Rev	DESCRIPTION	Date	Sw
A	First issue	09/01/2018	➢ 2.620

BEFORE READING

In the setup there is an option that can be used to change the mode accordingly to which the meter answers to demands of data issued by the master.
This option is named :

SArS : Secondary Address reset Sequence

For a detailed description of the FCB management, refer to the chapter of interest.

1. Standard M-Bus telegrams

1.1 Request for Data (REQ_UD2)

REQ_UD2	
CODE	**Description**
10h	Start
5B/7Bh	C field : Request for Data
PADR	A field : device address 0..250 /254
CS	CheckSum = (10h+5B/7Bh+PADR) mod 100h
16h	Stop

Answer to Request for Data (REQ_UD2)

See in the following table the summary of the 3 basic telegrams.

	RSP_UD - 1st message										
Symbol	**Sequence**	**UNIT**	**DIF**	**DIFE(1)**	**DIFE(2)**	**DIFE(3)**		**VIF**	**VIFE**	**FORMAT**	**LINE**
Et+	Active positive Energy (primary side - total Energy)	0	0x04					0x84	0X3B	INT 32	**1**
P+	ΣP+	0	0x04					0xAB	0x3B	INT 32	**2**
P-	ΣP-	0	0x04					0xAB	0x3C	INT 32	**3**
Er+	Reactive positive energy	1	0x84	0x40				0x84	0X3B	INT 32	**4**
Q+	ΣQ+	1	0x84	0x40				0xAB	0x3B	INT 32	**5**
Q-	ΣQ-	1	0x84	0x40				0xAB	0x3C	INT 32	**6**
Part Et+	Active energy (terminal side - base energy)	2	0x84	0x40				0x84	0X3B	INT 32	**7**
Part Er+	Null (RFU)	3	0x84	0xC0	0x40			0x84	0x3B	INT 32	**8**
Et-	Null (RFU)	4	0x84	0x80	0x80	0x40		0x84	0X3C	INT 32	**9**
Er-	Null (RFU)	5	0x84	0xC0	0x80	0x40		0x84	0x3C	INT 32	**10**
	RSP_UD - 2nd message										
Symbol	**Sequence**	**UNIT**	**DIF**	**DIFE(1)**	**DIFE(2)**	**DIFE(3)**		**VIF**	**VIFE**	**FORMAT**	**LINE**
L1-N	V1	2	0x84	0x80	0x40			0xFD	0x48	INT 32	**11**
I1	I1	2	0x84	0x80	0x40			0xFD	0x59	INT 32	**12**
P1+	P1	2	0x84	0x80	0x40			0xAB	0x3B	INT 32	**13**
P1-	P1-negative	2	0x84	0x80	0x40			0xAB	0x3C	INT 32	**14**
L2-N	V2	3	0x84	0xC0	0x40			0xFD	0x48	INT 32	**15**
I2	I2	3	0x84	0xC0	0x40			0xFD	0x59	INT 32	**16**
P2+	P2	3	0x84	0xC0	0x40			0xAB	0x3B	INT 32	**17**
P2-	P2-negative	3	0x84	0xC0	0x40			0xAB	0x3C	INT 32	**18**
L3-N	V3	4	0x84	0x80	0x80	0x40		0xFD	0x48	INT 32	**19**
I3	I3	4	0x84	0x80	0x80	0x40		0xFD	0x59	INT 32	**20**
P3+	P3	4	0x84	0x80	0x80	0x40		0xAB	0x3B	INT 32	**21**
P3-	P3-negative	4	0x84	0x80	0x80	0x40		0xAB	0x3C	INT 32	**22**
L1-L2	V12	5	0x84	0xC0	0x80	0x40		0xFD	0x48	INT 32	**23**
Q1+	Q1	5	0x84	0xC0	0x80	0x40		0xAB	0x3B	INT 32	**24**
Q1-	Q1-negative	5	0x84	0xC0	0x80	0x40		0xAB	0x3C	INT 32	**25**
L2-L3	V23	6	0x84	0x80	0xC0	0x40		0xFD	0x48	INT 32	**26**
Q2+	Q2	6	0x84	0x80	0xC0	0x40		0xAB	0x3B	INT 32	**27**
Q2-	Q2-negative	6	0x84	0x80	0xC0	0x40		0xAB	0x3C	INT 32	**28**
L1-L3	V13	7	0x84	0xC0	0xC0	0x40		0xFD	0x48	INT 32	**29**
Q3+	Q3	7	0x84	0xC0	0xC0	0x40		0xAB	0x3B	INT 32	**30**
Q3-	Q3-negative	7	0x84	0xC0	0xC0	0x40		0xAB	0x3C	INT 32	**31**

