

## Electrical Energy Meter with integrated M-Bus interface EEM400C-D-M

Electrical energy meter with integrated M-Bus interface enable the reading of all relevant data such as energy, current, voltage and power (active and reactive).

### Main Features:

- 3-phase energy meter, 3 × 230/400 VAC 50 Hz
- Measurement through a current transformer up to 1500 A
- Display of active power, voltage and current for every phase
- Display of active power for all phases
- M-Bus interface to retrieve the data
- Reactive power per phase or total, available via M-Bus interface
- Up to 250 meters can be addressed through primary addresses
- 7-digit display
- Can be sealed with sealing cap (optional)
- Accuracy class B according to EN50470-3, accuracy class 1 according to IEC62053-21

### Order number:

Standard Version: EEM400C-D-M  
 MID Version: EEM400C-D-M-MID  
 Sealing caps: EEM400-SEALCAP (Bulk with 20 units)

### Technical data

Precision class	B according to EN50470-3, 1 according to IEC62053-21
Operating voltage	3 × 230 / 400 VAC, 50 Hz Tolerance -20% / +15 %
Power consumption	Active 0.4 W per phase
Counting range	000'000.0...999'999.9 1'000'000...9'999'999
Display	LCD backlit, digits 6 mm high
Display without mains power	Capacitor based LCD max. 2 times over 10 days



### Mounting

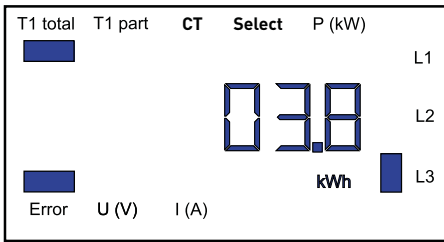
Mounting	On 35 mm rail, according to EN60715TH35
Terminal connections main circuit	Conductor cross-section 1.5–16 mm <sup>2</sup> , screwdriver pozidrive no. 1, slot no.2, torque 1.5–2 Nm
Terminal connections control circuit	Conductor cross-section max. 2.5 mm <sup>2</sup> , screwdriver pozidrive no. 0, slot no.2, torque 0.8 Nm
Insulation characteristics	4 kV / 50 Hz test according to VDE0435 for energy meter part 6 kV 1.2 / 50 μs surge voltage according to IEC255-4 2 kV/50Hz test according to VDE0435 for interface Device protection class II
Ambient temperature	-25°...+55° C
Storage temperature	-30°...+85° C
Relative humidity	95% at 25°...+40 °C, without condensation
EMC/interference immunity	Surge voltage according to IEC61000-4-5: on main circuit, 4 kV on the M-Bus, 1 kV Burst voltage according to IEC61000-4-4: on main circuit 4 kV on the M-Bus 1 kV ESD according to IEC61000-4-2: contact 8 kV, air 15 kV

### CT measurement

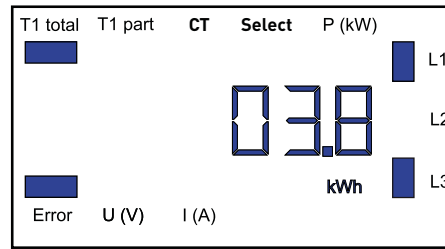
Reference/max. current	5...1500 A $I_{ref} = 5 \text{ A}, I_{max} = 6 \text{ A}$			
Starting/minimum current	$I_{st} = 10 \text{ mA}, I_{min} = 0.05 \text{ A}$			
Converter ratio	5:5	50:5	100:5	150:5
	200:5	250:5	300:5	400:5
	500:5	600:5	750:5	1000:5
	1250:5	1500:5		
Pulses per kWh	LED	10 Imp/kWh		

