M-Bus protocol

- **CALEC® ST II**
- **AMBILL**
- **AMTRON X-50**

Manufacturer:	Aquametro AG
Device:	CALEC® ST II
Firmware version:	2.00.00
Manufacturer code:	0x05b4
Device versions:	0xc0 (Volume) 0xc1 (Mass) 0xc2 (Flow) 0xc3 (Reserved) 0xc4 (BDE) 0xc5 (AMTRON X-50) 0xc6 (AMBILL) 0xc7 (TGR) 0xc8 (BDV) 0xc9 (DTF)
Medium:	0x04 (Heat return) 0x0c (Heat supply) 0x07 (Water)

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1. Overview

1.1 Versions

Different versions of the CALEC ST II are available.
This document describes the M-Bus protocol used in all versions.

Version	Device version (DEV)	Explanation
Standard	0xc0	Standard energy calculator with volume display
Mass	0xc1	Standard energy calculator with mass display
Flow	0xc2	Flow calculator
Reserved	0xc3	
BDE	0xc4	Bidirectional energy measurement controlled by the differential temperature
X-50	0xc5	Standard energy calculator AMTRON X-50
AMBILL	0xc6	Water calculator
TGR	0xc7	Energy calculator with tariffs controlled by reference temperature
BDV	0xc8	Bidirectional energy measurement controlled by an external control signal
DTF	0xc9	Double-tariff energy calculator

Table 1: Versions of CALEC ST II

A distinction is made between these versions in the M-Bus protocol as follows:

- The device version (device byte) is different.
- The mass version transfers mass instead of volume.
- The flow version is a flow calculator without temperature measurement and energy billing.
- The BDE version has an additional channel for energy and volume in the event of negative output. The direction-dependent data are coded with DIFE 0x3b or 0x3c.
- The BDV version has an additional channel for energy and volume in the event of negative flow.
- The TGR version has 2 additional energy registers, and the DTF version has an additional tariff channel.

General: M-Bus in accordance with EN 1434-3, special units in accordance with EN 13757.

1.2 M-Bus interfaces

The CALEC ST II has up to three independent M-Bus channels. The device can therefore be operated simultaneously in two M-Bus networks and also be read or parametrised via the optical head.
These channels are shown as nos. 1 to 3 in the display.

The baud rate and the response telegram can be parametrised separately for each channel.

The parametrisation of the baud rate and readout telegram always affects the channel currently in use. For example, you cannot use channel 1 to change the baud rate for channel 2.

The CALEC ST has up to three M-Bus interfaces. The infrared interface (IR) is always available.
Depending on the options fitted, units may contain up to two wired M-Bus interfaces.

M-Bus interface #1 occupies channel #1, M-Bus interface #2 occupies channel #2.
The IR interface occupies channel #3.

1.3 Firmware versions

This document is valid from firmware version 2.00.00 onwards.

1.4 Explanation of abbreviations

Abbreviation	Explanation
REQ_UD2	Request for a data telegram (RSP_UD) from the master
RSP_UD	Data telegram sent as a response to the master
SND_UD	Data/parametrisation telegram from the master to CALEC ST II
SND_NKE	Initialisation telegram in accordance with EN 13757
ACK	Confirmation telegram to a SND_UD in accordance with EN 13757
PADR	Placeholder for the primary address (1 byte)
LEN	Placeholder for the length byte (1 byte), calculated in accordance with EN 13757
IDENT	Placeholder for the secondary address (4 bytes)
MAN	Placeholder for the manufacturer code (2 bytes)
DEV	Placeholder for the device version (1 byte)
MED	Placeholder for the medium (1 byte)
ACC	Placeholder for the access counter (1 byte)
STAT	Placeholder for the status (1 byte)
CS	Placeholder for the checksum (1 byte), calculated in accordance with EN 13757

Table 2: Abbreviations

1.5 M-Bus services

The device communicates in accordance with EN 13757-2 and EN 13757-3.
These two standards are referred to as EN 13757 in this document.
The device supports only some of the telegrams defined in the standard.

Service	Master	CI	CALEC ST II	For details see chapter
Activate slave selection	SND_UD	52h	ACK	2.4.1 Slave select telegram
Reset slave selection	SND_NKE		ACK	2.4.2 SND_NKE telegram
Read out data	REQ_UD2		RSP_UD	3 Read out data
Parametrising	SND_UD	51h	ACK	4 Parametrising
Application reset	SND_UD	50h	ACK	4.2 Application reset

Table 3: M-Bus services

1.6 Baud rates

The CALEC ST II can communicate at 300, 2400 and 9600 baud.
The factory setting for the baud rate is 2400.

1.7 M-Bus addressing

The device supports primary and secondary addressing in accordance with EN 13757.
The factory setting for the device's primary address is 0.

Addressing	PADR	For details see chapter
Primary addressing	0 ... 250	2.1 Primary addressing
Point-to-point addressing	254	2.2 Point-to-point addressing
Broadcast addressing	255	2.3 Broadcast addressing
Secondary addressing	253	2.4 Secondary addressing

Table 4: Overview of M-Bus addressing

1.8 Readout

The CALEC ST II recognises 5 different kinds of response telegram.
The default telegram is active when the device is restarted.

Response telegram	Quantity	Contents	For details see chapter
Standard	1	Current counter readings	3.2.1 Standard telegram
Billing date	12	Billing date data	3.2.2 Billing date telegram
Logger	500 (30)	Logger data	3.2.3 Logger telegram
Freeze	1	Frozen counter readings	3.2.4 Freeze telegram
No data	1	No data available	3.2.5 Empty telegram
Service	1	For service purposes	3.2.6 Service telegram

Table 5 Overview of response telegrams

1.9 Parametrisation

The CALEC ST II is protected against unauthorised manipulation by means of a protection system.
There are three levels of protection:

User (highest level of protection)
- Locked padlock symbol on the display
- The keys cannot be used to change parameters.
- Only non-meter-related parameters can be changed using M-Bus.

Service (medium level of protection)
- Open padlock symbol on the display
- The keys or M-Bus can only be used to amend parameters which are not subject to verification.

Programming (lowest level of protection)
- No padlock symbol on the display
- The keys or M-Bus can be used to amend all parameters.
- Changing the protection level to allow programming may involve destroying the verification seal.

Parameters	Protection level	For details see chapter
Baud rate	User	4.1.1 Parametrise baud rate
Primary address	User	4.1.2 Parametrise primary address
Secondary address	User	4.1.3 Parametrise secondary address
Response telegram	User	4.1.4 Parametrise response telegram
Date/Time	User	4.1.5 Parametrise date/time
Error hours counter	Programming	4.1.6 Programme error hours counter
Alarm hours counter	Programming	4.1.7 Programme alarm hours counter
Billing date	User	4.1.8 Parametrise billing date
Customer text field	User	4.1.9 Parametrise customer text field
Impulse value	Programming	4.1.11 Parametrise impulse value
Freeze	User	4.1.10 Freeze command
Impulse value for auxiliary counter 1	Service	4.1.12 Parametrise impulse value for auxiliary counter #1
Impulse value for auxiliary counter 2	Service	4.1.13 Parametrise impulse value for auxiliary counter #2
Impulse value for auxiliary counter 3	Service	4.1.14 Parametrise impulse value for auxiliary counter #3
Installation side	Programming	26 Parametrise installation side
Units	Service / program	5.1.1 Units

Table 6: Overview of parametrisation telegrams

1.10 Variable units

The units and resolutions of the counter readings and pulse values of the CALEC ST II can be parametrised in any way. This has a direct impact on the transfer of data to the M-Bus. These variable units are described as VIF1, VIF2 etc. in the protocol descriptions. Details can be found in chapter 5.

Value	Variable unit
Energy counter readings	VIF1
Volume/mass counter readings	VIF2
Auxiliary counter readings	VIF3
Auxiliary counter impulse values	VIF4

Table 7: Overview of variable units

The units for the instantaneous values are fixed on the M-Bus and cannot be changed. However, a different unit can be set for the display. This does not affect data transfer on the M-Bus.

