contains a 4-pole terminal strip with terminals marked D+, D-, Vcc and GND (ground). This module needs an external supply voltage of 12Vdc ±5V at <5W.
- RS-232: The module board contains a 3-pole terminal strip with terminals marked DAT, REQ and GND (ground). This connection can be used in conjunction with the HYD cable adapter for PC communication.

2.1 Communication priorities

Mutual influence between interfaces:

Interface	Priority
optical ZVEI	1
M-Bus	2

Interface	Priority
optical ZVEI	1
RS-485 / RS-232	2

The M-Bus and RS-485, RS-232 interfaces can no longer be used at port 1 during optical communication whereas port 2 can still be used for communication.
However, port 2 is not usable if integrated radio is active.

2.2 Telegram formats

Communication complies with:

- IEC 870-5-1 Telecontrol equipment and systems; Transmission protocols; Section One - Transmission frame formats.

2.3 UART

Baud rates

- M-Bus: 300 and 2400 baud, 8E1 automatic baud rate detection and switching
- RS-485: 300 and 2400 baud, 8E1
- RS-232: 300 and 2400 baud, 8E1
- ZVEI optical: 2400 baud, 8E1

2.4 Protocol layer

1. EN 13757-3
2. Data output
a) Variable protocol
b) “Least Significant Byte first” (Mode 1) for multi-byte variables
c) All response telegrams also available for C-1 error

2.5 Connection set-up for optical ZVEI

To activate the optical ZVEI interface, a ‘0’ - ‘1’ bit pattern must be sent continuously at 2400 bauds for 2.2 s (= 480 bytes + $55 + 8 data bits + no parity + 1 stop bit). The actual communication can be started after a pause of 11 to 330 bit times (2400 bauds).

2.6 Connection set-up for M-Bus/RS-485/RS-232

After connection to the M-Bus/RS-485/RS-232, the TSS721 interface module is ready for reliable communication.

2.7 Addressing

The meter can be addressed using two addressing variants: with a logic address (primary address) or by using a filter via its ex works identification (secondary address).

2.7.1 Selection (secondary address)

Request telegram:	68 0B 0B 68 53 FD 52 NN NN NN NN HH HH ID MM CS 16
Response:	E5 (only if filter matches)

Structure of filter:

4-byte BCD	NN (serial number)	$F digit joker
2-byte HST	HH (manufacturer code)	$FF byte joker
1-byte ID (Sharky: $28)	ID (identification code)	$FF joker
1-byte SMED	MM (medium code)	$FF joker

After selection, the meter behaves as if it also had the primary address $FD and can therefore be operated via the primary address $FD (response always with own primary address).

2.7.2 Deselection

Request telegram:	10 40 FD CS 16
Response:	no answer

To reliably end communication with the selected meter, the meter must be deselected or by using a selective wrong filter.

3 Reading the meter

Procedure:

1. Define response – "Define response values"
2. Request response
3. Interpretation of data

3.1 Standard data reading (Application Reset 0)

Meter reading process always uses a long frame with the following structure:

To make sure the standard value "00" (All) is obtained, an Application Reset should be carried out with sub-code "00":

SND_UD: "68 04 04 68 **73/53** **FD** **50** **00** **CS** 16"

C-field: **73** or **53**

Address field: e.g. **FD** (equiv. to 253)

CI-field: **50**

Application Reset Sub-code: **00**

"00" equiv. to "All" – (*see Appendix 1)*

or e.g. "20" equiv. to "Simple Billing"

Checksum: **CS**

3.2 Request response

The following command must be sent to obtain a response from the meter:

Request telegram		Response
REQ_UD2	10 7B AA CS 16	RSP_UD

3.3 Interpretation of data

The data received basically corresponds to the protocol structure of EN13757-3.
e.g.: containing the definition of units

3.3.1 Mbus Status Byte

Bit	*description*	*usage*
0	reserved	-
1	any application error	-
2	power low	Err8 Err9
3	permanent error	C - 1, Err4
4	temporary error	Err1, Err3, Err6, Err7, leak error
5	manufacturer specific	*1)
6	manufacturer specific	*1)
7	manufacturer specific	*1)

*1)

Error	C -1	Err8	Err4	Err1	Err7	Err9	Err3	Err6	Leak error	Err5
Mbus status Byte	0x08	0x04	0x28	0x50	0x70	0x84	0xB0	0xD0	0xF0	0x10
priority	high									low

4 Customer telegram

Registers at each port can be read or programmed direct in the meter using subtables.
The IZAR@SET program can be used to set the customer telegram.
This program can be downloaded at:

http://www.brunataskovgaard.dk/produkter/software

5 Default telegram

From manufacturer side the following telegrams are standard (if no special telegram content is agreed):

Port1*	Port2
current energy	current energy
current volume	current volume
current flow rate	current flow rate
current forward temperature @ EBKAELTE	current forward temperature @ EBKAELTE
current return temperature @ EBKAELTE	current return temperature @ EBKAELTE
current tariff register 1	current tariff register 1
current error hours	current error hours
Pulse in- Register at mounted pulse input module	Pulse in- Register at mounted pulse input module
· current pulse input counter 1	· current pulse input counter 1
· current pulse input counter 2	· current pulse input counter 2
tariff enable 2	tariff enable 2

* *Application Reset Subcode 0x30*

The customer telegram Port1 is left empty by the manufacturer.