	RSP_UD - 3rd message										
Symbol	**Sequence**	**UNIT**	**DIF**	**DIFE(1)**	**DIFE(2)**	**DIFE(3)**	**DIFE(4)**	**VIF**	**VIFE**	FORMAT	LINE
PF	Power factor	8	0x82	0x80	0x80	0x80	0x40	0xEE	0x3B	INT 16	32
PF-	Power factor -	8	0x82	0x80	0x80	0x80	0x40	0xEE	0x3C	INT 16	33
Fr	Frequency	9	0x82	0xC0	0x80	0x80	0x40	0x6E		INT 16	34
	Current ratio (KTA)	10	0x84	0x80	0xC0	0x80	0x40	0x6E		INT 32	35
	Voltage ratio (KTV)	11	0x84	0xC0	0xC0	0x80	0x40	0x6E		INT 32	36

Position	Description	Byte	Data type
1	3-phase Active Positive Energy	4	**Type B , Binary Integer**
2	3-phse Active Positive Power	4	**TELEGRAM 1**
3	3-phase Active Negative Power	4	
4	3-phase Reactive Positive Energy	4	
5	3-phase Reactive Positive Power	4	
6	3-phase Reactive Negative Power	4	
7	3-phase Active Partial Energy	4	
8	3-phase Reactive Partial Energy	4	
9	3-phase Active Negative Energy	4	
10	3-phase Reactive Negative Energy	4	
11	Pad bytes	5	
12	Voltage L1	4	**Type B , Binary Integer**
13	Current I1	4	**TELEGRAM 2**
14	Active Power L1	4	
15	Negative Active Power L1	4	
16	Voltage L2	4	
17	Current I2	4	
18	Active Power L2	4	
19	Negative Active Power L2	4	
20	Voltage L3	4	
21	Current I3	4	
22	Active Power L3	4	
23	Negative Active Power L3	4	
24	Voltage L1-L2	4	
25	Reactive Power L1	4	
26	Negative Reactive Power L1	4	
27	Voltage L2-L3	4	
28	Reactive Power L2	4	
29	Negative Reactive Power L2	4	
30	Voltage L3-L1	4	
31	Reactive Power L3	4	
32	Negative Reactive Power L3	4	
33	Pad bytes	5	
34	Power Factor	2	**Type B , Binary Integer**
35	Negative power factor	2	**TELEGRAM 3**
36	Frequency	2	
37	Current Transform Ratio KTA	4	
38	Voltage Transform Ratio KTV	4	
39	Power Factor L1	2	
40	Negative Power Factor L1	2	
41	Power Factor L2	2	
42	Negative Power Factor L2	2	
43	Power Factor L3	2	
44	Negative Power Factor L3	2	
45	Pad bytes	5	

1.2 Details of telegrams 1,2,3

Details of the telegrams (all values are hexadecimal).