2. Addressing

2.1 Primary addressing

Individual CALEC ST II units can be addressed via primary addressing in an M-Bus network. The permitted primary address range is 0 – 250. Each telegram contains the primary address in the A field.

2.2 Point-to-point addressing

Point-to-point addressing can be use the M-Bus network consists of a single CALEC® ST II and a master. To do this, the A field in the master telegram is set to 254 (0xfe).
The CALEC ST II responds to point to point telegrams irrespective of how the primary address is parametrised.

2.3 Broadcast addressing

Broadcast addressing can be used when all the counters in a network are to receive a telegram at the same time (e.g. setting the date) which they need to process. The A field in the telegram of the master is set to 255 (0xff). The CALEC ST II does not respond to broadcast telegrams, but executes the commands.

2.4 Secondary addressing

If an M-Bus network contains more than 250 meters, secondary addressing is used.
Secondary addressing uses the A field: 253 (0xfd) with the 8-byte header selected.
The device must be selected using a slave select telegram prior to actual communication. Secondary addressing can be removed again after the actual communication. Deselection is carried out via a SND_NKE command or by selecting another device.

2.4.1 Slave select telegram

The CALEC ST II can be selected for secondary addressing using the following telegram:

Name	Number of bytes	Value	Explanation (examples)
Start	1	0x68	
L field	1	0x0b	
L field	1	0x0b	
Start	1	0x68	
C field	1	0x53 / 0x73	SND_UD
Addr. field	1	0xfd	Secondary addressing
CI field	1	0x52	Slave select
Sec.adr.field	4	IDENT	Secondary address of the CALEC ST II
Manufacturer code	2	MAN	0x05b4 = Aquametro
Device version	1	DEV	As per chapter 1.1

Name	Number of bytes	Value	Explanation (examples)
Medium	1	MED	0x04 = return / 0x0c = flow
Checksum	1	CS	
Stop	1	0x16	

Table 8: Slave select telegram

C field: The CALEC ST II does not differentiate between 0x53 and 0x73.
IDENT: The 8-bit wildcard 0c0xff can be used instead of the exact secondary address. Example 0xfffff344: All CALEC ST devices with a secondary address ending in 0x344 are selected.
MAN: The 16-bit wildcard 0xffff can be used instead of 0x05b4.
DEV: The 8-bit wildcard 0xff can be used instead of 0xc0.
MED: The 8-bit wildcard 0xff can be used instead of 0x04/0x0c.

- If all 4 details tally with the parametrisation of the CALEC ST II, it is selected and responds with an ACK telegram.

- If at least one of the details does not match the parametrisation it is deselected and does not respond.

2.4.2 SND_NKE telegram

Secondary addressing can be cleared with the following telegram:

Name	Number of bytes	Value	Explanation
Start	1	0x10	
C field	1	0x40	SND_NKE
Addr. field	1	PADR	Primary address
Checksum	1	CS	
Stop	1	0x16	

Table 9: SND_NKE telegram

- The CALEC ST responds with an ACK telegram.

3. Readout

3.1 REQ_UD2 command

Readout is always requested by the master by means of an REQ_UD2 telegram:

Name	Number of bytes	Value	Explanation
Start field	1	0x10	
C field	1	0x5b / 0x7b	REQ_UD2
Addr. field	1	PADR	Primary address
Checksum	1	CS	
Stop	1	0x16	

Table 10: REQ_UD2 telegram

- The CALEC ST II does not differentiate between 0x5B and 0x7B in the C field.
- The CALEC ST II responds with the RSP_UD telegram set.

3.2 RSP_UD telegrams

The CALEC ST II has different RSP_UD telegrams.
The parametrisation of these telegrams is described in chapter 4.1.4.

3.2.1 Standard telegram

Name	No. Bytes	Value	Unit	Tariff	Storage	Explanation (examples)	Available in version
Start	1	0x68					All
L field	1	LEN					All
L field	1	LEN					All
Start	1	0x68					All
C field	1	0x08				RSP_UD	All
Adr.field	1	PADR				Primary address	All
CI field	1	0x52 / 0x72				Readout	All
Sec.adr.field	4	IDENT				Secondary address	All
Manufacturer	2	0xb405				0x05b4 = Aquametro	All
Version	1	DEV				Device as per chapter 1.1	All
Medium	1	MED				0x04 = return 0x0c = supply 0x07 = water	All
Acces-cnt.	1	ACC				Increment per readout	All
Status	1	STAT				Status in accordance with EN 13757	All
Signature	2	0000h				Not used	All
DIF	1	0x04					C0,C1,C5,C7,C9
VIF	≥1	VIF1					C0,C1,C5,C7,C9
Value	4	INT4	0	0	0	Energy counter reading	C0,C1,C5,C7,C9
DIF	1	0x04					C4,C8
VIF	≥2	VIF1, 0x3b					C4,C8
Value	4	INT4	0	0	0	Energy counter reading pos.	C4,C8
DIF	1	0x04					C4,C8
VIF	≥2	VIF1, 0x3c					C4,C8
Value	4	INT4	0	0	0	Energy counter reading neg.	C4,C8
DIF	2	0x84, 10					C7,C9
VIF	≥1	VIF1					C7,C9
Value	4	INT4	0	1	0	Energy tariff 1	C7,C9
DIF	2	0x84, 20					C7
VIF	≥1	VIF1					C7
Value	4	INT4	0	2	0	Energy tariff 2	C7
DIF	1	0x04					C0,C5,C7,C9
VIF	≥1	VIF2					C0,C5,C7,C9
Value	4	INT4	0	0	0	Volume counter reading	C0,C5,C7,C9
DIF	1	0x04					C4,C8
VIF	≥2	VIF2, 0x3b					C4,C8
Value	4	INT4	0	0	0	Volume counter reading pos.	C4,C8
DIF	1	0x04					C4,C8
VIF	≥2	VIF2, 0x3c					C4,C8
Value	4	INT4	0	0	0	Volume counter reading neg.	C4,C8
DIF	2	0x84, 10					C9
VIF	≥1	VIF2					C9
Value	4	INT4	0	1	0	Volume tariff 1	C9
DIF	1	0x04					C1
VIF	≥1	VIF2					C1
Value	4	INT4	0	0	0	Mass counter reading	C1
DIF	1	0x04					C2
VIF	≥1	VIF3					C2

Name	No. Bytes	Value	Unit	Tariff	Storage	Explanation (examples)	Available in version
Value	4	INT4	0	0	0	Auxiliary counter reading #1	C2
DIF	1	0x04					C6
VIF	≥1	VIF2					C6
Value	4	INT4	0	0	0	Auxiliary counter reading #1 volume	C6
DIF	2	0x84, 40					All
VIF	≥1	VIF3					All
Value	4	INT4	1	0	0	Auxiliary counter reading #2	All
DIF	3	0x84, 80, 40					All *4
VIF	≥1	VIF3					All *4
Value	4	INT4	2	0	0	Auxiliary counter reading #3	All *4
DIF	1	0x05					All *1
VIF	1	0x2b					All *1
Value	4	Float	0	0	0	Output [W]	All *1
DIF	1	0x05					All except C1 *2
VIF	1	0x3b					All except C1 *2
Value	4	Float	0	0	0	Flow [l/h]	All except C1 *2
DIF	1	0x05					C1 *2
VIF	1	0x53					C1 *2
Value	4	Float	0	0	0	Mass flow [kg/h]	C1 *2
DIF	1	0x05					C0,C1,C4,C7,C8,C9
VIF	1	0x5b					C0,C1,C4,C7,C8,C9
Value	4	Float	0	0	0	Flow temperature [°C]	C0,C1,C4,C7,C8,C9
DIF	1	0x05					C0,C1,C4,C7,C8,C9
VIF	1	0x5f					C0,C1,C4,C7,C8,C9
Value	4	Float	0	0	0	Return temperature [°C]	C0,C1,C4,C7,C8,C9
DIF	1	0x05					C0,C1,C4,C7,C8,C9
VIF	1	0x63					C0,C1,C4,C7,C8,C9
Value	4	Float	0	0	0	Temperature differential [K]	C0,C1,C4,C7,C8,C9
DIF	1	0x05					C0,C1,C4,C7,C8,C9
VIF	2	0x83, 33					C0,C1,C4,C7,C8,C9
Value	4	Float	0	0	0	k factor [Wh / K / l]	C0,C1,C4,C7,C8,C9
DIF	1	0x05					C0,C1,C4,C7,C8,C9
VIF	2	0x9b, 2c					C0,C1,C4,C7,C8,C9
Value	4	Float	0	0	0	Density [kg / l]	C0,C1,C4,C7,C8,C9
DIF	1	0x04					All
VIF	1	0x22					All
Value	4	INT4	0	0	0	Operating hours [h]	All
DIF	1	0x34					All
VIF	1	0x22					All
Value	4	INT4	0	0	0	Error hours [h]	All
DIF	2	0xb4, 40					All
VIF	1	0x22					All
Value	4	INT4	1	0	0	Alarm hours [h]	All
DIF	1	0x04					All
VIF	1	0x6d					All
Value	4	INT4	0	0	0	Current date and time	All *3
DIF	1	0x05					C0,C1,C4,C5,C6,C7, C8,C9
VIF	2	0x93, 28					C0,C1,C4,C5,C6,C7,

