Honeywell

THE POWER OF CONNECTED

KSMW-PA2502 - Companion Standard

Display Implementation Guide

Revision 1.1

18.09.2018

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1. Introduction

1.1. Scope

This companion standard is a functional description of the 1 and 3-phase meters for the smart metering program of Kooperation Smart Meter West.
The companion standard will define the external interfaces including the communication profiles of the smart meters as well as the used object model and necessary program specific functionalities.
It must be noted, that the companion standard is not a substitution of the metering specification published by Kooperation Smart Meter West. It has to be seen as further definition to ensure interoperability between different metering devices within the here used smart metering infrastructure.

1.2. Normative references

This companion standard is based on the following document:

- EN 62056 – 5 & EN 62056-6 [A]
- DLMS Blue Book version 1000-1 Ed. 12.2 [B]
- DLMS Green Book version 1000-2 Ed. 8.3 [C]
- IDIS Standard Package 2, Edition 2.0, 03-06-2014 [D]
- Published Specification “05_PA2502_Beschreibung_Anforderungen_IMS_V2” from 17.11.2016 [E]

The above mentioned documents are valid unless explicitly mentioned.
Mentioning DLMS/COSEM in this document refers to the above mentioned versions of the Green and Blue Book.

1.3. Document list

This companion standard references to the following documents, which are delivered together with the companion standard:

- KSMW-PA2502 Companion Standard Object Model rev 1.1.xls [1]
- KSMW-PA2502 Companion Standard G3-PLC Implementation Guide rev 1.1.pdf [2]
- KSMW-PA2502 Companion Standard Main Document rev 1.1.pdf [3]
- KSMW-PA2502 Companion Standard M-Bus Implementation Guide rev 1.1.pdf [4]
- KSMW-PA2502 Companion Standard P2P WAN Implementation Guide rev 2.5.pdf [5]

1.4. Abbreviations

Abbreviation	Explanation
AA	Application Association
AARE	Application Association Response

AARQ	Application Association ReQuest
ACSE	Association Control Service Element
APDU	Application Protocol Data Unit
ASE	Application Service Element
A-XDR	Adapted Extended Data Representation
CII	Consumer Information Interface
CIP	Consumer Information Push
class_id	Interface class identification code
COSEM	Companion Specification for Energy Metering
COSEM object	An instance of a COSEM interface class
DC	Data Concentrator used for PLC communication
DLMS	Device Language Message Specification
ERP	Enterprise Resource Planning
FC	Frame Counter
G3	G3 PLC supporting IPv6
GCM	Galois/Counter Mode, an algorithm for authenticated encryption with associated data
UTC	Coordinated Universal Time
CSD	Circuit Switched Data
HDLC	High-level Data Link Control
HES	Head End System similar to MDC
HLS	COSEM High Level Security
IC	COSEM Interface Class
IEC	International Electrotechnical Commission
LLC	Logical Link Control (Sublayer)
LLS	COSEM Low Level Security
LN	COSEM Logical Name
MDC	Meter Data Collect similar to HES
MDM	Meter Data Management
OBIS	Object Identification System
PDU	Protocol Data Unit
PUSH	the data is pushed by the meter to the HES using the Data Notification service

SAP	Service Access Point
SMS	Short Message Service
L_SAP	Link layer Service Access Point

Table 1: List of used abbreviations

1.5. Revisions History

Version	Revisions	Date	Author
0.0	Initial Draft Version	16.11.2017	R. Thor
0.1	1st Draft Release	20.12.2017	R. Thor
0.2	Update according: KSMW PA2502 Companion Standard Review List Rev 0.2.xlsx	29.01.2018	R. Thor
0.3	Update according: KSMW PA2502 Companion Standard Review List Rev 0.3.xlsx	22.02.2018	R. Thor
0.4	Update according: KSMW PA2502 Companion Standard Review List Rev 0.4.xlsx	06.03.2018	R. Thor
0.5	Update according: KSMW PA2502 Companion Standard Review List Rev 0.5.xlsx	19.03.2018	R. Thor
0.6	Update according: KSMW PA2502 Companion Standard Review List Rev 0.6.xlsx	06.04.2018	R. Thor
1.0	Update according: KSMW PA2502 Companion Standard Review List Rev 1.0.xlsx	03.07.2018	R. Thor
1.1	Update according: KSMW PA2502 Companion Standard Review List Rev 1.1.xlsx	18.09.2018	R. Thor

