SAIA BURGESS CONTROLS

3-phase bidirectional energy meter
with M-Bus interface

Bidirectional energy meters with a M-Bus interface make it possible to read out all relevant data such as energy (total and partial), current and voltage per phase, active and idle power per phase or as total output.

ALE 3 | 65A | M-Bus | MID

Specifications

- 3-phase energy meter, 3 × 230 / 400 VAC 50 Hz
- Direct metering to 65 A in both directions of current
- Display of the active power, voltage and current per phase
- Display of the total active power
- M-Bus interface used to query data
- Idle power per phase or total available via the interface
- Up to 254 energy meters can be connected to a single M-Bus interface.
- 7-digit LCD display for energy supply and feeding back
- Can be sealed and is provided with a sealing cap as an accessory
- Accuracy class B in accordance with EN50470-3,
  Accuracy class 1 in accordance with IEC62053-21

Order number

MID version:	ALE3B5FM00C3A00
Sealing cap:	4 104 7485 0

Technical data

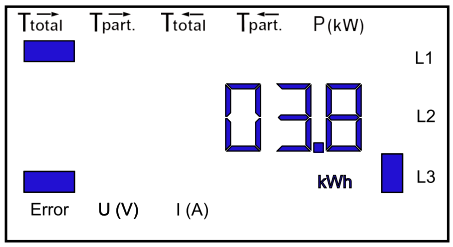
Accuracy class	B in accordance with EN50470-3, 1 in accordance with IEC62053-21
Operating voltage	3 × 230 / 400 VAC, 50 Hz Tolerance -20 %/+15%
Reference current/maximal current	I_{ref} = 10 A, I_{max} = 65 A
Start current /min current	I_{st} = 40 mA, I_{min} = 0.5 A
Power consumption	Active 0.4 W per phase
Meter range	00'000.00…99'999.99 100'000.0…999'999.9
Display	Backlit LCD, numbers 6 mm high
Display without mains electricity	Condenser protected LCD maximum 2 times in 10 days
Pulses per kWh	LED : 1000 pulses/kWh

Assembly

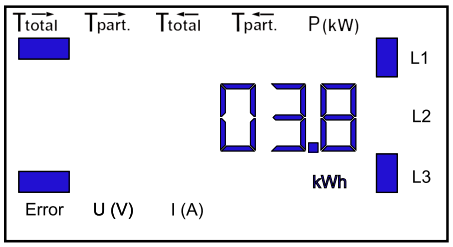
Assembly	On 35 mm top-hat rail in accordance with EN60715TH35
Connections Main current circuit	Conductor cross section 1.5 –16 mm², Pozidrive screwdriver size 1, flat-head screwdriver size 2, torque 1.5 – 2 Nm
Connections Control current circuit	Conductor cross section 2.5 mm², Pozidrive screwdriver size 0 or flat-head screwdriver size 2, torque 0.8 Nm
Insulating properties	- 4 kV / 50 Hz test in accordance with VDE0435 for energy meters - 6 kV 1.2 / 50 µs overvoltage in accordance with IEC255-4 - 2 kV / 50 Hz test in accordance with VDE0435 for interfaces - Device protection class II
Ambient temperature	–25 °…+55 °C
Storage temperature	–30 °…+85 °C
Environment	Mechanical M2 Electromagnetic E2
Relative humidity	75 % without condensation
EMC/resistance	- Surge voltage in accordance with IEC61000-4-5 at the main current circuit 4 kV at the M-Bus interface 1 kV - Burst voltage in accordance with IEC61000-4-4, at the main current circuit 4 kV at the M-Bus interface 1 kV - ESD in accordance with IEC61000-4-2, contact 8 kV, air 15 kV