Name	No. Bytes	Value	Unit	Tariff	Storage	Explanation (examples)	Available in version
							C8,C9
Value	4	Float	0	0	0	Impulse value [l]	C0,C1,C4,C5,C6,C7, C8,C9
DIF	1	0x05					C2
VIF	≥2	VIF4					C2
Value	4	Float	0	0	0	Impulse value for auxiliary counter #1	C2
DIF	2	0x85, 40					All
VIF	≥2	VIF4					All
Value	4	Float	1	0	0	Impulse value for auxiliary counter #2	All
DIF	3	0x85, 80, 40					All *4
VIF	≥2	VIF4					All *4
Value	4	Float	2	0	0	Impulse value for auxiliary counter #3	All *4
DIF	1	0x0c					All
VIF	1	0x78					All
Value	4	BCD8	0	0	0	Production number	All
DIF	1	0x0d					All
VIF	2	0xfd, 11					All
Value	1	Int1				Large customer text field	All
Value	--	ASCII	0	0	0	Customer text field	All
DIF	1	0x0b					All
VIF	2	0xfd, 0e					All
Value	3	BCD6	0	0	0	Firmware version	All
DIF	1	0x0c					All
VIF	2	0xfd, 0d					All
Value	3	BCD8	0	0	0	Hardware version	All
CS	1	CS					All
Stop	1	0x16					All

Table 11: Standard telegram

*1 Power only available if the device is an energy calculator, or auxiliary counter #1 is metering energy.
*2 Flow only available if the device is an energy calculator, or auxiliary counter #1 is metering volume/mass.
*3 The current date and time supports both the millennium and summer/winter time bits.
*4 Auxiliary counter #3 is only available when input #3 is not used as a control signal (direction/tariff).

3.2.2 Billing date telegrams

The CALEC ST II can handle 12 billing date memories, the AMTRON X-50 (C5) can handle 2.
Each billing date memory is displayed in a separate telegram.
The protocol numbering starts from memory number 1:
The data for billing date #1 is transferred as M-Bus memory number #1, and for billing date #12 it is M-Bus memory number #12.

Coding of memory numbers:
The following table contains a list of the values for billing date #1 (memory #1); the memory number increases in accordance with *5.

Name	No. Bytes	Value	Unit	Tariff	Storage	Explanation (examples)	Available in version

Name	No. Bytes	Value	Unit	Tariff	Storage	Explanation (examples)	Available in version
Start	1	0x68					All
L field	1	LEN					All
L field	1	LEN					All
Start	1	0x68					All
C field	1	0x08				RSP_UD	All
Adr.field	1	PADR				Primary address	All
CI field	1	0x52 / 0x72				Readout	All
Sec.adr.field	4	IDENT				Secondary address	All
Manufacturer	2	0xb405				0x05b4 = Aquametro	All
Version	1	DEV				Device as per chapter 1.1	All
Medium	1	MED				0x04 = return 0x0c = supply 0x07 = water	All
Acces-cnt.	1	ACC				Increment per readout	All
Status	1	STAT				Status in accordance with EN 13757	All
Signature	2	0000h				Not used	All
DIF	≥1	0x42					All [*5]
VIF		0xec, 7e					All [*6]
Value		Date type G			1...	Future storage date	All
DIF	≥1	0x42					All [*5]
VIF		0x6c					All
Value		Date type G			1...	Storage date	All
DIF	≥1	0x44					C0,C1,C5,C7,C9 [*5]
VIF	≥1	VIF1					C0,C1,C5,C7,C9
Value	4	INT4	0	0	1...	Energy counter reading	C0,C1,C5,C7,C9
DIF	≥1	0x44					C4,C8 [*5]
VIF	≥2	VIF1, 0x3b					C4,C8
Value	4	INT4	0	0	1...	Energy counter reading pos.	C4,C8
DIF	≥1	0x44					C4,C8 [*5]
VIF	≥2	VIF1, 0x3c					C4,C8
Value	4	INT4	0	0	1...	Energy counter reading neg.	C4,C8
DIF	≥2	0xc4, 10					C7,C9 [*5]
VIF	≥1	VIF1					C7,C9
Value	4	INT4	0	1	1...	Energy tariff 1	C7,C9
DIF	≥2	0xc4, 20					C7 [*5]
VIF	≥1	VIF1					C7
Value	4	INT4	0	2	1...	Energy tariff 2	C7
DIF	≥1	0x44					C0,C5,C7,C9 [*5]
VIF	≥1	VIF2					C0,C5,C7,C9
Value	4	INT4	0	0	1...	Volume counter reading	C0,C5,C7,C9
DIF	≥1	0x44					C4,C8 [*5]
VIF	≥2	VIF2, 0x3b					C4,C8
Value	4	INT4	0	0	1...	Volume counter reading pos.	C4,C8
DIF	≥1	0x44					C4,C8 [*5]
VIF	≥2	VIF2, 0x3c					C4,C8
Value	4	INT4	0	0	1...	Volume counter reading neg.	C4,C8
DIF	≥2	0x84, 10					C9 [*5]
VIF	≥1	VIF2					C9
Value	4	INT4	0	1	1...	Volume tariff 1	C9
DIF	≥1	0x44					C1 [*5]

Name	No. Bytes	Value	Unit	Tariff	Storage	Explanation (examples)	Available in version
VIF	≥1	VIF2					C1
Value	4	INT4	0	0	1...	Mass counter reading	C1
DIF	≥1	0x44					C2 *5
VIF	≥1	VIF3					C2
Value	4	INT4	0	0	1...	Auxiliary counter reading #1	C2
DIF	≥1	0x44					C6 *5
VIF	≥1	VIF2					C6
Value	4	INT4	0	0	1...	Auxiliary counter reading #1 volume	C6
DIF	≥2	0xc4, 40					All *5
VIF	≥1	VIF3					All
Value	4	INT4	1	0	1...	Auxiliary counter reading #2	All
DIF	≥3	0xc4, 80, 40					All *4 *5
VIF	≥1	VIF3					All *4
Value	4	INT4	2	0	1...	Auxiliary counter reading #3	All *4
DIF	≥1	0x74					All *5
VIF	1	0x22					All
Value	4	INT4	0	0	1...	Error hours [h]	All
DIF	2	0xf4, 40					All *5
VIF	1	0x22					All
Value	4	INT4	1	0	1...	Alarm hours [h]	All
CS	1	CS					All
Stop	1	0x16					All

Table 12: Billing date telegrams

*5 The DIF/DIFE includes the memory number as follows, in accordance with EN 13757:

DIF	Billing #1	Billing #2	Billing #3	Billing #4	…	Billing #12
0x02	0x42	0x82, 01	0xc2, 01	0x82, 02		0x82, 06
0x04	0x44	0x84, 01	0xc4, 01	0x84, 02		0x84, 06
0x84, 10	0xc4, 10	0x84, 11	0xc4, 11	0x84, 12		0x84, 16
0x84, 20	0xc4, 20	0x84, 21	0xc4, 21	0x84, 22		0x84, 26
0x84, 40	0xc4, 40	0x84, 41	0xc4, 41	0x84, 42		0x84, 46
0x84, 80, 40	0xc4,80,40	0x84,81,40	0xc4,81,40	0x84,82,40		0x84,86,40

*6 The date of future billing date is coded as “AnyYear”, i.e. the year is transferred as 127.
The year does not matter for parametrisation of the future billing date, as the CALEC ST II ignores this information.