1.2.1 Telegram 1

RSP_UD			
Field Name	**Byte n.**	**Value**	**Meaning**
Start	1	68	Start byte
L-f	1	LEN	Frame number byte
L-f	1	LEN	Frame number byte
Start	1	68	Start byte
C-f	1	08	RSP_UD
A-f	1	PADR	0..250
CI-f	1	72	Variable structure ,LSB is trasmitted first
Secondary address	4	IDENT	XXXXXXXX (8 BCD digits)
Manufacturer code	2	A5 25	"IME" = 25A5
Device version	1	GEN	Version
Medium	1	02	Electricity
Access number	1	TC	incremented by 1 for any aswered telegram
Status	1	STAT	Status (*)
Signature	2	00 00	Not used
(**)			
DIF	1	1F	more records will follow in next telegram
Value	5	0000000000	PAD bytes
Checksum	1	CS	
Stop	1	16	

(**) data in lines 1 .. 10 of telegram n.1

1.2.2 Telegram 2

RSP_UD			
Field Name	**Byte Number**	**Value**	**Meaning**
Start	1	68	Start byte
L-f	1	LEN	Frame number byte
L-f	1	LEN	Frame number byte
Start	1	68	Start byte
C-f	1	08	RSP_UD
A-f	1	PADR	0..250
CI-f	1	72	Variable structure,LSB is trasmitted first
Secondary address	4	IDENT	XXXXXXXX (8 BCD digits)
Manufacturer code	2	A5 25	"IME" = 25A5
Device version	1	GEN	Version
Medium	1	02	Electricity
Access number	1	TC	incremented by 1 for any aswered telegram
Status	1	STAT	Status (*)
Signature	2	00 00	Not used
(**)			
DIF	1	1F	More records will follow in next telegram
Value	5	0000000000	PAD bytes
Checksum	1	CS	
Stop	1	16	

(**) data in lines 11 .. 31 of telegram n.2

1.2.3 Telegram 3

RSP_UD			
Field Name	**Byte Number**	**Value**	**Meaning**
Start	1	68	Start byte
L-f	1	LEN	Frame number byte
L-f	1	LEN	Frame number byte
Start	1	68	Start byte
C-f	1	08	RSP_UD
A-f	1	PADR	0..250
CI-f	1	72	Variable structure, LSB is trasmitted first
Secondary address	4	IDENT	XXXXXXXX (8 BCD digits)
Manufacturer code	2	A5 25	"IME" = 25A5
Device version	1	GEN	Version
Medium	1	02	Electricity
Access number	1	TC	incremented by 1 for any answered telegram
Status	1	STAT	Status (*)
Signature	2	00 00	Not used
(**)			
DIF	1	0F	Indicating that this is the last telegram
Value	5	0000000000	PAD bytes
Checksum	1	CS	
Stop	1	16	

(**) data in lines 32 .. 36 of telegram n.3

2. Initialization of Slave (SND_NKE)

To start or initialize the communication Master sends this telegram to Slave :

SND_NKE command
Type : short frame

CODE	Description
10h	Start
40h	C field : initialization
PADR	A field : device address 0..250 /254/255
CS	CheckSum = (10h+40h+PADR) mod 100h
16h	Stop

If the Slave receives SND_NKE it resets TC counter of sent telegrams and answers with E5.

3. Primary address reading

SND_UD command
Type : long frame

To read Primary Address send a SND_UD telegram and then REQ_UD2.
This command must be sent in a point to point mode to read out the primary address of a device which the user doesn't know the primary address of (so the demand is in broadcast).

Field Name	Number of byte	Value	Meaning
Start	1	68h	Start
L-f	1	05h	Header
L-f	1	05h	
Start	1	68h	
C-f	1	53h/73h	SND_UD
A-f	1	FE	Broadcast Address
CI-f	1	51h	Data send
DIF	1	08h	Selection for Readout
VIF	1	7Ah	
Check Sum	1	CS	
Stop	1	16h	Stop

Reading example of primary address 1 :

SND_UD	68 05 05 68 53 FE 51 08 7A 24 16
E5h	E5
REQ_UD2	10 7B FE 79 16
RSP_UD	68 12 12 68 08 01 72 00 00 00 00 A8 15 00 02 9E 00 00 00 01 7A 01 54 16