Error display

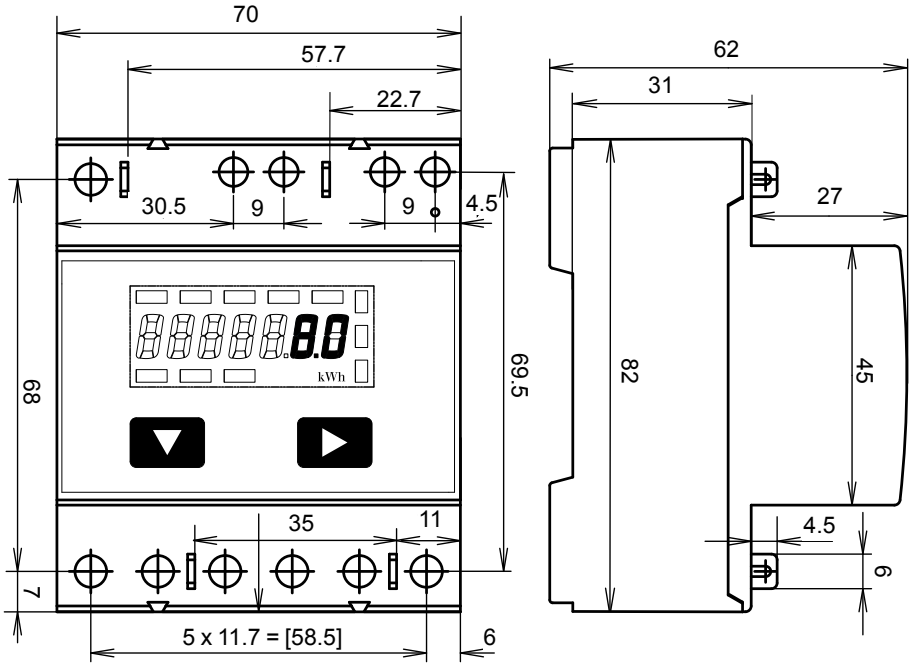
Example: Connection error at L3



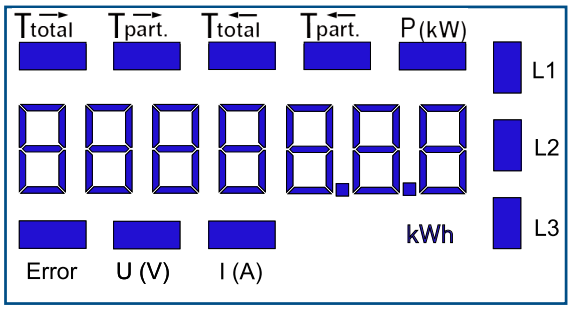
Example: Connection error at L1 and L3



Dimension drawings

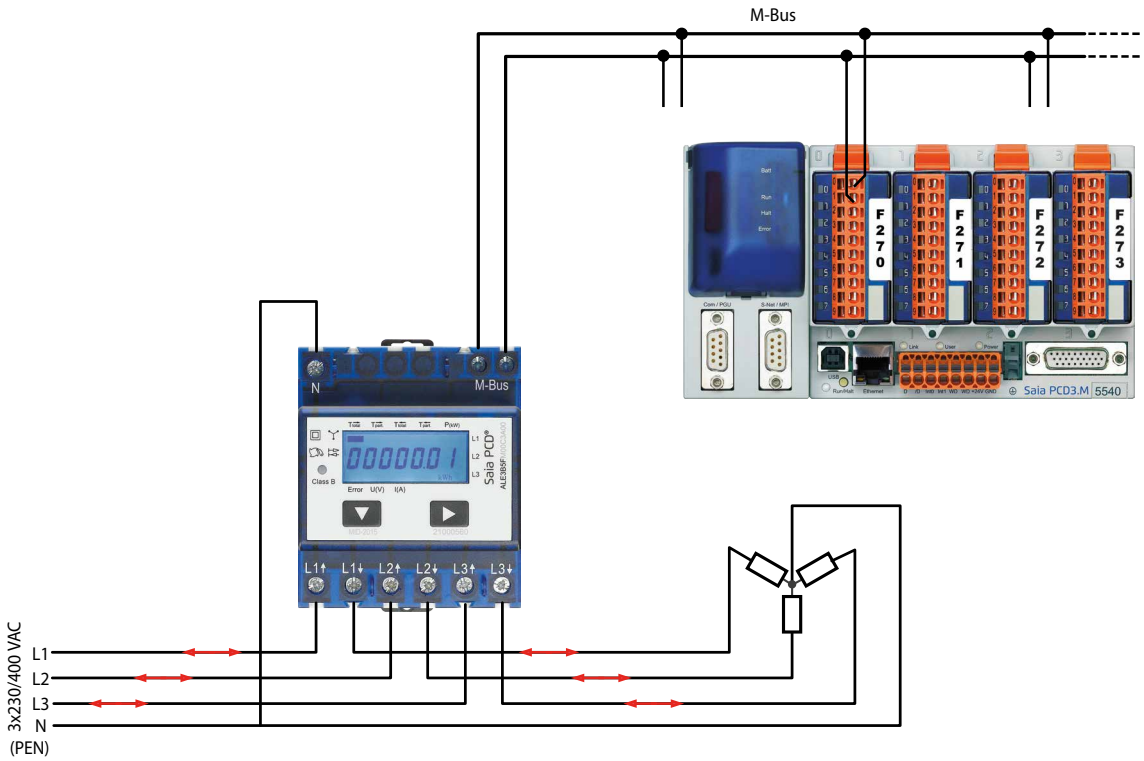


Display components, direct measurement



- ▶ T_{total} Shows the total consumption T→
- ▶ $T_{part.}$ Shows the partial consumption at T→; this value can be reset
- ▶ T_{total} Shows the total consumption T←
- ▶ $T_{part.}$ Shows the partial consumption at T←; this value can be reset
- ▶ P (kW) Shows the present output per phase or for all phases
  Current «→» = supply (P positive)
  Current «←» = feedback (P negative)
- ▶ U (V) Shows the voltage per phase
- ▶ I (A) Shows the current per phase
- ▶ kWh Shows the unit kWh in the consumption or in the feedback display
- ▶ L1/L2/L3 Displays the corresponding phase for the P, U, I or error display
- ▶ Error In the absence of a phase. The corresponding phase is also displayed.