3.2.3 Logger telegram

The CALEC ST II can handle 500 logger memories, the AMTRON X-50 (C5) can handle 30.
Each logger memory is displayed in a separate telegram.
The protocol numbering starts from memory number 100:
i.e. the data from logger #1 are therefore transferred as M-Bus memory number #100.

Coding of memory numbers:
The following table contains a list of the values for logger #1 (memory #100); the memory number increases in accordance with *7.
The storage numbers are coded in DIF, DIFE in accordance with EN 13757-3. The maximum values are also coded in DIF in accordance with EN13757-3.

No logger data:

If there is no date for a logger (for new devices), the “no data telegram” is transmitted instead of the logger telegram.

Name	No. Bytes	Value	Unit	Tariff	Storage	Explanation (examples)	Available in version
Start	1	0x68					All
L field	1	LEN					All
L field	1	LEN					All
Start	1	0x68					All
C field	1	0x08				RSP_UD	All
Adr.field	1	PADR				Primary address	All
CI field	1	0x52 / 0x72				Readout	All
Sec.adr.field	4	IDENT				Secondary address	All
Manufacturer	2	0xb405				0x05b4 = Aquametro	All
Version	1	DEV				Device as per chapter 1.1	All
Medium	1	MED				0x04 = return 0x0c = supply 0x07 = water	All
Acces-cnt.	1	ACC				Increment per readout	All
Status	1	STAT				Status in accordance with EN 13757	All
Signature	2	0000h				Not used	All
DIF	≥3	0x84, 82, 03					All *7
VIF		0x6d					All
Value		Date type F			100…	Storage date	All
DIF	≥3	0x84, 82, 03					C0,C1,C5,C7,C9 *7
VIF	≥1	VIF1					C0,C1,C5,C7,C9
Value	4	INT4	0	0	100…	Energy counter reading	C0,C1,C5,C7,C9
DIF	≥3	0x84, 82, 03					C4,C8 *7
VIF	≥2	VIF1, 3b					C4,C8
Value	4	INT4	0	0	100…	Energy meter pos.	C4,C8
DIF	≥3	0x84, 82, 03					C4,C8 *7
VIF	≥2	VIF1, 3c					C4,C8
Value	4	INT4	0	0	100…	Energy meter neg.	C4,C8
DIF	≥3	0x84, 92, 03					C7,C9 *7
VIF	≥1	VIF1					C7,C9
Value	4	INT4	0	1	100…	Energy tariff 1	C7,C9
DIF	≥3	0x84, a2, 03					C7 *7
VIF	≥1	VIF1					C7
Value	4	INT4	0	2	100…	Energy tariff 2	C7
DIF	≥3	0x84, 82, 03					C0,C5,C7,C9 *7
VIF	≥1	VIF2					C0,C5,C7,C9
Value	4	INT4	0	0	100…	Volume counter reading	C0,C5,C7,C9
DIF	≥3	0x84, 82, 03					C4,C8 *7
VIF	≥2	VIF2, 0x3b					C4,C8
Value	4	INT4	0	0	100…	Volume meter pos.	C4,C8
DIF	≥3	0x84, 82, 03					C4,C8 *7
VIF	≥2	VIF2, 0x3c					C4,C8
Value	4	INT4	0	0	100…	Volume meter neg.	C4,C8
DIF	≥3	0x84, 92, 03					C9 *7
VIF	≥1	VIF2					C9
Value	4	INT4	0	1	100…	Volume tariff 1	C9
DIF	≥3	0x84, 82, 03					C1 *7
VIF	≥1	VIF2					C1
Value	4	INT4	0	0	100…	Mass counter reading	C1

Name	No. Bytes	Value	Unit	Tariff	Storage	Explanation (examples)	Available in version
DIF	≥3	0x84, 82, 03					C2 *7
VIF	≥1	VIF3					C2
Value	4	INT4	0	0	100…	Auxiliary counter reading #1	C2
DIF	≥3	0x84, 82, 03					C6 *7
VIF	≥1	VIF2					C6
Value	4	INT4	0	0	100…	Auxiliary counter reading #1 volume	C6
DIF	≥3	0x84, c2, 03					All *7
VIF	≥1	VIF3					All
Value	4	INT4	1	0	100…	Auxiliary counter reading #2	All
DIF	≥3	0x84, 82, 43					All *4 *7
VIF	≥1	VIF3					All *4
Value	4	INT4	2	0	100…	Auxiliary counter reading #3	All *4
DIF	≥3	0xb4, 82, 03					All *7
VIF	1	0x22					All
Value	4	INT4	0	0	100…	Error hours [h]	All
DIF	≥3	0xb4, c2, 03					All *7
VIF	1	0x22					All
Value	4	INT4	1	0	100…	Alarm hours [h]	All
DIF	≥3	0x95, 82, 03					All *1 *7
VIF	1	0x2b					All *1
Value	4	Float	0	0	100…	Max. output [W]	All *1
DIF	≥3	0x94, 82, 03					All *1 *7
VIF	2	0xab, 39					All *1
Value	4	Date type F	0	0	100…	Time of max. output	All *1
DIF	≥3	0x95, 82, 03					All except C1 *2 *7
VIF	1	0x3b					All except C1 *2
Value	4	Float	0	0	100…	Max. throughput [l/h]	All except C1 *2
DIF	≥3	0x94, 82, 03					All except C1 *2 *7
VIF	2	0xbb, 39					All except C1 *2
Value	4	Date type F	0	0	100…	Time of max. throughput	All except C1 *2
DIF	≥3	0x95, 82, 03					C1 *2 *7
VIF	1	0x53					C1 *2
Value	4	Float	0	0	100…	Max. mass flow [kg/h]	C1 *2
DIF	≥3	0x94, 82, 03					C1 *2 *7
VIF	1	0xd3, 39					C1 *2
Value	4	Date type F	0	0	100…	Time of max. mass	C1 *2
DIF	≥3	0x95, 82, 03					C0,C1,C4,C7,C8,C9 *7
VIF	1	0x5b					C0,C1,C4,C7,C8,C9
Value	4	Float	0	0	100…	Max. supply temp. [°C]	C0,C1,C4,C7,C8,C9
DIF	≥3	0x94, 82, 03					C0,C1,C4,C7,C8,C9 *7
VIF	2	0xdb, 39					C0,C1,C4,C7,C8,C9
Value	4	Date type F	0	0	100…	Time of max. supply temp.	C0,C1,C4,C7,C8,C9
DIF	≥3	0x95, 82, 03					C0,C1,C4,C7,C8,C9 *7
VIF	1	0x5f					C0,C1,C4,C7,C8,C9
Value	4	Float	0	0	100…	Max. return temp.[°C]	C0,C1,C4,C7,C8,C9

Name	No. Bytes	Value	Unit	Tariff	Storage	Explanation (examples)	Available in version
DIF	≥3	0x94, 82, 03					C0,C1,C4,C7,C8,C9 *7
VIF	2	0xdf, 39					C0,C1,C4,C7,C8,C9
Value	4	Date type F	0	0	100…	Time of max. return temp.	C0,C1,C4,C7,C8,C9
CS	1	CS					All
Stop	1	0x16					All

Table 13: Logger telegram

Notes on maximum values:
In each logger period, the CALEC ST II calculates the value for the maximum output. The throughput and flow and return temperatures are also recorded at the point at which this maximum output occurs. These four values are transferred as the max. output, the max. throughput, the max. flow temperature and the max. return temperature. The time of occurrence is also transmitted for each of these four values. These four times are always the same, but are transmitted to simplify data evaluation.