**In this case, instead of an empty protocol the meter sends the Application Reset Subcode 0x30 – protocol.
This is identical to the standard protocol Port2 (Port2 is predefined with Application Reset Subcode 0x30)**

6 Meter Parameterisation

The meter is equipped with a number of registers that can be set without breaking the calibration seal.

6.1 Structure of instruction set

Byte	Meaning	Description/content/value
	Header Long Frame (HLF)	
HLF 1	1st start character	$68
HLF 2	Long field	3 + x
HLF 3	Long field	3 + x
HLF 4	2nd start character	$68
HLF 5	C-field	$53 SND_UD
HLF 6	A-field	(Bus) address of meter
HLF 7	CI-field	$51 data send mode 1
	Variable Data Blocks (VDB)	
VDB 1.. VDB x		
	End of Long Frame (ALF)	
ALF 1	Checksum	
ALF 2	Stop character	$16

6.2 Date and time

The date and time can be changed with the following telegram:

Send:

$68 $09 $09 $68 $53 $ FE $51 **$04 $6D [Date Time (4 Byte Mbus Type F)]** Check $16

Example: (15.05.2006):

$68 $09 $09 $68 $53 $FE $51 **$04 $6D $0F $0A $CF $05** $00 $16

Read: $E5

6.3 New primary address

If VBD1 = $01 and VDB2 = $7A, VDB3 is used as new primary address.

Send: $68 $06 $06 $68 $53 $FE $51 **$01 $7A [Address]** Check $16

Example (address 5):

$68 $06 $06 $68 $53 $FE $51 **$01 $7A $05** $22 $16

Read: $E5

Special cases:

A-field	Function	Use
$FD	Characters for secondary addressing	Secondary addressing
$FE	Broadcast (to all) with response	Only one meter connected
$FF	Broadcast (to all) without response	System-wide control

6.4 Serial number / customer number

The new meter number NNUM can be defined with the following telegram:
4-byte BCD

Send: $68 $09 $09 $68 $53 $FE $51 **$0C $79 [NNUM] Check** $16

Example (SN 12345678):

$68 $09 $09 $68 $53 $FE $51 **$0C $79 $78 $56 $34 $12** $3B $16

Read: $E5

Note: The NNUM is part of the secondary address.

6.5 New reading date 1

If VBD1 = $44, VDB2 = $ED and VDB3 = $7E, VDB4 and VDB5 are used as new next reading date (data type F).

Send: $68 $0A $0A $68 $53 $FE $51 $42 $EC $7E **[Set Accounting Date1]**
Check $16

Example (01.05.2006):

$68 $0A $0A $68 $53 $FE $51 **$44 $ED $7E $C1 $05** $17 $16

Read: $E5

6.6 New reading date 2

If VBD1 = $84, VDB2 = $ED and VDB3 = $7E, VDB4 and VDB5 are used as new next reading date (data type F).

Send: $68 $0B $0B $68 $53 $FE $51 $82 $01 $EC $7E **[Set Accounting Date2]** **Check** $16

Example:

$68 $0B $0B $68 $53 $FE $51 **$84 $01 $ED $7E $DF $0C** $7D $16

Read: $E5

6.7 Pulse input counter 1

If IMPIN1PL = 0, IMPCNT1 can be changed. This programming facility can be disabled by HYD!
4-byte BCD

Send: $68 $0B $0B $68 $53 $FE $51 **$8C $40 $FD $3A [Set IMPCNT1]** Check $16

Example (55667788):

$68 $0B $0B $68 $53 $FE $51 **$8C $40 $FD $3A $88 $77 $66 $55** $5F $16

Read: $E5

6.8 Pulse input counter 2

If IMPIN2PL = 0, IMPCNT2 can be changed. This programming facility can be disabled by HYD!
4-byte BCD

Send: $68 $0C $0C $68 $53 $FE $51 **$8C $80 $40 $FD $3A [Set IMPCNT2]** Check $16

Example (66554433):