Connection diagram



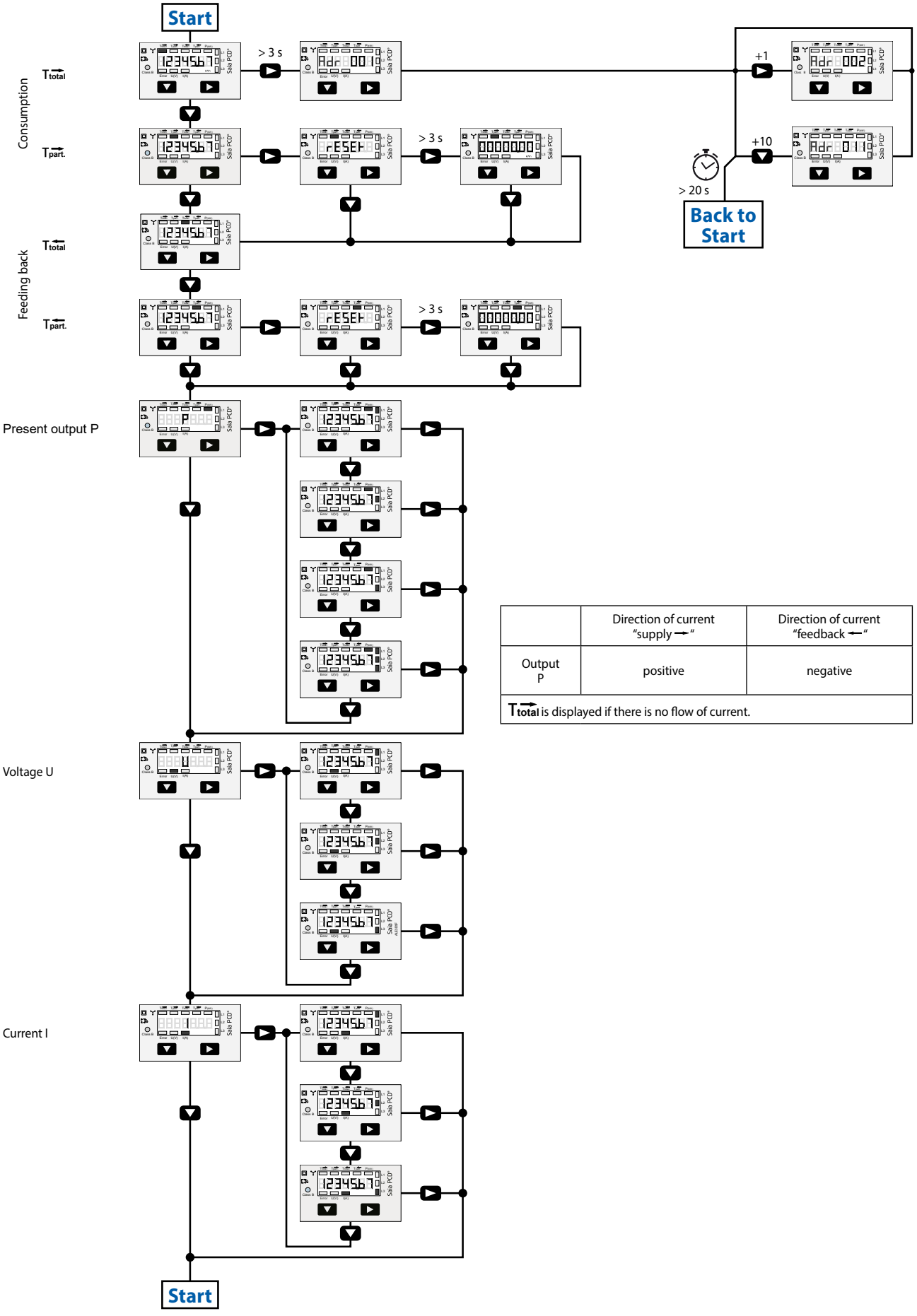
FW versions

In autumn 2016, a new FW version was launched. As of firmware version 1.3.3.6, the setting of the baud rate changes.

- The baud rate is no longer automatically detected, it has to be changed using the two keys and the LC display (see pages 4 and 5).
- The baud rate can be changed using a M-Bus telegram (see pages 6 and 7).