3.2.4 Freeze telegram

The “Freeze” command (see chapter □) allows the current values to be frozen. These frozen values can be read out using the “Freeze telegram”. This telegram has the same structure as the logger telegram. The values are transmitted as M-Bus memory number 31 (see *7).

*7 The DIF/DIFE includes the memory number as follows, in accordance with EN 13757:

DIF	Freeze Mem. (Mem. #31)	…	Logger #1 = (Mem. #100)	Logger #2 = (Mem. #101)	…	Logger #500 = (Mem. #599)
0x02	0xc2, 0f		0x82, 82, 03	0xc2, 82, 03		0xc2, 8b, 82, 01
0x04	0xc4, 0f		0x84, 82, 03	0xc4, 82, 03		0xc4, 8b, 82, 01
0x05	0xc5, 0f		0x85, 82, 03	0xc5, 82, 03		0xc5, 8b, 82, 01
0x84, 10	0xc4, 1f		0x84, 92, 03	0xc4, 92, 03		0xc4, 9b, 82, 01
0x84, 20	0xc4, 2f		0x84, a2, 03	0xc4, a2, 03		0xc4, ab, 82, 01
0x84, 40	0xc4, 4f		0x84, c2, 03	0xc4, c2, 03		0xc4, cb, 82, 01
0x84, 80, 40	0xc4, 8f, 40		0x84, 82, 43	0xc4, 82, 43		0xc4, 8b, c2, 01

3.2.5 Empty telegram

If no logger data are available, the “no data” telegram is transmitted instead of this telegram.

Name	No. Bytes	Value	Unit	Tariff	Storage	Explanation (examples)	Available in version
Start	1	0x68					All
L field	1	LEN					All
L field	1	LEN					All
Start	1	0x68					All
C field	1	0x08				RSP_UD	All
Adr.field	1	PADR				Primary address	All
CI field	1	0x52 / 0x72				Readout	All
Sec.adr.field	4	IDENT				Secondary address	All
Manufacturer	2	0xb405				0x05b4 = Aquametro	All
Version	1	DEV				Device as per chapter	All

Name	No. Bytes	Value	Unit	Tariff	Storage	Explanation (examples)	Available in version
						1.1	
Medium	1	MED				0x04 = return 0x0c = supply 0x07 = water	All
Acces-cnt.	1	ACC				Increment per readout	All
Status	1	STAT				Status in accordance with EN 13757	All
Signature	2	0000h				Not used	All
CS	1	CS					All
Stop	1	0x16					All

Table 14: No data telegram

3.2.6 Service telegram

The service telegram transfers data required for service, testing and production.

Name	No. Bytes	Value	Unit	Tariff	Storage	Explanation (examples)	Available in version
Start	1	0x68					All
L field	1	LEN					All
L field	1	LEN					All
Start	1	0x68					All
C field	1	0x08				RSP_UD	All
Adr.field	1	PADR				Primary address	All
CI field	1	0x52 / 0x72				Readout	All
Sec.adr.field	4	IDENT				Secondary address	All
Manufacturer	2	0xb405				0x05b4 = Aquametro	All
Version	1	DEV				Device as per chapter 1.1	All
Medium	1	MED				0x04 = return 0x0c = supply 0x07 = water	All
Acces-cnt.	1	ACC				Increment per readout	All
Status	1	STAT				Status in accordance with EN 13757	All
Signature	2	0000h				Not used	All
DIF	1	0x04					C0,C1,C5,C7,C9
VIF	≥1	VIF1					C0,C1,C5,C7,C9
Value	4	INT4	0	0	0	Energy counter reading	C0,C1,C5,C7,C9
DIF	1	0x05					C0,C1,C5,C7,C9
VIF	≥1	VIF1					C0,C1,C5,C7,C9
Value	4	Float	0	0	0	Residual energy counter reading	C0,C1,C5,C7,C9
DIF	1	0x04					C4,C8
VIF	≥2	VIF1, 0x3b					C4,C8
Value	4	INT4	0	0	0	Energy counter reading pos.	C4,C8
DIF	1	0x05					C4,C8
VIF	≥2	VIF1, 0x3b					C4,C8
Value	4	Float	0	0	0	Residual energy meter pos.	C4,C8
DIF	1	0x04					C0,C5,C7,C9

Name	No. Bytes	Value	Unit	Tariff	Storage	Explanation (examples)	Available in version
VIF	≥1	VIF2					C0,C5,C7,C9
Value	4	INT4	0	0	0	Volume counter reading	C0,C5,C7,C9
DIF	1	0x05					C0,C5,C7,C9
VIF	≥1	VIF2					C0,C5,C7,C9
Value	4	Float	0	0	0	Residual volume reading	C0,C5,C7,C9
DIF	1	0x04					C4,C8
VIF	≥2	VIF2, 0x3b					C4,C8
Value	4	INT4	0	0	0	Volume counter reading pos.	C4,C8
DIF	1	0x05					C4,C8
VIF	≥2	VIF2, 0x3b					C4,C8
Value	4	Float	0	0	0	Residual volume meter pos.	C4,C8
DIF	1	0x04					C1
VIF	≥1	VIF2					C1
Value	4	INT4	0	0	0	Mass counter reading	C1
DIF	1	0x05					C1
VIF	≥1	VIF2					C1
Value	4	Float	0	0	0	Residual mass counter reading	C1
DIF	1	0x15					All *1
VIF	1	0x2b					All *1
Value	4	Float	0	0	0	Max. output [W]	All *1
DIF	1	0x15					All except C1 *2
VIF	1	0x3b					All except C1 *2
Value	4	Float	0	0	0	Max. throughput [l/h]	All except C1 *2
DIF	1	0x15					C1 *2
VIF	1	0x53					C1 *2
Value	4	Float	0	0	0	Max. mass flow [kg/h]	C1 *2
DIF	1	0x15					C0,C1,C4,C7,C8,C9
VIF	1	0x5b					C0,C1,C4,C7,C8,C9
Value	4	Float	0	0	0	Max. supply temp. [°C]	C0,C1,C4,C7,C8,C9
DIF	1	0x25					C0,C1,C4,C7,C8,C9
VIF	1	0x5f					C0,C1,C4,C7,C8,C9
Value	4	Float	0	0	0	Min. return temp. [°C]	C0,C1,C4,C7,C8,C9
DIF	1	0x15					C0,C1,C4,C7,C8,C9
VIF	1	0x63					C0,C1,C4,C7,C8,C9
Value	4	Float	0	0	0	Temperature differential [K]	C0,C1,C4,C7,C8,C9
DIF	1	0x45					C0,C1,C4,C7,C8,C9
VIF	2	0xfd, 3a					C0,C1,C4,C7,C8,C9
Value	4	Float	0	0	1	Arithm. Mean value th	C0,C1,C4,C7,C8,C9
DIF	2	0x85, 01					C0,C1,C4,C7,C8,C9
VIF	2	0xfd, 3a					C0,C1,C4,C7,C8,C9
Value	4	Float	0	0	2	Arithm. Mean value tc	C0,C1,C4,C7,C8,C9
DIF	2	0xc5, 01					C0,C1,C4,C7,C8,C9
VIF	2	0xfd, 3a					C0,C1,C4,C7,C8,C9
Value	4	Float	0	0	3	Std. deviation th	C0,C1,C4,C7,C8,C9
DIF	2	0x85, 02					C0,C1,C4,C7,C8,C9
VIF	2	0xfd, 3a					C0,C1,C4,C7,C8,C9
Value	4	Float	0	0	4	Std. deviation tc	C0,C1,C4,C7,C8,C9
DIF	2	0xc5, 02					C0,C1,C4,C7,C8,C9
VIF	2	0xfd, 3a					C0,C1,C4,C7,C8,C9
Value	4	Float	0	0	5	Increase th	C0,C1,C4,C7,C8,C9