$68 $0C $0C $68 $53 $FE $51 **$8C $80 $40 $FD 3A $33 $44 $55 $66** $57 $16

Read: $E5

6.9 Clearing operating days

If NCLROTC = 0, ONTIME can be cleared in the field by communication.
2 byte BCD

Send: $68 $07 $07 $68 $53 $FE $51 **$0A $27 [clear operation days]** Check $16

Example (clearing):

$68 $07 $07 $68 $53 $FE $51 **$0A $27 $00 $00** $D3 $16

Read: E5

6.10 Clearing error hour counter

If NCLREDC = 0, ERRDAY can be cleared in the field by communication.
2 byte BCD

Send: $68 $07 $07 $68 $53 $FE $51 **$0A $AC $18 [clear error hours]** Check $16

Example (clearing):

$68 $07 $07 $68 $53 $FE $51 **$0A $AC $18 $00 $00** $02 $16

Read: E5

6.11 Monthly values (last month)

The monthly memory with a capacity of 24 months is located in the EEPROM at address 0x1880 0x28FF with 64 bytes per month. The addresses per month are located at 0x1880, 0x18C0, 0x1900, 0x1940, 0x1980, ….. 0x1E00, 0x1E40.

Each entry has the following structure:

Value	Size	Type	Address
· Date time stamp	2 Byte	MBus type G	0
· Energy resolution last digit LCD	4 Byte	BCD	2
· Tariff register 1	4 Byte	BCD	6
· Tariff register 2	4 Byte	BCD	10
· Tariff definition 1	2 Byte	HY spec.	14
· Tariff definition 2	2 Byte	HY spec.	16
· Volume resolution last digit LCD	4 Byte	BCD	18
· Error hour counter	1 Byte	BCD	22
· Maximum monthly flow rate	3 Byte	BCD	23
· Time maximum monthly flow rate	2 Byte	MBus type F (Lbyte)	26
· Date maximum monthly flow rate	2 Byte	MBus type G	28
· Maximum monthly power resolution last digit LCD	4 Byte	BCD	30
· Time maximum monthly power	2 Byte	MBus type (Lbyte)	34
· Date maximum monthly power	2 Byte	MBus type G	36
· Pulse input counter 1 (volume)	4 Byte	BCD	38
· Pulse input counter 2 (volume)	4 Byte	BCD	42
· Definition pulse input counter 1	1 Byte	HY spec.	46
· Definition pulse input counter 2	1 Byte	HY spec.	47
· ONTIME (operating hour counter)	2 Byte	BCD	48
· Maximum value forward flow temperature	2 Byte	HEX (0.1°C res)	50
· Time maximum value forward flow temperature	2 Byte	MBus type F (Lbyte)	52
· Date maximum value forward flow temperature	2 Byte	MBus type G	54
· Maximum value return flow temperature	2 Byte	HEX (0.1°C res)	56
· Time maximum value return flow temperature	2 Byte	MBus type F (Lbyte)	58
· Date maximum value return flow temperature	2 Byte	MBus type G	60

6.11.1 Reading

Write read pointer to address

AppResSubCode 0xC0

Collect data (read pointer is always incremented by data block size)

- Check address, as possibly wrong if communication error
- Interpret response

6.11.2 Deletion

Deletion is not possible in the field.

6.12 Deleting error log

The event memory with a capacity of 127 entries is located in the EEPROM at address 0x1680 to 0x1880, with 4 bytes per entry. The administration data is located at address 0x00.

Address:	EEPROM
Communication address:	0x1680
EEPROM address:	0x280
Size:	0x200

Example:

Address	Value	Type
0x1680	Ondex content next storage	Hex mask = 0x7C
0x1682	Date last delete	MBus type G
0x1684	Index content “0”	
0x1688	Index content “1”	
….	….	
0x1880	Index content “127”	

Every entry is structured as follows:

1. Byte	2. Byte	3. Byte with event	4. Byte with source
Date MBus Type G		0x01 C-1 checksum error 0x02 E-8 mains supply lack Backup 0x04 E-1 error temperature-measuring 0x20 Leakage error at input 1 0x40 Leakage error at input 2 0x80 Protection seal	0x1F Hour 0x20 Low bit SFCNT 0x40 Reset ONTIME or ERRHOUR

6.12.1 Reading

Write read pointer to address

AppResSubCode 0xC0

Collect data
- Check address, as possibly wrong if communication error
- Interpret response

6.12.2 Set read pointer (readout address and length)

Send:

$68 $0D $0D $68 $53 $FE $51 $2F $0F $00 $01 $6E $03 $03 **[AdrLo AdrHi] $80** Check $16

Example (0x1880):

$68 $0D $0D $68 $53 $FE $51 $2F $0F **$00 $01 $6E $03 $03 $80 $18 $80** $16

Read: $E5

7 Appendix 1

Application Reset Subcode:

Application Reset Subcode	Telegram data
0X00 “All”	Current energy Current tariff register 1 Current tariff register v2 Current volume Current power Current flow rate Current forward temperature @ EBKAELTE Current return temperature @ EBKAELTE Current temperature difference Current operating days Current date and time Accounting date1 (memory number = 1) · energy · volume · tariff register 1 · tariff register 2 · date · next accounting date1 Accounting date2 (memory number = 3) · energy · volume · tariff register 1 · tariff register 2 · date · next accounting date 2 Pulse in-Register · Current pulse input counter 1 · Current pulse input counter 2
0X10 “User data”	Current energy Current tariff register 1 Current tariff register 2 Current volume Current power Current flow rate Current forward temperature @ EBKAELTE Current return temperature @ EBKAELTE Current temperature difference Current operating days Current date and time Accounting date1 (storage number = 1) · energy · volume · tariff register 1 · tariff register 2 · date · next accounting date1 Accounting date2 (storage number = 3) · energy · volume

	· tariff register 1 · tariff register 2 · date · next accounting date2 Accounting date1 last year (memory number = 2) · energy · volume · tariff register 1 · tariff register 2 · date Accounting date2 last year (memory number = 4) · energy · volume · tariff register 1 · tariff register 2 · date
0X20 “Simple billing”	As 1 or Current date and time Current energy Current tariff register 1 Accounting date1 (storage number = 1) · energy · tariff register 1 · date · next accounting date1 Current volume Current forward temperature @ EBKAELTE Current return temperature @ EBKAELTE Current flow rate Current power GLYKOL TEXT PULSE TEXT TENR HistoryLog2 data
0x30 „Enhanced billing“	Current energy Current volume Current flow rate Current forward temperature TH @ EBKAELTE Current return temperature TC @ EBKAELTE Current tariff register 1 Current error hour counter Current pulse input counter 1 Current pulse input counter 2 Tariff limit 2 reached
0x40 „Multi tariff billing“	Current energy Current volume Current tariff register 1 Current tariff register 2 Current pulse input counter 1 (at pulse input mounted) Current operating days Error hour counter Current flow rate Current power Current forward temperature TH @ EBKAELTE Current return temperature TC @ EBKAELTE

	Date of last monthly memory Energy of last monthly memory Volume of last monthly memory Pulse counter 1 of last monthly memory Tariff energy 1 of last monthly memory Operating days of last monthly memory Error hour counter of last monthly memory
0x50 „Instaneous values“	Current energy Current tariff energy 1 Current tariff energy 2 Current volume Current power Current flow rate Current forward temperature TH @ EBKAELTE Current return temperature TC @ EBKAELTE Current operating days Current error hour counter
0x60 „Load Management values for management“	Proprietary data number: 4 -> $0F $04 SWVER READPTR READLEN Bytes · Application reset subcode = 0x60 makes READPTR = 0x2900 and READLEN = maximum possible length · READPTR is automatically incremented by READLEN for Every REQ_UD2
0x70 „Reserved“	As 1
0x80 „Installation and startup“	Current date and time ($04 $6D DTFZEIT) Next accounting date 1 Next accounting date 2
0x90 „Testing“	manufacturer specific data number 7 · 0x0F 0x07 · 2 byte Flow temperature · 2 byte Return temperature · 8 byte VOLAK · 8 byte VOLAKR · 3 byte HYSTAK · 1 byte USDFCNT · 3 byte USDIFFT · 1 byte EMPFZKOR · 2 byte USDSCAL · 1 byte US4MCAL · 2 byte PHASE1 · 2 byte PHASE2 · 1 byte USMNEG · 2 byte USDS1US · 1 byte KOMMAV · 2 byte NUMARATORV · 1 byte UNTIVOLV
0xA0 „Calibration“	current forward temperature @ EBKAELTE current return temperature @ EBKAELTE current difference temperature manufacturer specific data number 8 · 0x0F 0x08 · 1 byte EICHCNT · 1 byte EICHWERT

	· 6 byte EICHAK · 1 byte EICHSTAT · 2 byte EICHAK2 · 7 byte ZVENAKK · 7 byte VOLAK · 1 byte UNITVOLE · 1-3 byte VIF energy · 1-2 byte VIF volume
0xB0 „Manufacturing“	manufacturer specific data number 4 · 0x0F 0x04 · SWVER READPTR *data (number = READLEN)* · READPTR is incremented by every readout by READLEN
0xC0 „Development“	Like 0xB0 without Init READPTR and READLEN
0xD0 „Selftest“	Current energy Current date and time
0xE0 „Reserved“	Like 0
0xF0 „Reserved“	Adjustable telegram