Table 2: Revisions History

2. Display functionality

2.1. Display and Button Handling

The meters support a display and 1 or 2 push buttons for the local user interface

[A]–Button (mandatory): stepping through the menu structure and display items
[R]–Button (**optional**): triggering a manual billing profile capture (Demand Reset)

The following display modes are available using the push buttons:

- ⇨ Default mode
  - Scroll Data mode
  - Breaker mode
- ⇨ Display test mode
- ⇨ Menu mode
  - Standard Data mode
  - Load Profile mode

The push button provides the following functionality:
[A]–Button: for stepping through the menu structure and display items

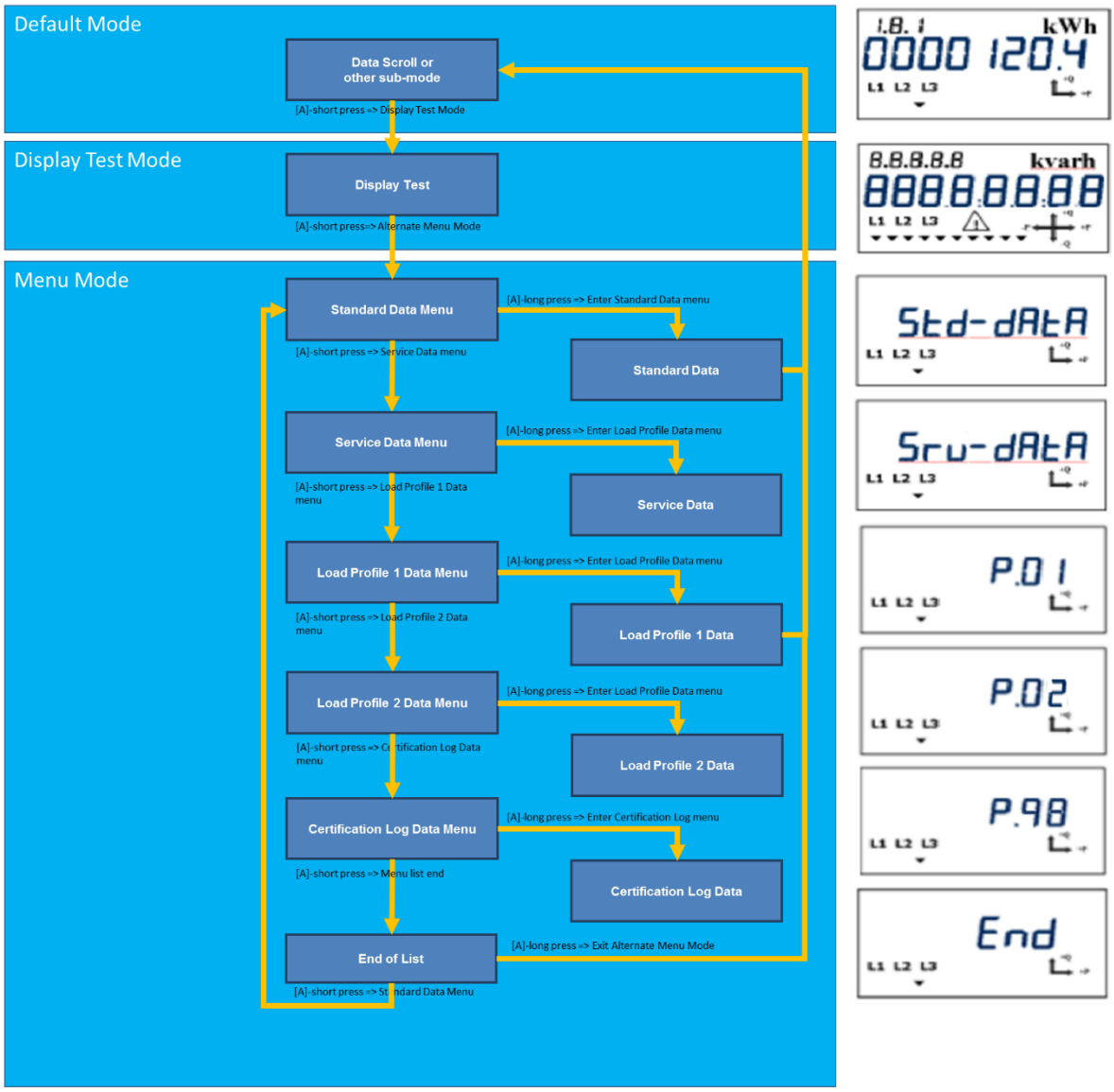
[A] Button behavior:

- ⇨ **short press** (t < 2s)
  Switch to the next menu or display list item
- ⇨ **long press** (2s < t < 5s)
  Activation of menu item or skipping of the previous month value
- ⇨ **very long press** (t >= 5s)
  Return to normal scroll mode from any status

Independent of the currently active display mode, 20min after the last button press the display returns to the Default mode.

2.2. Display modes and menu behavior

Please find here a flow chart of the menu structure with some examples of how the data could look on a display:



2.2.1. Default mode

The starting position for the display handling is always the default mode.

The default mode supports further sub-modes, depending on the current status of the meter.

- ⇨ Data Scroll mode:
  Active, in case the breaker status is NOT ‘ready for manual reconnection’.
- ⇨ Breaker Reconnect mode:
  Active, in case the breaker status is ‘ready for manual reconnection’.
- ⇨ Consumer Information mode:
  Active, in case the meter received a consumer message to be shown.
- ⇨ Fatal Error Mode:
  Active, in case the Fatal Error Register (Identifier F.F) contains a fatal error condition to be shown.

In case meter status demands activating several sub-modes, the following priority list should be applied:

1. Consumer Information mode
2. Breaker Reconnect mode
3. Fatal Error Mode
4. Data Scroll mode

Independent of which sub-mode is currently active, a short press on [A]–Button activates the Display Test mode.

2.2.1.1. Data Scroll mode

This mode scrolls through all defined display items automatically in a given interval.
If only one single item is defined for the data scroll sequence, it will be shown constantly on the display.

The data elements shown in the Data Scroll mode and the scroll interval are configurable using the object

- ⇨ 0-0:21.0.1.255 - General display readout (data scroll mode)

Please find here an example of how the Data Scroll mode could be configured:

Default mode - Data Srcoll mode			
OBIS Code (Display)	*Description of the value displayed*	*Value (Display)*	*Unit (Display)*
0.9.1	Local Time	12:53	
0.9.2	Local Date	15.02.2017	
1.8.0	Active energy import (+A)	123456,78	kWh

2.2.1.2. Breaker reconnect mode

This mode allows the manual reconnection for the Breaker and shows the message PRESS.ON in the value field.

Default mode - Breaker reconnect mode			
OBIS Code (Display)	*Description of the value displayed*	*Value (Display)*	*Unit (Display)*
	ready for reconnection	PRESS.ON	

A long press on [A]–Button trigger the actual reconnection of the breaker.
After the successful reconnection, the Data Scroll mode is active again.

2.2.1.3. Consumer Information mode

This mode allows showing additional information on the meter display.

Default mode - Consumer Information mode			
OBIS Code (Display)	*Description of the value displayed*	*Value (Display)*	*Unit (Display)*
	consumer information message	XXXXXXXX	

Depending on the capabilities of the meter displays, the message must be sent in a format that is supported by the individual meter.

Follow the definition of 'long display data' in chapter 2.3 in case the sent message is longer than the visible number of characters on the display.

Any update of the consumer message by remote configuration will restart the sequence

A long press on [A]–Button acknowledges the reception of the consumer message and removes it from the display.

2.2.1.4. Fatal Error Mode

This mode shows the Fatal Error Register (Identifier F.F) in case a fatal error occurred.

Fatal Error Register (Identifier F.F):
The Fatal Error Register is serving the legal certification requirements of MID and BEV. This item represents the Fatal Error Register object (0-0:97.97.128.255 => F.F) on the display.