Name	No. Bytes	Value	Unit	Tariff	Storage	Explanation (examples)	Available in version
DIF	2	0x85, 03					C0,C1,C4,C7,C8,C9
VIF	2	0xfd, 3a					C0,C1,C4,C7,C8,C9
Value	4	Float	0	0	6	Increase tc	C0,C1,C4,C7,C8,C9
DIF	2	0xc5, 03					C0,C1,C4,C7,C8,C9
VIF	2	0xfd, 3a					C0,C1,C4,C7,C8,C9
Value	4	Float	0	0	7	Zero point th	C0,C1,C4,C7,C8,C9
DIF	2	0x85, 04					C0,C1,C4,C7,C8,C9
VIF	2	0xfd, 3a					C0,C1,C4,C7,C8,C9
Value	4	Float	0	0	8	Zero point tc	C0,C1,C4,C7,C8,C9
DIF	1	0x74					All
VIF	1	0x6d					All
Value	4	Date type F	0	0	1	Time of e-counter overflow	All
DIF	2	0xb4, 01					All
VIF	1	0x6d					All
Value	4	Date type F	0	0	2	Time of counter reset	All
DIF	2	0xf4, 01					All
VIF	1	0x6d					All
Value	4	Date type F	0	0	3	Time of temp. alarm	All
DIF	2	0xb4, 02					All
VIF	1	0x6d					All
Value	4	Date type F	0	0	4	Time of calibration error	All
DIF	2	0xf4, 02					All
VIF	1	0x6d					All
Value	4	Date type F	0	0	5	Time of CRC error	All
DIF	1	0x02					All
VIF	2	0xfd, 66					All
Value		INT2				Calibration year	All
DIF	1	0x05					C0,C1,C4,C5,C6,C7, C8,C9
VIF	2	0x93, 28					C0,C1,C4,C5,C6,C7, C8,C9
Value	4	Float	0	0	0	Impulse value [l]	C0,C1,C4,C5,C6,C7, C8,C9
DIF	1	0x05					C2
VIF	≥2	VIF4					C2
Value	4	Float	0	0	0	Impulse value for auxiliary counter #1	C2
DIF	2	0x85, 40					All
VIF	≥2	VIF4					All
Value	4	Float	1	0	0	Impulse value for auxiliary counter #2	All
DIF	3	0x85, 80, 40					All *4
VIF	≥2	VIF4					All *4
Value	4	Float	2	0	0	Impulse value for auxiliary counter #3	All *4
DIF	1	0x02					All
VIF	2	0xec, 39					All
Value	2	Date type G	0	0	0	Production date	All
DIF	2	0x8c, 40					All
VIF	1	78					All
Value	4	BCD8	1	0	0	Hardware lot number	All
CS	1	CS					All
Stop	1	0x16					All

Table 15: Service telegram

4. Parametrisation

All parameters are saved in EEPROM and are not lost when the power goes down or the batteries are replaced.

All parameter settings are prefixed with an SND-UD telegram by the master. The CALEC ST II responds with an ACK telegram.

4.1 SND_UD telegrams

There is a separate telegram for each parametrisable value. Only one parameter can be changed with each telegram. It is not possible to summarise multiple values in one telegram.

4.1.1 Parametrise baud rate

The CALEC ST II supports 300, 2400 and 9600 baud. It is parametrised to 2400 baud on delivery. The baud rate can be parametrised using the following telegrams:

Name	Number of bytes	Value	Explanation
Start	1	0x68	
L field	1	0x03	
L field	1	0x03	
Start	1	0x68	
C field	1	0x53 / 0x73	SND_UD
A field	1	PADR	Primary address
CI field	1	0xb8 / 0xbb / 0xbd	0xb8 = 300 baud 0xbb = 2400 baud 0xbd = 9600 baud
Checksum	1	CS	
Stop	1	0x16	

Table 16: Parametrise baud rate

- The CALEC ST II does not differentiate between 0x53 and 0x73 in the C field.
- The CALEC ST II responds with an ACK telegram at the old baud rate and then switches to the new baud rate.

4.1.2 Parametrise primary address

The primary address can be parametrised using the following telegram. Values of 0 to 250 are accepted. The factory setting for the primary address is 0.

Name	Number of bytes	Value	Explanation
Start	1	0x68	
L field	1	0x06	
L field	1	0x06	
Start	1	0x68	
C field	1	0x53 / 0x73	SND_UD
A field	1	PADR	(old) primary address
CI field	1	0x51	Parametrisation
DIF	1	0x01	
VIF	1	0x7a	
Value	1	0x00 – 0xfa	New primary address 0 – 250
Checksum	1	CS	
Stop	1	0x16	

Table 17: Parametrise primary address

- The CALEC ST II does not differentiate between 0x53 and 0x73 in the C field.
- The CALEC ST II responds with an ACK telegram.

4.1.3 Parametrise secondary address

Name	Number of bytes	Value	Explanation
Start	1	0x68	
L field	1	0x09	
L field	1	0x09	
Start	1	0x68	
C field	1	0x53 / 0x73	SND_UD
A field	1	PADR	Primary address
CI field	1	0x51	Parametrisation
DIF	1	0x0c	
VIF	1	0x79	
Value	4	BCD8	New secondary address
Checksum	1	CS	
Stop	1	0x16	

Table 18: Parametrise secondary address

- The CALEC ST II does not differentiate between 0x53 and 0x73 in the C field.
- The CALEC ST II responds with an ACK telegram.

4.1.4 Parametrise response telegram

The response telegram can be parametrised using the following command. The telegram always has the same structure. The appropriate DIF, DIFE and VIF must be used depending on the required response telegram. These can be found in Table 20: Parametrise response telegram.
The factory setting for the CALEC ST is an active standard telegram.

Name	Number of bytes	Value	Explanation
Start	1	0x68	
L field	1	L	
L field	1	L	
Start	1	0x68	
C field	1	0x53 / 0x73	SND_UD
A field	1	PADR	Primary address
CI field	1	0x51	Parametrisation
DIF, DIFE	Variable		See column “DIF, DIFE” in the following table
VIF	1		See column “VIF” in the following table
Checksum	1	CS	
Stop	1	0x16	

Table 19: Response telegram parametrisation frame

- Memory numbering is in accordance with EN 1434 and EN 13757.
- The CALEC ST II does not differentiate between 0x53 and 0x73 in the C field.
- The CALEC ST II responds with an ACK telegram.

Response telegram	DIF, DIFE	VIF
Standard	0x08	0x7e
Service	0x08	0x7f
Freeze	0xc8,0f	0x7e
Billing date 1	0x48	0x7e
Billing date 2	0x88, 01	0x7e
Billing date 3	0xc8, 01	0x7e
Billing date 4	0x88, 02	0x7e
Billing date 5	0xc8, 02	0x7e
Billing date 6	0x88, 03	0x7e
Billing date 7	0xc8, 03	0x7e
Billing date 8	0x88, 04	0x7e

Response telegram	DIF, DIFE	VIF
Logger 1	0x88, 82, 03	0x7e
Logger 2	0xc8, 82, 03	0x7e
…		
Logger 100	0xc8, 83, 06	0x7e
Logger 101	0x88, 84, 06	0x7e
…		
Logger 200	0xc8, 85, 09	0x7e
Logger 201	0x88, 86, 09	0x7e
…		
Logger 300	0xc8, 87, 0c	0x7e
Logger 301	0x88, 88, 0c	0x7e
…		

Response telegram	DIF, DIFE	VIF
Billing date 9	0xc8, 04	0x7e
Billing date 10	0x88, 05	0x7e
Billing date 11	0xc8, 05	0x7e
Billing date 12	0x88, 06	0x7e

Response telegram	DIF, DIFE	VIF
Logger 400	0xc8, 89, 0f	0x7e
Logger 401	0x88, 8a, 0f	0x7e
…		
Logger 500	0xc8, 8b, 82, 01	0x7e

Table 20: Parametrise response telegram

4.1.5 Parametrise date/time

Name	Number of bytes	Value	Explanation
Start	1	0x68	
L field	1	0x09	
L field	1	0x09	
Start	1	0x68	
C field	1	0x53 / 0x73	SND_UD
A field	1	PADR	Primary address
CI field	1	0x51	Parametrisation
DIF	1	0x04	
VIF	1	0x6d	
Value	4	Type F	New date/time
Checksum	1	CS	
Stop	1	0x16	

Table 21: Parametrise date/time

- The date and time format supports both the millennium and summer/winter time bits.
- The CALEC ST II does not differentiate between 0x53 and 0x73 in the C field.
- The CALEC ST II responds with an ACK telegram.