Up to versions FW1.3.3.5

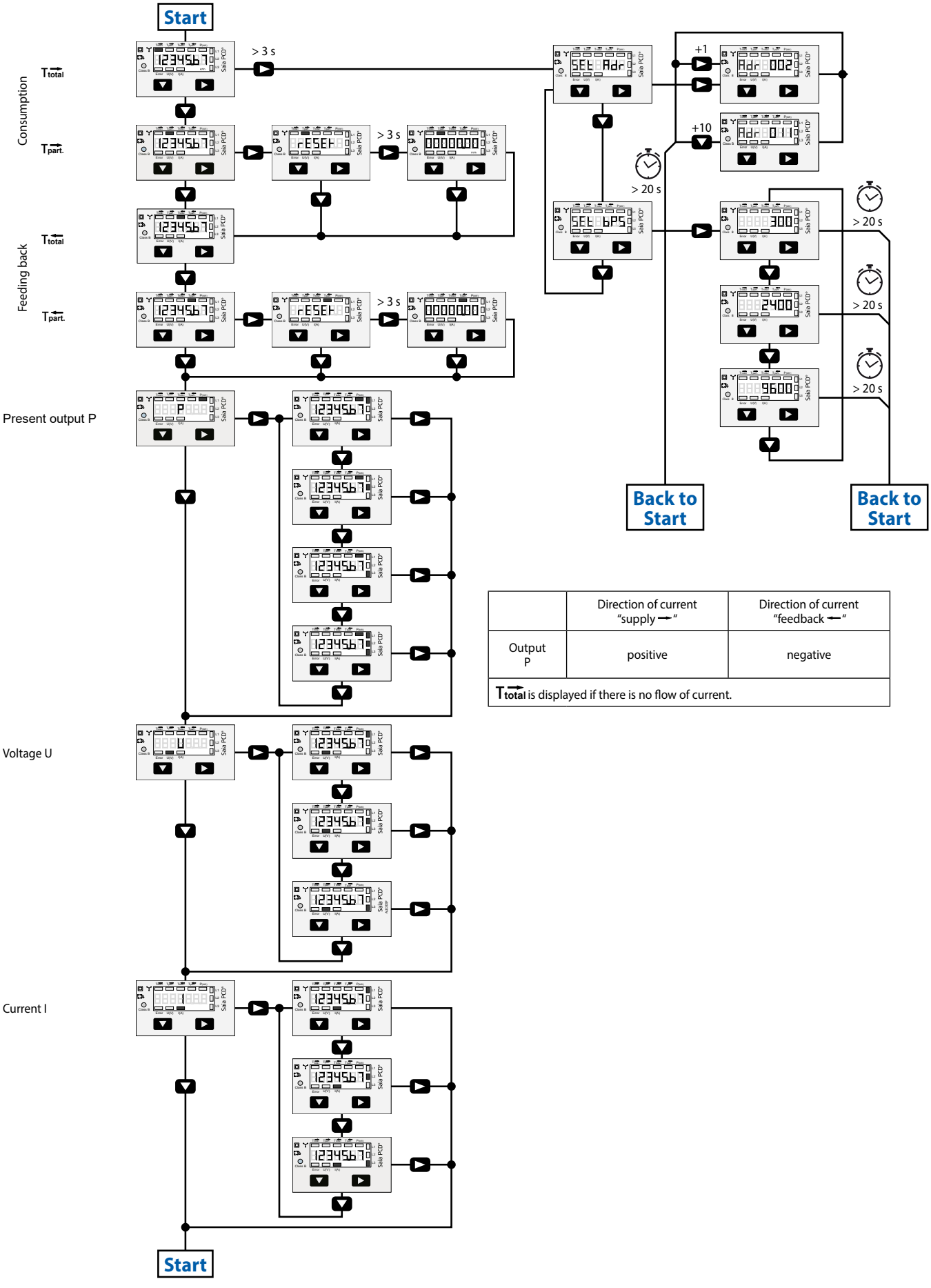
Menu to display the values on the LCD



	Direction of current "supply →"	Direction of current "feedback ←"
Output P	positive	negative
$T_{total}^{\rightarrow}$ is displayed if there is no flow of current.		

Starting with version FW1.3.3.6

Menu to display the values on the LCD



	Direction of current "supply →"	Direction of current "feedback ←"
Output P	positive	negative
$T_{total}^{\rightarrow}$ is displayed if there is no flow of current.		

Up to versions FW1.3.3.5

Technical data M-Bus

Bus System	M-Bus	
Standard	EN13757	
Bus length	According to M-Bus specification	
Transmission rates	300, 2400, 9600 Bd. The transmission rate is automatically detected	
Response time	Write:	up to 60 ms
	Read:	up to 60 ms

Data transfer

- When reading out the values, all values are transferred in a telegram
- It supports the following telegrams (see p.6 for more detailed information):

- Initialisation	SND_NKE	Response: 0xE5
- Reading meter	REQ_UD2	Response: RSP_UD
- Changing primary address	SND_UD	Response: 0xE5
- Reset T_{part}	SND_UD	Response: 0xE5

- The device does not respond to unknown queries
- The transmission rate is automatically detected
- The device has a voltage monitor. In the case of a power failure, all the registers are saved in the EEPROM.

Changing the M-Bus primary address

- In order to change the M-Bus primary address, hold down ▶
- In the following menu, ▼ increases the address by 10, ▶ increases the primary address by 1
- When the desired address is set, wait until the main display appears again

Secondary addressing

- It is possible to communicate with the energy meter usint the secondary address, according to EN13757
- The use of Wild Cards is possible

Starting with version FW1.3.3.6

Technical data M-Bus

Bus System	M-Bus	
Standard	EN13757	
Bus length	According to M-Bus specification	
Transmission rates	300, 2400, 9600 Bd (factory setting: 2400 Bd). The transmission rate can be changed via display/M-Bus.	
Response time	Write:	up to 60 ms
	Read:	up to 60 ms

Data transfer

- When reading out the values, all values are transferred in a telegram
- It supports the following telegrams (see p.6 for more detailed information):
  - Initialisation SND_NKE Response: 0xE5
  - Reading meter REQ_UD2 Response: RSP_UD
  - Changing primary address SND_UD Response: 0xE5
  - Reset T_{part} SND_UD Response: 0xE5
  - Slave selection for secondary addressing SND_UD Response: 0xE5
  - The transmission rate is changeable SND_UD Response: 0xE5
- The device does not respond to unknown queries
- The device has a voltage monitor. In the case of a power failure, all the registers are saved in the EEPROM.

Changing the M-Bus primary address

- In order to change the M-Bus primary address, hold down ▶ touch for 3 sec, then press ▶ again
- In the following menu, ▼ increases the address by 10,
  ▶ increases the primary address by 1
- When the desired address is set, wait until the main display appears again

Secondary addressing

- It is possible to communicate with the energy meter using the secondary address, according to EN13757
- The use of Wild Cards is possible

Changing the baud rate

Variant 1 (local keys and LCD):

- In order to change the M-Bus baud rate, hold down ▶ touch for 3 sec, then press ▼ again, and then press ▶
- In the following menu, ▼ changes the baud rate from 300 to 9600 baud and 2400
- When the desired M-Bus baud rate is set, wait until the main display appears again

Variante 2 (using M-Bus):

- Send: 9600 ➔ Telegram: 0x68 0x03 0x03 0x68 0x43 <addr> **0xBD** <cs> 0x16
  2400 ➔ Telegram: 0x68 0x03 0x03 0x68 0x43 <addr> **0xBB** <cs> 0x16
  300 ➔ Telegram: 0x68 0x03 0x03 0x68 0x43 <addr> **0xB8** <cs> 0x16
- Response: 0xE5 (sent with the baud rate)
- A M-Bus master must communicate within 10

Connection diagram / Method of operation

Energy is added as indicated by the arithmetic operator. Positive output in the meter indicates that energy is being supplied, while negative output indicates that energy is being delivered. The energy measurement is carried out in accordance with mode 2, is balanced.