Default mode - Fatal Error mode			
OBIS Code (Display)	*Description of the value displayed*	*Value (Display)*	*Unit (Display)*
F.F	Fatal Error Register	A1B2C3D4	

The Fatal Error Code will be constantly shown without moving to the Data Scroll mode again.

2.2.2. Display Test mode

This mode activates all individual segments on the LCD.

Display Test mode - Display Test			
OBIS Code (Display)	*Description of the value displayed*	*Value (Display)*	*Unit (Display)*
88:88:88:88:88	Display test - ALL LCD segments on	8888888888	kWh

A short press on [A]–Button activates the Menu mode.

2.2.3. Menu mode

This mode allows stepping through the menu items for the Standard Data mode, the Service Data mode, the Load Profile Data mode and Certification Protected Log Data mode.
When entering the Menu mode, the menu item for the Standard Data mode is shown first.

Using short [A]-Button presses allows stepping through the menu items.
Using long [A]-Button presses allows entering the selected menu.

Menu mode			
OBIS Code (Display)	*Description of the value displayed*	*Value (Display)*	*Unit (Display)*
	Standard Data menu	STD-DATA	
	Service Data menu	SRV-DATA	
	Load Profile 1 Data menu	P.01	
	Load Profile 2 Data menu	P.02	
	Certification Protected Log Data menu	P.98	
	List End identifier	End	

The menu items ‘Load Profile 1 data menu’ (P.01) and ‘Load Profile 2 data menu’ (P.02) are only available in case the option of displaying these load profiles on the LCD is enabled. Otherwise, this menu items are skipped completely and not available for selection.

The menu item ‘Certification Protected Log data menu’ (P.98) is always available.

The end of the menu item list is marked with the list-end identifier as text "End" in the value range of the display. The sequence will then start at the beginning again.

2.2.3.1. Menu item – Standard Data

This menu allows displaying of additional registers and data items.

Using short [A]-Button presses allows stepping through the additional information items. For the purpose of a faster data retrieval, long [A]-Button presses allow skipping the display of existing historical values.

The last value in the display list is the list-end identifier, which is marked as text "End" in the value range of the display.

The data elements shown in the Standard Data mode are configurable using the object

- ⇨ 0-0:21.0.2.255 - Alternate display readout (Standard Data mode)

Here an example of what the Standard Data list could look like:

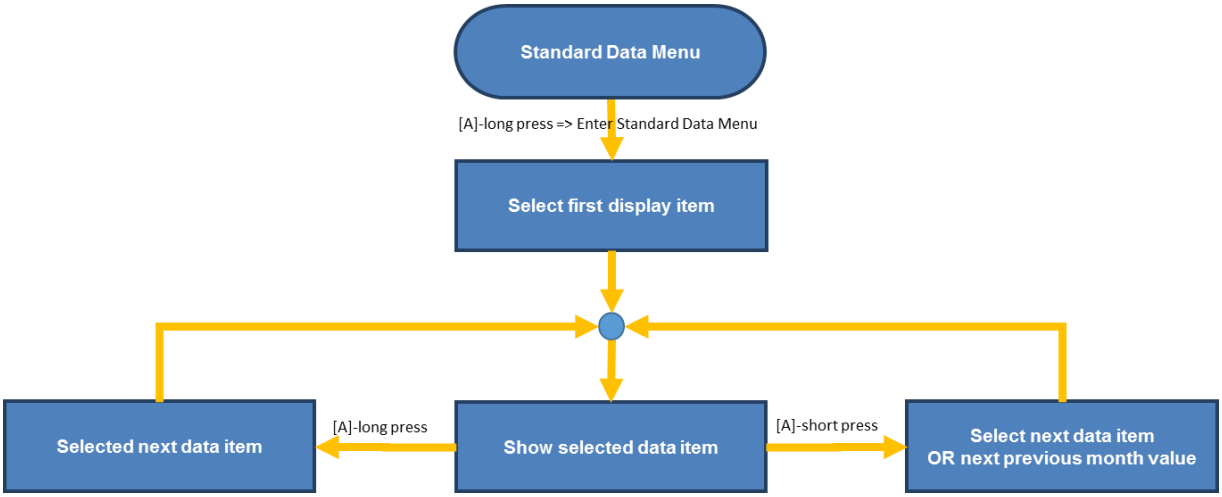
Menu mode - Standard data menu			
OBIS Code (Display)	*Description of the value displayed*	*Value (Display)*	*Unit (Display)*
0.9.1	Local Time	12:53	
0.9.2	Local Date	15.02.2017	
F.F	Fatal Error Register	A1B2C3D4	
97.97.0	Error Register	A1B2C3D4	
96.1.0	Device ID 1, manufacturing number	A1B2C3D4	
0.2.1	Parameter Record Number	A1B2C3D4	
0.1.0	Billing Period Counter	12	
0.1.2.05	Billing Timestamp - last billing timestamp	12:34 01.02.17	
0.1.2.04	Billing Timestamp - 2nd to last billing timestamp	12:34 01.01.17	
1.8.0	Active energy import (+A) - current value	123456,78	kWh
1.8.0.05	Active energy import (+A) - last billing value	123456,78	kWh
1.8.0.04	Active energy import (+A) - 2nd to last billing value	123456,78	kWh
1.8.1	Active energy import (+A) rate 1 - current value	123456,78	kWh
1.8.1.05	Active energy import (+A) rate 1 - last billing value	123456,78	kWh
1.8.1.04	Active energy import (+A) rate 1 - 2nd to last billing value	123456,78	kWh
1.4.0	Demand Active energy import (+A) - current value	xxx 12,34	kW
1.6.0	Max Demand Active energy import (+A) - current value	12,34	kW
1.6.0	Max Demand Active energy import (+A) - current timestamp	12:34 01.02.17	
1.6.0.05	Max Demand Active energy import (+A) - last billing value	12,34	kW
1.6.0.05	Max Demand Active energy import (+A) - last billing timestamp	12:34 01.01.17	
1.6.0.04	Max Demand Active energy import (+A) - 2nd to last billing value	12,34	kW
1.6.0.04	Max Demand Active energy import (+A) - 2nd to last billing timestamp	12:34 14.02.17	
1.2.0	Cumulative Max Demand Active energy import (+A) - current value	1234,56	kW
0.2.0	Active firmware version (LR)	V0123	
0.2.8	Active firmware signature (LR)	A1B2C3D4	
	List-End identifier	End	

Historical billing data:

The sequence of the historical data is always from the youngest to the oldest value.
The identification of the historical billing information is using the F field of the OBIS code.
The numbering starts with 00 and increments with every historical reset. (First historical value identified with 01). Eg, in the table above the most recent set of historic billing data is 05, the previous set is 04. After the next historical data reset, the most recent will be 06 and the previous will be 05.
The valid range is from 00 to 99, rolling over when the maximum is reached.

In case no historical billing values are available, the display sequence shall skip all further related display items and move to the next valid register.

REMARK: Deactivation of the monthly billing registration does not automatically skip the requirement of displaying the historical billing information. Triggering of historical data is still possible by ad-hoc request or manual reset via the [R]-Button.



Example for skipping next previous month value:
Current display item **1.8.0**

- ⇨ short [A]-Button press shows **1.8.0.05** next
- ⇨ long [A]-Button press shows **1.8.1** next

2.2.3.2. Menu item – Service Data

This menu allows displaying of additional registers and data items.

Using short [A]-Button presses allows stepping through the additional information items. For the purpose of a faster data retrieval, long [A]-Button presses allow skipping the display of existing historical values.

The last value in the display list is the list-end identifier, which is marked as text "End" in the value range of the display.