4.1.6 Programming error hour counter

Name	Number of bytes	Value	Explanation
Start	1	0x68	
L field	1	0x09	
L field	1	0x09	
Start	1	0x68	
C field	1	0x53 / 0x73	SND_UD
A field	1	PADR	Primary address
CI field	1	0x51	Parametrisation
DIF	1	0x34	
VIF	1	0x22	
Value	4	Int4	New value from the error hour counter
Checksum	1	CS	
Stop	1	0x16	

Table 22: Programming error hour counter

- Programming of the error hour counter must be carried out in programming mode.
- The CALEC ST II does not differentiate between 0x53 and 0x73 in the C field.
- The CALEC ST II responds with an ACK telegram.

4.1.7 Programming alarm hour counter

Name	Number of bytes	Value	Explanation
Start	1	0x68	

Name	Number of bytes	Value	Explanation
L field	1	0x0a	
L field	1	0x0a	
Start	1	0x68	
C field	1	0x53 / 0x73	SND_UD
A field	1	PADR	Primary address
CI field	1	0x51	Parametrisation
DIF	2	0xb4, 40	
VIF	1	0x22	
Value	4	Int4	New value of the alarm hour counter
Checksum	1	CS	
Stop	1	0x16	

Table 23: Programming alarm hour counter

- Programming of the alarm hour counter must be carried out in programming mode.
- The CALEC ST II does not differentiate between 0x53 and 0x73 in the C field.
- The CALEC ST II responds with an ACK telegram.

4.1.8 Parametrise billing date

The CALEC ST II can handle 12 billing date memories, the AMTRON X-50 (C5) can handle 2.
Each memory time (billing date) can be programmed separately.
The data are stored at the end of the defined day.

Name	Number of bytes	Value	Explanation
Start	1	0x68	
L field	1	0x0a	
L field	1	0x0a	
Start	1	0x68	
C field	1	0x53 / 0x73	SND_UD
A field	1	PADR	Primary address
CI field	1	0x51	Parametrisation
DIF	1	0x42	
VIF, VIFE	≥2	0xec, 7e	Example for billing date #1. Numbering according to table 3.2.2 Billing date telegrams
Value	2	Type G	New billing date
Checksum	1	CS	
Stop	1	0x16	

Table 24: Parametrise billing date

- The year of the date transmitted is ignored and set internally to 127 (AnyYear). The day and month are adopted.
- The CALEC ST II does not differentiate between 0x53 and 0x73 in the C field.
- The CALEC ST II responds with an ACK telegram.

4.1.9 Parametrise customer text field

Name	Number of bytes	Value	Explanation
Start	1	0x68	
L field	1	LEN	
L field	1	LEN	
Start	1	0x68	
C field	1	0x53 / 0x73	SND_UD
A field	1	PADR	Primary address
CI field	1	0x51	Parametrisation
DIF	1	0x0d	
VIF, VIFE	2	0xfd, 11	
	1	0x01 – 0x28	Number of bytes in customer text field

Name	Number of bytes	Value	Explanation
Value	1 – 40		Customer text field (ASCII string)
Checksum	1	CS	
Stop	1	0x16	

Table 25: Parametrise customer text field

- Customer text fields are variable in length. The options are 1 – 40 bytes. The length code can be found between VIFE and the text field.
- The CALEC ST II does not differentiate between 0x53 and 0x73 in the C field.
- The CALEC ST II responds with an ACK telegram.

4.1.10 Freeze command

The Freeze command allows the current values to be frozen. The frozen values remain stored in memory until a new Freeze command is triggered. They can be read out via the “Freeze telegram” (see chapter: 3.2.4 Freeze telegram).

Name	Number of bytes	Value	Explanation
Start	1	0x68	
L field	1	0x07	
L field	1	0x07	
Start	1	0x68	
C field	1	0x53 / 0x73	SND_UD
A field	1	PADR	Primary address
CI field	1	0x51	Parametrisation
DIF, DIFE	2	0xc0, 0f	
VIF, VIFE	2	0xfe, 0b	
Checksum	1	CS	
Stop	1	0x16	

Table 26: Freeze command

- The CALEC ST II does not differentiate between 0x53 and 0x73 in the C field.
- The CALEC ST II responds with an ACK telegram.

4.1.11 Parametrise impulse value

Name	Number of bytes	Value	Explanation
Start	1	0x68	
L field	1	0x0a	
L field	1	0x0a	
Start	1	0x68	
C field	1	0x53 / 0x73	SND_UD
A field	1	PADR	Primary address
CI field	1	0x51	Parametrisation
DIF	1	0x05	
VIF, VIFE	2	0x93, 28	
Value	4	Float	Impulse value [l]
Checksum	1	CS	
Stop	1	0x16	

Table 27: Parametrise impulse value

- For this parametrisation, the device must be in “programming” protection level.
- The CALEC ST II does not differentiate between 0x53 and 0x73 in the C field.
- The CALEC ST II responds with an ACK telegram.

4.1.12 Parametrise impulse value for auxiliary counter #1

In the device version “Flow (C2)”, input #1 on auxiliary counter #1 is incremented. The allocated impulse value is configured using the following command:

Name	Number of bytes	Value	Explanation
Start	1	0x68	
L field	1	LEN	
L field	1	LEN	
Start	1	0x68	
C field	1	0x53 / 0x73	SND_UD
A field	1	PADR	Primary address
CI field	1	0x51	Parametrisation
DIF, DIFE	1	0x05	
VIF, VIFE	2	VIF4	
Value	4		Impulse value for auxiliary counter #1
Checksum	1	CS	
Stop	1	0x16	

Table 28: Parametrise impulse value for auxiliary counter 1

- For this parametrisation, the device must be in “Service” protection level.
- The CALEC ST II does not differentiate between 0x53 and 0x73 in the C field.
- The CALEC ST II responds with an ACK telegram.

4.1.13 Parametrise impulse value for auxiliary counter #2

Name	Number of bytes	Value	Explanation
Start	1	0x68	
L field	1	LEN	
L field	1	LEN	
Start	1	0x68	
C field	1	0x53 / 0x73	SND_UD
A field	1	PADR	Primary address
CI field	1	0x51	Parametrisation
DIF, DIFE	2	0x85, 40	
VIF, VIFE	2	VIF4	
Value	4		Impulse value for auxiliary counter #2
Checksum	1	CS	
Stop	1	0x16	

Table 29: Parametrise impulse value for auxiliary counter 2

- For this parametrisation, the device must be in “Service” protection level.
- The CALEC ST II does not differentiate between 0x53 and 0x73 in the C field.
- The CALEC ST II responds with an ACK telegram.