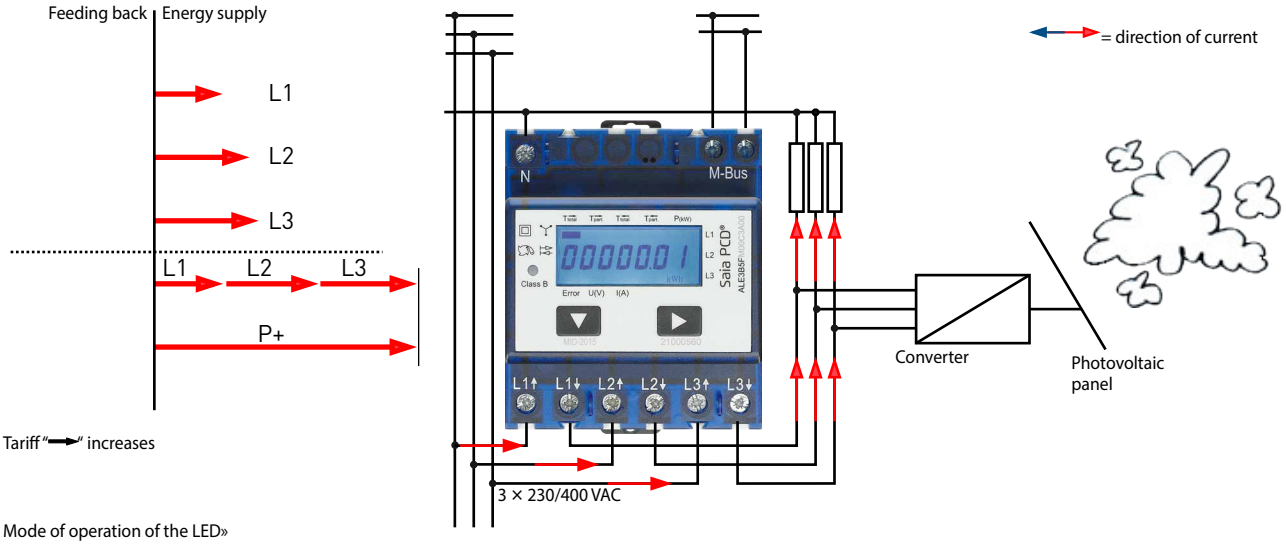
If the supply of energy (P positive) is greater than the delivery of energy (P negative), the counter T→ increases.

The LED is OFF and only switches on if there is a pulse.

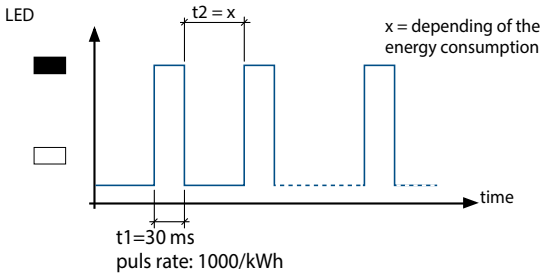
If the delivery of energy is greater than the supply of energy, the counter T← increases.

The LED is ON and only switches off if there is a pulse.

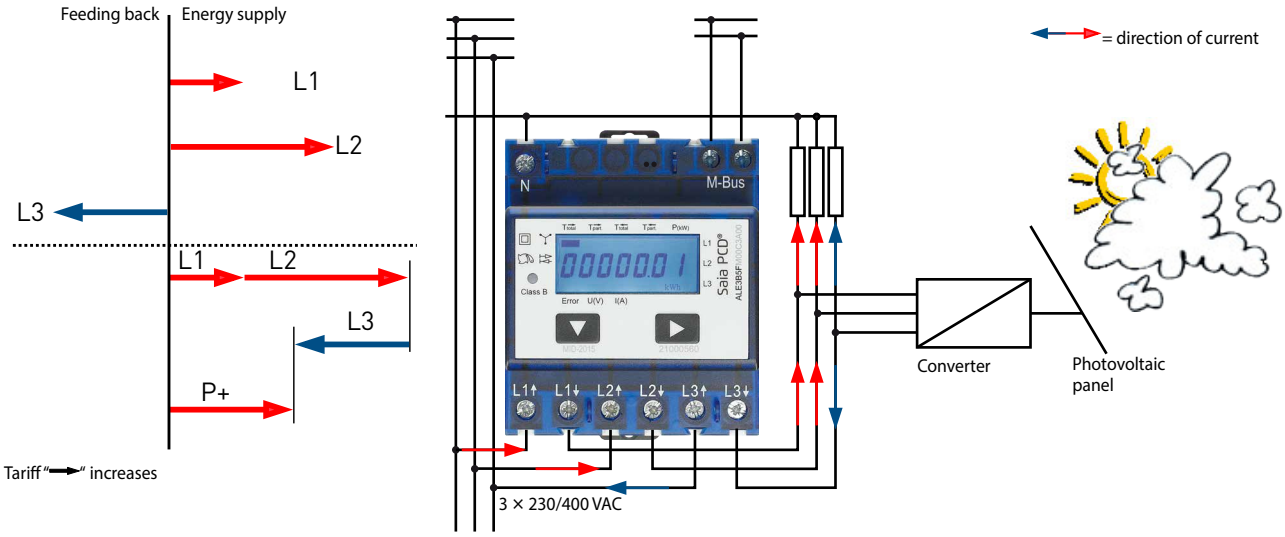
Method of operation with direction of current «supply →»



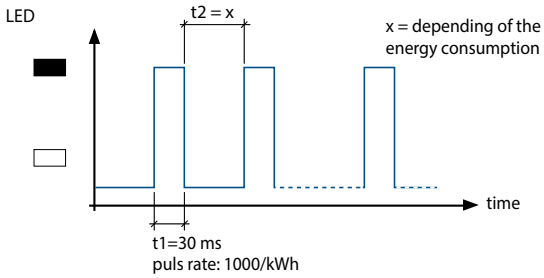
Mode of operation of the LED»