## Error display

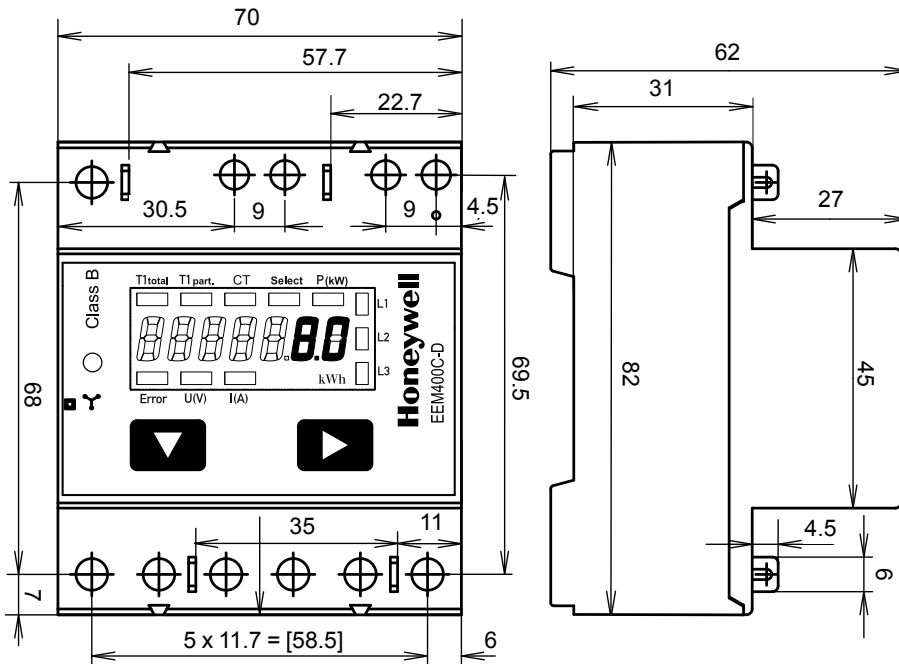
Example: Connection error at L3



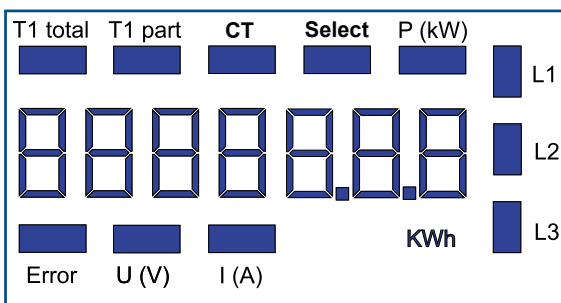
Example: Connection error at L1 and L3



## Dimensioned drawings

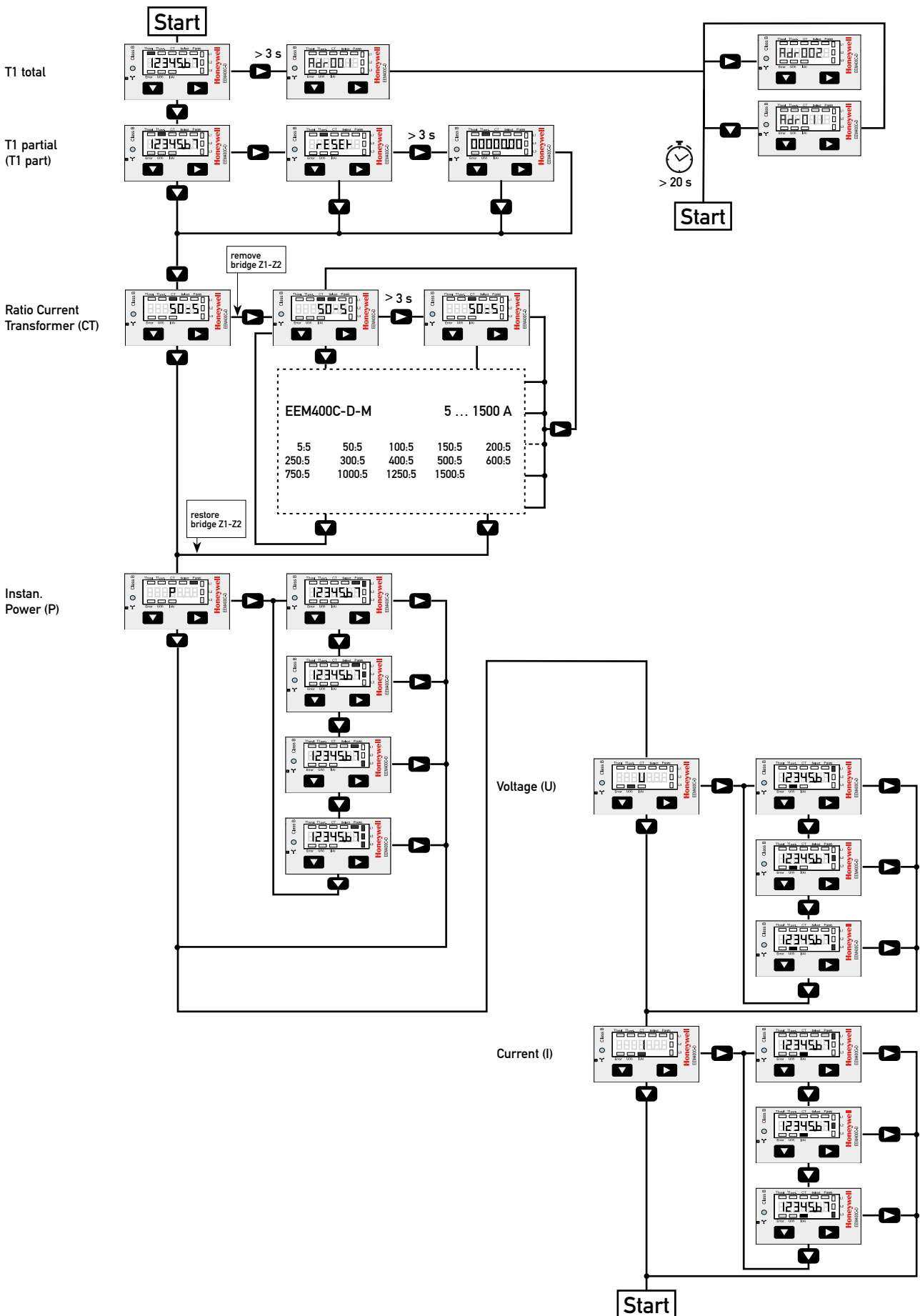


## Display elements

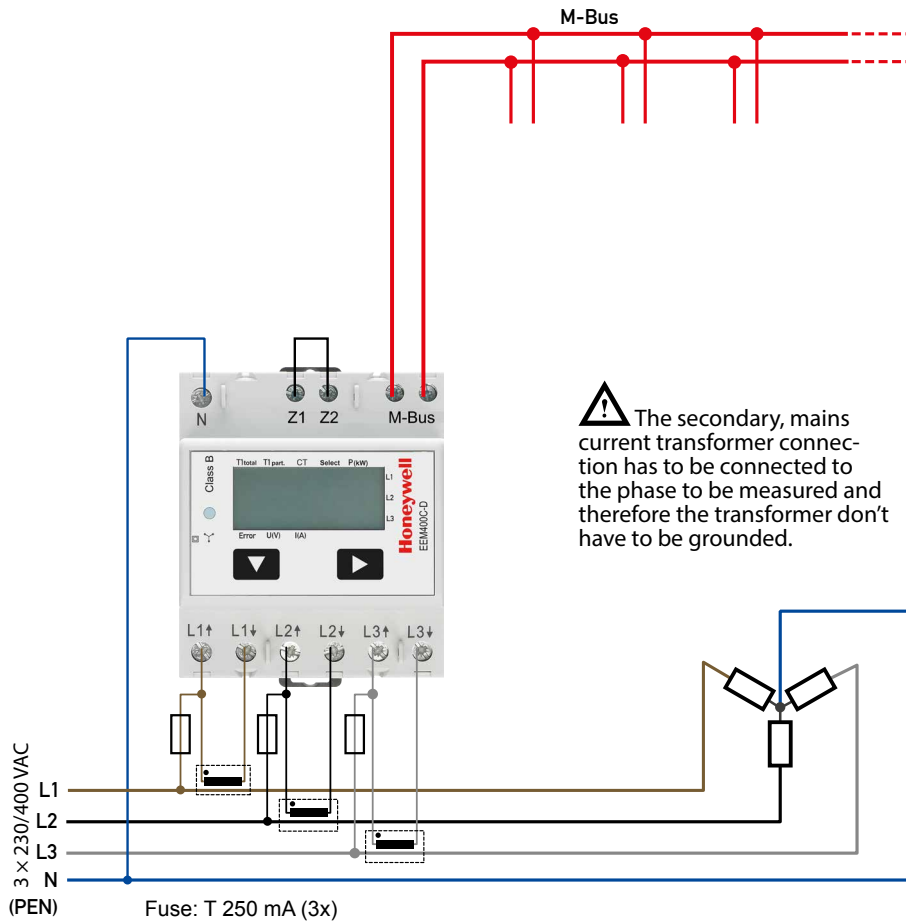


- T1 total Indicates total consumption
- T1 part Indicates partial consumption
- CT This value can be reset
- Select Indicates the setting for the current transformer ratio
- P (kW) When bridge Z1-Z2 is open, the transformer ratio can be adjusted under menu item: Select
- U (V) Indicates the instantaneous output per phase or for all phases
- I (A) Indicates voltage per phase
- kWh Indicates current per phase
- kWh Indicates the unit kWh for display of consumption
- L1 / L2 / L3 Whenever the display shows P, U, I or Error, the corresponding phase will be indicated