Answer : 01 7A 01 (in blue) : 01 is the device primary address

4. Read the secondary address

Type : long frame

To read the Secondary Address send a SND_UD telegram and then REQ_UD2 :

Command

Field Name	Number of byte	Value	Meaning
Start	1	68h	Start
L-f	1	05h	Header
L-f	1	05h	
Start	1	68h	
C-f	1	53h/73h	SND_UD
A-f	1	PADR	Primary Address
CI-f	1	51h	Data send
DIF	1	08h	
VIF	1	79h	
Check Sum	1	CS	
Stop	1	16h	Stop

Answer

SND_UD	68 05 05 68 73 FE 51 08 79 43 16
Answer	E5 h
REQ_UD2	10 5B FE 59 16
RSP_UD	68 15 15 68 08 01 72 78 56 34 12 A8 15 00 02 0E 00 00 00 0C 79 78 56 34 12 F5 16

Primary address : FE (in this broadcast – point to point – just for example)
Secondary address : **78 56 34 12** (8 BCD digits) but LSB before and MSB at the end so :
Real value : **12 34 56 78**

5. Application Reset

Type : control frame

The device allows the application reset command
After this message the device resets the answer counter, the pending selection frame, the error flags and responds with the ACK character (E5h) :

Field Name	Byte n.	Value	Meaning
Start	1	68h	
L-f	1	03h	Header
L-f	1	03h	
Start	1	68h	
C-f	1	53h/73h	SND_UD
A-f	1	PADR	Primary Address
CI-f	1	50h	Application reset
Check Sum	1	CS	
Stop	1	16h	

6. Selection through Secondary Addressing

Type : long frame

In an M-Bus network it is possible to have maximum 250 participants with primary addresses from 1 to 250. The address 0 is used for a not configured device.

If there are more than 250 devices, it is mandatory to use the secondary address.

Master sends the following SND_UD telegram to a Slave to select it :

Field Name	Byte n.	Value	Meaning
Start	1	68h	
L-f	1	0Bh	Header
L-f	1	0Bh	
Start	1	68h	
C-f	1	53h/73h	SND_UD
A-f	1	FDh	Primary Address
CI-f	1	52h	
Value	4	X1X0 X3X2 X5X4 X7X6	Secondary Address
Manufacturer code	2	A5 25	"IME" = 25A5
Device version	1	Binary	Version (1.00 => 100 = 64h)
Medium	1	02	Electricity
Check Sum	1	CS	
Stop	1	16h	

The Primary address used is FDh

If there is a Slave having the Secondary Address specified X7X6 X5X4 X3X2 X1X0, with the right Manufacturer code, Device version and Medium it will respond with an ACK (0xE5) character otherwise there will be no answer.
If the Slave is correctly selected, it changes its state in "selected" . This means that it will answer with a RSP_UD to all commands REQ_UD2, issued to the Slave.
The Slave remains in a "selected" state until it receives either a selection command to a different Secondary Address or a SND_NKE command to Address 0xFD.
In the Selection command it is allowed to use 0xF wild card instead of any digit of Manufacturer code, Device version and Medium. For example 0xFFFF instead of 0xA525, 0xFF instead of 0x1D and 0xFF instead of 0x02.

Example

Secondary address :

SND_UD	[68][0b][0b][68][53][fd][52][02][00][00][00][a5][25][14][02][8d][16]
Answer	E5 h

7. Writing and reading of Baud rate

Type : long frame

Writing

To write Baud rate it is necessary to send a SND_UD telegram :

Field Name	Number of byte	Value	Meaning
Start	1	68h	Start
L-f	1	03h	Header
L-f	1	03h	
Start	1	68h	
C-f	1	53h/73h	SND_UD
A-f	1	PADR	Primary Address
Value	1	XXh	Data send
Check Sum	1	CS	
Stop	1	16h	Stop

Parameter :

XX h :

B8 h -> 300 b/s
B9 h -> 600 b/s
BA h -> 1200 b/s
BB h -> 2400 b/s
BC h -> 4800 b/s
BD h -> 9600 b/s

NOTE
When Slave receives this telegram, before it sends E5h as confirmation at current Baud Rate and then changes its Baud Rate to the new.