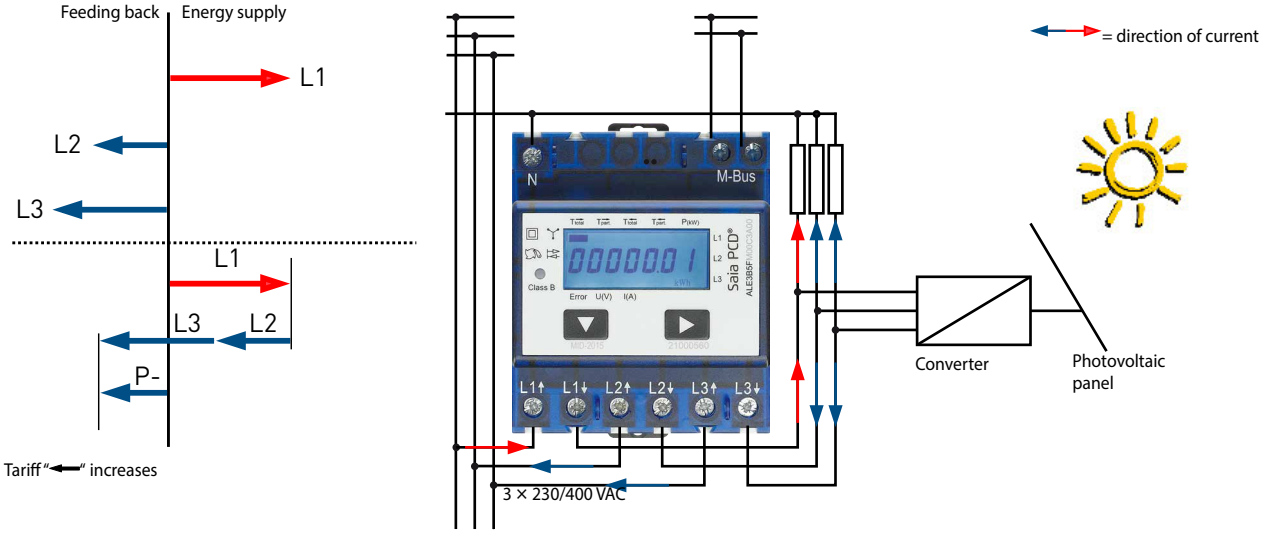
Method of operation with direction of current «supply →» and «feeding back ←»



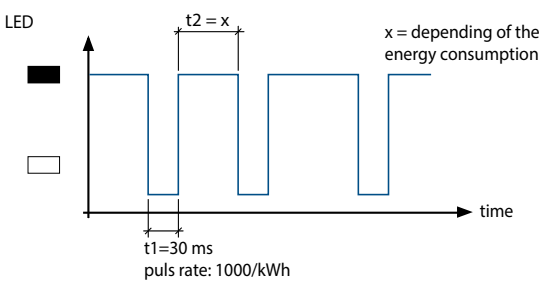
Mode of operation of the LED



Method of operation with direction of current «feeding back ←»



Mode of operation of the LED



Value information field (VIF)
Provides information on multiplier and the unit of the following data block

Value information field extension (VIFE)
Detailed information on multiplier and the unit of the following data block

Data information field (DIF)
Specifies how the data should be interpreted by the master in terms of length and encoding

Data information field extension (DIFE)
Provides information on the tariff or subunits of the following data block

Reading meter

Query: REQ_UD2
Response: RSP_UD (see Telegram structure)

Telegram structure

0x68	0x92	0x92	0x68	0x08	PAdr	0x72	ID	0x43	0x4c	DEV
02	ACC	STAT	0	0	0x8c	0x10	VIF	EtoIn	0x8c	0x11
VIF	EpaT1	0x8c	0x20	VIF	EtoOut	0x8c	0x21	VIF	EpaT2	0x02
0xFD	0xC9	0xFF	0x01	Vph1	0x02	0xFD	VIFE	0xFF	0x01	Iph1
0x02	VIF	0xFF	0x01	Pph1	0x82	0x40	VIF	0xFF	0x01	Prph1
0x02	0xFD	0xC9	0xFF	0x02	Vph2	0x02	0xFD	VIFE	0xFF	0x02
Iph2	0x02	VIF	0xFF	0x02	Pph2	0x82	0x40	VIF	0xFF	0x02
Prph2	0x02	0xFD	0xC9	0xFF	0x03	Vph3	0x02	0xFD	VIFE	0xFF
0x03	Iph3	0x02	VIF	0xFF	0x03	Pph3	0x82	0x40	VIF	0xFF
0x03	Prph3	0x02	0xFF	0x68	RappW	0x02	VIF	0xFF	0x00	Ptot
0x82	0x40	VIF	0xFF	0x00	Prtot	0x01	0xFF	0x14	Pwr_Dir	CSum
0x16										
Constants		**Variable at 1 byte**			**Variable at 2 bytes**			**Variable at 4 bytes**		