- Error When phase is absent or current direction is wrong. The corresponding phase will also be indicated.

## Menu to display the value on LCD



## Wiring diagram



## Technical data M-Bus

Bus System	M-Bus
Bus length	According to M-Bus specification
Transmission rates	300, 2400, 9600 Bd. The transmission rate is automatically detected
Response time: (system response)	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 page 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<sub>part</sub> 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

### 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	0xEE	0x21	DEV
02	ACC	STAT	0	0	0x8c	0x10	VIF	EtoT1	0x8c	0x11
VIF	EpaT1	0x8c	0x20	VIF	EtoT2	0x8c	0x21	VIF	EpaT2	0x02
0xFD	0xC9	0xFF	0x01	Vph1	0x02	0xFD	VIFE	0xFF	0x01	lph1
0x02	VIF	0xFF	0x01	Pph1	0x82	0x40	VIF	0xFF	0x01	Prph1
0x02	0xFD	0xC9	0xFF	0x02	Vph2	0x02	0xFD	VIFE	0xFF	0x02
lph2	0x02	VIF	0xFF	0x02	Pph2	0x82	0x40	VIF	0xFF	0x02
Prph2	0x02	0xFD	0xC9	0xFF	0x03	Vph3	0x02	0xFD	VIFE	0xFF
0x03	lph3	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	0x13	Cur_Tar	Csum
0x16										
Variable at 1, 2 or 4 bytes										

Byte	Content	Type	Description	Manufacturer-specific
23 – 26	EtoT1 = x	4 b. BCD	T1 total	
30 – 33	EpaT1 = x	4 b. BCD	T1 partial	
37 – 40	EtoT2 = x	4 b. BCD	T2 total	
44 – 47	EpaT2 = x	4 b. BCD	T2 partial	
53 – 54	Vph1 = x	2b. Integer	Voltage phase 1	
60 – 61	lph1 = 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	lph2 = 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	lph3 = 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	
138 – 139	Ptot = x	2b. Integer	Power total	
145 – 146	Prtot = x	2b. Integer	Reactive power total	
150	Cur_Tar = 0	1b. Integer	Current tariff	