Writing of a Baud Rare of 2400

SND_UD	68 03 03 68 73 53 00 BB 0E 16
Answer	E5 h

Reading

To read Baud rate it is necessary to send a SND_UD telegram and then a REQ_UD2 :

Field Name	Number of byte	Value	Meaning
Start	1	68h	Start
L-f	1	06h	Header
L-f	1	06h	
Start	1	68h	
C-f	1	53h/73h	SND_UD
A-f	1	PADR	Primary Address
CI-f	1	51h	Data send
DIF	1	08h	Selection for Readout
VIF	1	FFh	
VIFE	1	42h	Baud rate
Check Sum	1	CS	
Stop	1	16h	Stop

Reading of a Baud Rate of 300

SND_UD	68 06 06 68 53 01 FE 51 08 FF 42 EB 16
Answer	E5 h

REQ_UD2	10 7B FE 79 16
Answer	68 13 13 68 08 FD 72 01 00 00 00 A8 15 00 02 94 00 00 00 01 FF 42 00 7C 16

8. FCB bit management

If the option "SArS" is set on YES, every time the master selects the slave using the secondary address, the telegram (data messages) sequence is restarted from the telegram n. 1 In this case, the FCB bit continues toggling normally. If a FCB bit is received that is equal to the preceding, the meter does not repeat the last telegram (as it should do in other situations) and responds with the toggled FCB bit.

Table below shows the coding of the individual bits of the C field:

Bit Number	7	6	5	4	3	2	1	0
Calling Direction	0	1	FCB	FCV	F3	F2	F1	F0
Reply Direction	0	0	ACD	DFC	F3	F2	F1	F0

Fig. *Coding of the Control Field*

Bit 7 : it is reserved for future functions, and at present is 0
Bit 6 : it is used to specify the direction of data flow (1 = Master to Slave; 0 = Slave to Master).
Frame Count Bit FCB :
it is toggled when the slave has answered correctly. E.g. master sends FCB=0 , slave returns a valid answer, master sends FCB=1 and vice versa (0 .. 1 .. 0)
Frame Count Bit valid FCV :
0 : the toggle management must be ignored
1 : the toggle management must be used
Bits F3 F2 F1 F0 : they specify the function that must be performed by the slave.

When the meter answers 0x5B that means the FCB bit is = 0 and vice versa when answering 0x7B

Example giving

Case 1

SArS = NO

(Master)	Selection command of secondary address
(Slave)	E5
(Master)	REQ_UD2 command with FCB = 0x5B
(Slave)	Message response – telegram n. 1
(Master)	REQ_UD2 command with FCB = 0x7B
(Slave)	Message response – telegram n. 2
(Master)	REQ_UD2 command with FCB = **0x5B**
(Slave)	Message response – telegram n. 3
(Master)	Selection command of secondary address
(Slave)	E5
(Master)	**REQ_UD2 command with FCB = 0x5B**
(Slave)	**Message response – telegram n. 3**
	(The previous telegram is repeated as the FCB bits are the same before and after the selection)

Case 2

SArS = YES

(Master)	Selection command of secondary address
(Slave)	E5
(Master)	REQ_UD2 command with FCB = 0x5B
(Slave)	Message response – telegram n. 1
(Master)	REQ_UD2 command with FCB = 0x7B
(Slave)	Message response – telegram n. 2
(Master)	REQ_UD2 command with FCB = **0x5B**
(Slave)	Message response – telegram n. 3
(Master)	Selection command of secondary address
(Slave)	E5
(Master)	**REQ_UD2 command with FCB = 0x5B**
(Slave)	**Message response – telegram n. 1**
	(The telegram sequence is restarted due to the selection)

The Application Reset command has the effect to completely restart the telegram sequence.