Byte	Content	Type	Description	Manufacturer-specific
23 – 26	EtoIn = x	4 b. BCD	T1 total consumption	
30 – 33	EpaIn = x	4 b. BCD	T1 partial consumption	
37 – 40	EtoOut = x	4 b. BCD	T2 total feeding back	
44 – 47	EpaOut = x	4 b. BCD	T2 partial feeding back	
53 – 54	Vph1 = x	2b. Integer	Voltage phase 1	
60 – 61	Iph1 = x	2b. Integer	Current phase 1	
66 – 67	Pph1 = x	2b. Integer	Power phase 1	
73 – 74	Prph1 = x	2b. Integer	Reactive power phase 1	
80 – 81	Vph2 = x	2b. Integer	Voltage phase 2	
87 – 88	Iph2 = x	2b. Integer	Current phase 2	
93 – 94	Pph2 = x	2b. Integer	Power phase 2	
100 – 101	Prph2 = x	2b. Integer	Reactive power phase 2	
107 – 108	Vph3 = x	2b. Integer	Voltage phase 3	
114 – 115	Iph3 = x	2b. Integer	Current phase 3	
120 – 121	Pph3 = x	2b. Integer	Current phase 3	
127 – 128	Prph3 = x	2b. Integer	Reactive power phase 3	
132 – 133	RappW = x	2b. Integer	Transformer ratio	x (=0 for ALE3)
138 – 139	Ptot = x	2b. Integer	Power total	
145 – 146	Prtot = x	2b. Integer	Reactive power total	
150	Pwr_Dir	1b. Integer	Power Direction	

Unit with multiplier		ALE3	
I	(Current)	0.1	[A]
U	(Voltage)	1	[V]
P_{active}	(Power)	0.01	[kW]
$P_{reactive}$	(Reactive power)	0.01	[kvar]
E	(Consumption)	0.01	[kWh]

Telegram structure (detailed)

Byte	Value	Description
1	0x68	Start
2	0x92	Field length
3	0x92	Field length
4	0x68	Start
5	0x08	C
6	A	Primary address
7	0x72	CI
8	x	ID1 (LSB)
9	x	ID2
10	x	ID3
11	x	ID4 (MSB)
12	0x43	MAN1
13	0x4C	MAN2
14	x	DEV (Typ-Version)
15	02	MED (Electric)
16	x	ACC
17	* see footnote	STAT
18	0	SIG1
19	0	SIG2
20	0x8C	DIF
21	0x10	DIFE
22	0x04 0x05	VIF 0.01 kWh 0.1 kWh
23	EtoIn_4	Consumption Total
24	EtoIn_3	
25	EtoIn_2	
26	EtoIn_1	
27	0x8C	DIF
28	0x11	DIFE
29	0x04 0x05	VIF 0.01 kWh 0.1 kWh
30	EpaIn_4	Consumption Partial
31	EpaIn_3	
32	EpaIn_2	
33	EpaIn_1	
34	0x8C	DIF
35	0x20	DIFE
36	0x04 0x05	VIF 0.01 kWh 0.1 kWh
37	EtoOut_4	Feeding back Total
38	EtoOut_3	
39	EtoOut_2	
40	EtoOut_1	
41	0x8C	DIF
42	0x21	DIFE
43	0x04 0x05	VIF 0.01 kWh 0.1 kWh
44	EpaOut_4	Feeding back Partial
45	EpaOut_3	
46	EpaOut_2	
47	EpaOut_1	

Byte	Value	Description
48	0x02	DIF
49	0xFD	VIF
50	0xC9	VIFE = 1 V
51	0xFF	VIFE
52	0x01	VIFE
53	Vph1_2	Voltage phase 1
54	Vph1_1	
55	0x02	DIF
56	0xFD	VIF
57	0xDB 0xDC	VIFE 0.1 A 1 A
58	0xFF	VIFE
59	0x01	VIFE
60	Iph1_2	Current phase 1
61	Iph1_1	
62	0x02	DIF
63	0xAC 0xAD	VIF 0.01 kW 0.1 kW
64	0xFF	VIFE
65	0x01	VIFE
66	Pph1_2	Power phase 1
67	Pph1_1	
68	0x82	DIF
69	0x40	DIFE
70	0xAC 0xAD	VIF 0.01 kVAR 0.1 kVAR
71	0xFF	VIFE
72	0x01	VIFE
73	Prph1_2	Reactive power phase 1
74	Prph1_1	
75	0x02	DIF
76	0xFD	VIF = 1 V
77	0xC9	VIFE
78	0xFF	VIFE
79	0x02	VIFE
80	Vph2_2	Voltage phase 2
81	Vph2_1	
82	0x02	DIF
83	0xFD	VIF
84	0xDB 0xDC	VIFE 0.1 A 1 A
85	0xFF	VIFE
86	0x02	VIFE
87	Iph2_2	Current phase 2
88	Iph2_1	
89	0x02	DIF
90	0xAC 0xAD	VIF 0.01 kW 0.1 kW
91	0xFF	VIFE
92	0x02	VIFE
93	Pph2_2	Power phase 2
94	Pph2_1	

Byte	Value	Description
95	0x82	DIF
96	0x40	DIFE
97	0xAC 0xAD	VIF 0.01 kVAR 0.1 kVAR
98	0xFF	VIFE
99	0x02	VIFE
100	Prph2_2	Reactive power phase 2
101	Prph2_1	
102	0x02	DIF
103	0xFD	VIF = 1 V
104	0xC9	VIFE
105	0xFF	VIFE
106	0x03	VIFE
107	Vph3_2	Voltage phase 3
108	Vph3_1	
109	0x02	DIF
110	0xFD	VIF
111	0xDB 0xDC	VIFE 0.1 A 1 A
112	0xFF	VIFE
113	0x03	VIFE
114	Iph3_2	Current phase 3
115	Iph3_1	
116	0x02	DIF
117	0xAC 0xAD	VIF 0.01 kW 0.1 kW
118	0xFF	VIFE
119	0x03	VIFE
120	Pph3_2	Power phase 3
121	Pph3_1	
122	0x82	DIF
123	0x40	DIFE
124	0xAC 0xAD	VIF 0.01 kVAR 0.1 kVAR
125	0xFF	VIFE
126	0x03	VIFE
127	Prph3_2	Reactive power phase 3
128	Prph3_1	