Unit with multiplier			
I	(Current)	0.1 (5/5) 1 (all other)	[ A ] [ A ]
U	(Voltage)	1	[ V ]
P <sub>active</sub>	(Power)	0.1	[ kW ]
P <sub>reactive</sub>	(Reactive power)	0.1	[ kVAr ]
E	(Consumption)	0.1	[ 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	0xEE	MAN1
13	0x21	MAN2
14	x	DEV (Typ-Version)
15	02	MED (Electric)
16	x	ACC
17	0x01 0x02 0x04 0x08 0x10	STAT Application_busy Any_Application_Error Power_low Permanent_Error Temporary_Error
18	0	SIG1
19	0	SIG2
20	0x8C	DIF
21	0x10	DIFE
22	0x05	VIF 0.1 kWh
23	EtoT1_4	T1 Total
24	EtoT1_3	
25	EtoT1_2	
26	EtoT1_1	
27	0x8C	DIF
28	0x11	DIFE
29	0x05	VIF 0.1 kWh
30	EpaT1_4	T1 Partial
31	EpaT1_3	
32	EpaT1_2	
33	EpaT1_1	
34	0x8C	DIF
35	0x20	DIFE
36	0x05	VIF 0.1 kWh

Byte	Value	Description
37	EtoT2_4	T2 Total = 0
38	EtoT2_3	
39	EtoT2_2	
40	EtoT2_1	
41	0x8C	DIF
42	0x21	DIFE
43	0x05	VIF 0.1 kWh
44	EpaT2_4	T2 Partial = 0
45	EpaT2_3	
46	EpaT2_2	
47	EpaT2_1	
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	0xAD	VIF 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	0xAD	VIF 0.1 kVAr
71	0xFF	VIFE
72	0x01	VIFE
73	Prph1_2	Reactive power phase 1
74	Prph1_1	
75	0x02	DIF

Byte	Value	Description
76	0xFD	VIF
77	0xC9	VIFE = 1 V
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	lph2_2	Current phase 2
88	lph2_1	
89	0x02	DIF
90	0xAD	VIF 0.1 kW
91	0xFF	VIFE
92	0x02	VIFE
93	Pph2_2	Power phase 2
94	Pph2_1	
95	0x82	DIF
96	0x40	DIFE
97	0xAD	VIF 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
104	0xC9	VIFE = 1 V
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

Byte	Value	Description
114	lph3_2	Current phase 3
115	lph3_1	
116	0x02	DIF
117	0xAD	VIF 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	0xAD	VIF 0.1 kVAR
125	0xFF	VIFE
126	0x03	VIFE
127	Prph3_2	Reactive power phase 3
128	Prph3_1	
129	0x02	DIF
130	0xFF	VIF
131	0x68	VIFE
132	RappW_2	Transformer ratio
133	RappW_1	
134	0x02	DIF
135	0xAD	VIF 0.1 kW
136	0xFF	VIFE
137	0x00	VIFE
138	Ptot_2	Power total
139	Ptot_1	
140	0x82	DIF
141	0x40	DIFE
142	0xAD	VIF 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	0x13	VIFE
150	Cur_Tar	Cur_Tar =0
151	x	Checksum
152	0x16	Stop

## Initialisation

Query: SND-NKE  
Response: 0xE5

### Telegram structure (brief)

0x10	0x40	Padr	Csum	0x16
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### Telegram structure (detailed)

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

## Reset T<sub>part</sub> (Application reset with subcode)

Query: SND\_UD  
(Reset Counter: 0x01 = T1)  
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	Reset Counter T <sub>part</sub>
9		Checksum
10	0x16	Stop

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