4.1.14 Parametrise impulse value for auxiliary counter #3

In all versions of the device which do not require input #3 as a control signal (direction/tariff), the pulses of input #3 on auxiliary counter #3 are cumulative. The impulse value for this input is parametrised using the following command:

Name	Number of bytes	Value	Explanation
Start	1	0x68	
L field	1	LEN	
L field	1	LEN	
Start	1	0x68	
C field	1	0x53 / 0x73	SND_UD
A field	1	PADR	Primary address
CI field	1	0x51	Parametrisation
DIF, DIFE	3	0x85, 80, 40	
VIF, VIFE	2	VIF4	
Value	4		Impulse value for auxiliary counter #3

Name	Number of bytes	Value	Explanation
Checksum	1	CS	
Stop	1	0x16	

Table 30: Parametrise impulse value for auxiliary counter 3

- For this parametrisation, the device must be in “Service” protection level.
- The CALEC ST II does not differentiate between 0x53 and 0x73 in the C field.
- The CALEC ST II responds with an ACK telegram.

4.1.15 Parametrise installation side

Name	Number of bytes	Value	Explanation
Start	1	0x68	
L field	1	0x03	
L field	1	0x03	
Start	1	0x68	
C field	1	0x53 / 73	SND_UD
A field	1	PADR	Primary address
CI field	1	0x51	Parametrisation
DIF	1	0x01	
VIF, VIFE	2	0xfd, 09	
Value	1	0x04 / 0x0c	Installation side: 0x04 = return / 0x0c = supply (medium byte in accordance with EN 13757)
Checksum	1	CS	
Stop	1	0x16	

Table 31: Parametrise installation side

- For this parametrisation, the CALEC ST II must be in “Programming” protection level.
- The CALEC ST II does not differentiate between 0x53 and 0x73 in the C field.
- The CALEC ST II responds with an ACK telegram.

4.2 Application reset

The CALEC ST II supports the application reset and an extension based on what is known as subcode. These commands only affect the choice of response telegram.

The application reset commands are prefixed with an SND-UD telegram by the master.

Name	Number of bytes	Value	Explanation
Start	1	0x68	
L field	1	0x03	
L field	1	0x03	
Start	1	0x68	
C field	1	0x53 / 73	SND_UD
A field	1	PADR	Primary address
CI field	1	0x50	Application reset
Checksum	1	CS	
Stop	1	0x16	

Table 32: Application reset

- The application reset activates the standard telegram and has the same effect as the relevant parametrisation command.
- The CALEC ST II does not differentiate between 0x53 and 0x73 in the C field.
- The CALEC ST II responds with an ACK telegram.

Name	Number of bytes	Value	Explanation
Start	1	0x68	

Name	Number of bytes	Value	Explanation
L field	1	0x03	
L field	1	0x03	
Start	1	0x68	
C field	1	0x53 / 73	SND_UD
A field	1	PADR	Primary address
CI field	1	0x50	Application reset
	1	0xb0	Subcode 0xb0
Checksum	1	CS	
Stop	1	0x16	

Table 33: Application reset with subcode B0h

- The application reset with subcode 0xb0 activates the service telegram and has the same effect as the relevant parametrisation command.
- The CALEC ST II does not differentiate between 0x53 and 0x73 in the C field.
- The CALEC ST II responds with an ACK telegram.

Name	Number of bytes	Value	Explanation
Start	1	0x68	
L field	1	0x03	
L field	1	0x03	
Start	1	0x68	
C field	1	0x53 / 73	SND_UD
A field	1	PADR	Primary address
CI field	1	0x50	Application reset
	1	0x05	Subcode 0x05
Checksum	1	CS	
Stop	1	0x16	

Table 43: Application reset with subcode 05h

- The application reset with subcode 0x05 activates the short standard telegram.
- The CALEC ST II does not differentiate between 0x53 and 0x73 in the C field.
- The CALEC ST II responds with an ACK telegram.

4.3 ACK telegram

Name	Number of bytes	Value	Explanation
ACK	1	0xe5	

Table 34: ACK telegram

If the device responds with an ACK telegram, this means the command from the SND_UD telegram has been successfully executed. If the device cannot execute the command correctly, no ACK telegram is sent and there is a timeout.

5. Variable units

5.1.1 Units

Most units are variable and can be parametrised. The M-Bus standard treats the unit and resolution as a single unit, i.e. a conversion from e.g. kWh to kJ works on the same principle as changing the resolution by a factor of 100, for example. The VIF standardised in EN 13757 is used.

There are no M-Bus commands for parametrising units. The conversion is carried out manually using the keys. Where devices have been validated, this means destroying the validation seal.

5.2 Units and resolution of the energy counter readings (VIF1)

All energy counter readings are saved as 4-byte integers. Every counter reading also has a remainder register. This is a 4 byte float. The counter reading and remainder register always have the same unit/resolution.

The CALEC ST II display always shows the energy counter readings in the same unit/resolution as on the M-Bus.

All counter readings described with VIF1 can have the following units and resolutions:

Resolution	Unit	VIF / VIFE	Resolution	Unit	VIF / VIFE
0.001	kWh	0x03	0.001	GJ	0x0e
0.01	kWh	0x04	0.01	GJ	0x0f
0.1	kWh	0x05	0.1	GJ	0xfb, 08
1	kWh	0x06	1	GJ	0xfb, 09
0.001	MWh	0x06	0.001	kBtu	0x80, 3d
0.01	MWh	0x07	0.01	kBtu	0x81, 3d
0.1	MWh	0xfb, 00	0.1	kBtu	0x82, 3d
1	MWh	0xfb, 01	1	kBtu	0x83, 3d
0.001	MJ	0x0b	0.001	MBtu	0x83, 3d
0.01	MJ	0x0c	0.01	MBtu	0x84, 3d
0.1	MJ	0x0d	0.1	MBtu	0x85, 3d
1	MJ	0x0e	1	MBtu	0x86, 3d

Table 35: Variable units for energy counter readings VIF1

5.3 Units and resolution for volume/mass counter readings (VIF2)

All volume/mass counter readings are saved as 4-byte integers. Every counter reading also has a remainder register. This is a 4 byte float. The counter reading and remainder register always have the same unit/resolution.

The CALEC ST II display always shows the volume/mass counter readings in the same unit/resolution as on the M-Bus.

All counter readings described with VIF2 can have the following units and resolutions:

Resolution	Unit Volume	VIF / VIFE	Resolution	Unit Mass	VIF / VIFE
0.001	m^3	0x13	0.001	T	0x1b
0.01	m^3	0x14	0.01	T	0x1c
0.1	m^3	0x15	0.1	T	0x1d
1	m^3	0x16	1	T	0x1e
0.001	USgal	0x90, 3d			
0.01	USgal	0x91, 3d			
0.1	USgal	0x92, 3d			
1	USgal	0x93, 3d			

Table 36: Variable units for volume/mass counter readings VIF2

5.4 Units and resolution for auxiliary counter readings (VIF3)

The input medium can be selected:
This can be energy, volume, mass or no units.

All auxiliary counter readings are saved as 4 byte integers. Every counter reading also has a remainder register. This is a 4 byte float. The counter reading and remainder register always have the same unit/resolution.
The CALEC ST II display always shows the auxiliary counter readings in the same unit/resolution as on the M-Bus.

For energy, volume and mass, the unit is taken from the tables above.
Where there are no units, the following unit is used:

Medium	Resolution	Unit	VIF / VIFE
No units	1	HCA	0x6e

Table 37: No-unit HCA unit of auxiliary counter VIF3

5.5 Units for auxiliary counter impulse values (VIF4)

The units for the auxiliary counter impulse values depend on the medium set. The counter reading and impulse value always have the same unit. While the resolution for the counter reading can be configured, this is not necessary for the impulse value as it is a floating value.

All counter readings described with VIF4 can have the following units and resolutions:

Medium	Unit	VIF / VIFE
Energy	kWh / pulse	0x86, 28
Volume	l / pulse	0x93, 28
Mass	kg / pulse	0x9b, 28
No units	HCA / pulse	0xee, 28

Table 38: Variable units for auxiliary counter impulse values VIF4

5.6 Notes on units for all other values

All the values and units not described in chapters 5.2 to 5.5 are fixed on the M-Bus and cannot be altered.

However, they can be changed in the display of the CALEC ST II, which means that the values on the M-Bus and the display are shown differently. However, correct physical conversion between the units is guaranteed in all cases.

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