Byte	Value	Description
129	0x02	DIF
130	0xFF	VIF
131	0x68	VIFE
132	RappW_2	Transformer ratio
133	RappW_1	= 0 at ALE3
134	0x02	DIF
135	0xAC 0xAD	VIF 0.01 kW 0.1 kW
136	0xFF	VIFE
137	0x00	VIFE
138	Ptot_2	Power total
139	Ptot_1	
140	0x82	DIF
141	0x40	DIFE
142	0xAC 0xAD	VIF 0.01 kVAR 0.1 kVAR
143	0xFF	VIFE
144	0x00	VIFE
145	Prtot_2	Reactive power total
146	Prtot_1	
147	0x01	DIF
148	0xFF	VIF
149	0x14	VIFE
150	0 4	Consumption Feeding back
151	x	Checksum
152	0x16	Stop

* footnote

Byte	Bit	Value	Name	Description	Standard
17			**STAT**	**Status register**	
	0	b'xxxx xxx0'	Application_busy	Unused, is always 0	M-Bus
	1	b'xxxx xx1x'	Any_Application_Error	This bit is set when the internal communication is not working	M-Bus
	2	b'xxxx x0xx'	Power_low	Unused, is always 0	M-Bus
	3	b'xxxx 1xxx'	Permanent_Error	This bit is set when the counter type could not be found in the frame of the initialization	M-Bus
	4	b'xxx1 xxxx'	Temporary_Error	This bit is set during initialization phase and will be reset when all values have been read out once successfully. While this bit is set, the RSP_UD telegram contains no values	M-Bus
	5	b'xx1x xxxx'	Internal data refresh not ready	This bit is set as long as the internal communication is interrupted by other process	Defined by SBC
	6 and 7	b'00xx xxxx'	not defined	Unused, they are always 0	Unused

Initialisation

Query: SND-NKE
Response: 0xE5

Telegram structure (brief)

0x10	0x40	Padr	CSum	0x16

Telegram structure (detailed)

Byte	Value	Description
1	0x10	Start
2	0x40	Send or reply, reset
3		Primary address
4		Checksum
5	0x16	Stop

Reset ACC (application reset)

Query: SND-UD
Response: 0xE5

Telegram structure (brief)

0x68	0x03	0x03	0x68	0x53	Padr
0x50	CSum	0x16			

Telegram structure (detailed)

Byte	Value	Description
1	0x68	Start
2	0x03	Field length
3	0x03	Field length
4	0x68	Start
5	0x53	C
6		Primary address
7	0x50	CI
8		Checksum
9	0x16	Stop

Changing primary address

Query: SND_UD
(Byte 6 = actual M-Bus address;
Byte 10 = new address)
Response: 0xE5

Telegram structure (brief)

0x68	0x06	0x06	0x68	0x53	Padr
0x51	0x01	0x7A	New A	CSum	0x16

Telegram structure (detailed)

Byte	Value	Description
1	0x68	Start
2	0x06	Field length
3	0x06	Field length
4	0x68	Start
5	0x53	C
6		Primary address
7	0x51	CI
8	0x01	DIF
9	0x7A	VIF
10		New address
11		Checksum
12	0x16	Stop

Reset T_{part} (Application reset with subcode)

Query: SND_UD
(Reset Counter: 0x01 = $T1_{Part}$ 0x02 = $T2_{Part}$)
Response: 0xE5

Telegram structure (brief)

0x68	0x04	0x04	0x68	0x53	Padr
0x50	Reset	CSum	0x16		

Telegram structure (detailed)

Byte	Value	Description
1	0x68	Start
2	0x04	Field length
3	0x04	Field length
4	0x68	Start
5	0x53	C
6		Primary address
7	0x50	CI
8	0x01 0x02	Reset Counter $T1_{Part}$ $T2_{Part}$
9		Checksum
10	0x16	Stop

Secondary address

Query: SND_UD
Response: 0xE5

Telegram structure (brief)

68	0B	0B	68	53	FD
52	ID1	ID2	ID3	ID4	MAN1
MAN2	DEV	MED	CSum	16	

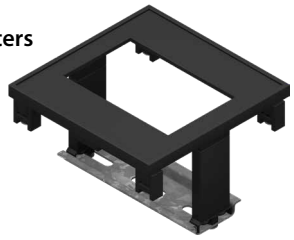
Telegram structure (detailed)

Byte	Value	Description
1	0x68	Start
2	0x0B	Field length
3	0x0B	Field length
4	0x68	Start
5	0x53	C
6	0xFD	Address selection for secondary addressing
7	0x52	CI
8	ID1	ID1
9	ID2	ID2
10	ID3	ID3
11	ID4	ID4
12	MAN1	MAN1
13	MAN2	MAN2
14	DEV	DEV
15	MED	MED
16	Csum	Csum
17	0x16	Stop

Accessories	Order no.
Sealing cover for **– Single-phase Saia PCD® energy meter AAE1** **– 3-phase Saia PCD® energy meter ALE3, and AWD3** 2 units are recommended for contact protection on AAE1. 4 units are recommended for contact protection on ALE3 and AWD3.	4 104 7485 0

ALE3 or AWD3 with sealing cover

Mounting frame for 3-ph energy meters of the families ALE3/AWD3	PMK-EEM400



ALE3 or AWD3 mounted in panel kit

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