The data elements shown in the Service Data mode are configurable using the object

- ⇨ 0-0:21.0.3.255 - Alternate display readout (Service Data mode)

Here an example of what the Service Data list could look like:

Menu mode - Service data menu			
OBIS Code (Display)	*Description of the value displayed*	*Value (Display)*	*Unit (Display)*
31.7.0	Instantaneous current L1	123,4	A
32.7.0	Instantaneous voltage L1	123	V
51.7.0	Instantaneous current L2	123,4	A
52.7.0	Instantaneous voltage L2	123	V
71.7.0	Instantaneous current L3	123,4	A
72.7.0	Instantaneous voltage L3	123	V
14.7.0	Instantaneous net frequency; any phase	12,34	Hz
1.7.0	Instantaneous active import power (+P)	12,34	kW
2.7.0	Instantaneous active export power (-P)	12,34	kW
3.7.0	Instantaneous reactive import power (+Q)	12,34	kvar
4.7.0	Instantaneous reactive export power (-Q)	12,34	kvar
9.7.0	Instantaneous apparent import power (+S)	12,34	kVA
10.7.0	Instantaneous apparent export power (-S)	12,34	kVA
13.7.0	Instantaneous Power factor import (|+P/+S|)	1,234	
84.7.0	Instantaneous Power factor export (|-P/-S|)	1,234	

2.2.3.3. Menu item – Load Profile 1 Data (15min)

This menu allows displaying of the 15min Load Profile data items.

Load Profile date selection display

The first displayed value is the date of the latest available day block in the load profile. Each additional short [A]-Button press will display the chronologically preceding day available in the load profile.
In case of deactivation or power fail over several days, the missing days will not be shown as they are not actually recorded in the load profile.
The last value in the list is the list-end identifier, which is marked as text "End" in the value range of the display. It appears after the oldest available Load Profile date.

A long [A]-Button press enters the detailed Load Profile interval data display.

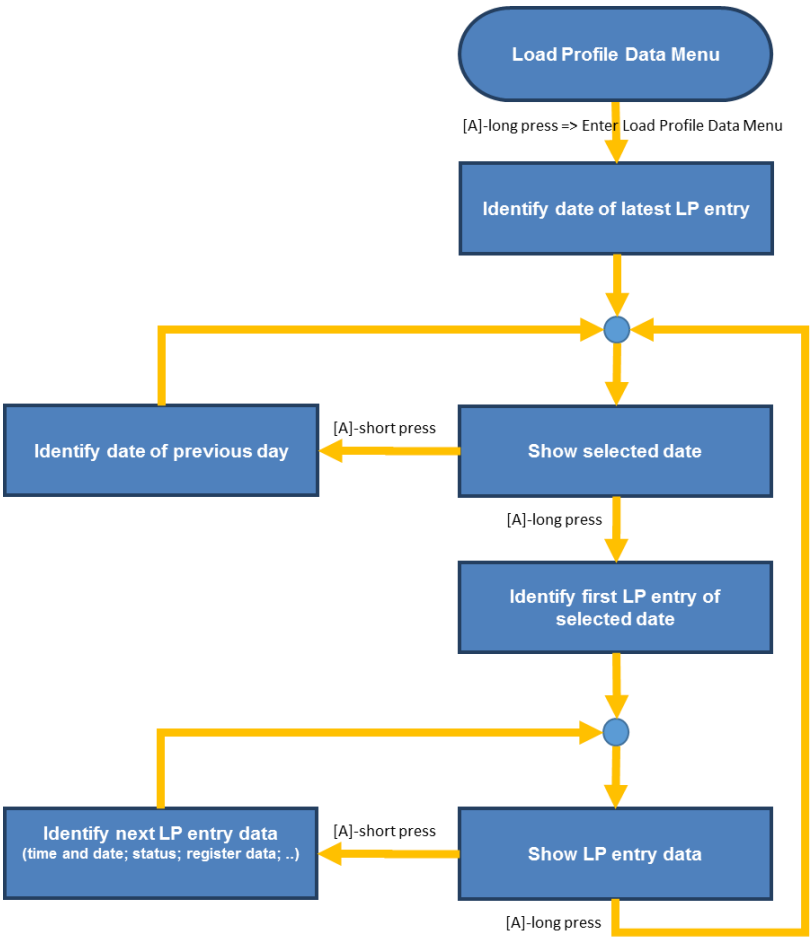
Menue mode - Load Profile 1 data menue - LP date selection display			
OBIS Code (Display)	*Description of the value displayed*	*Value (Display)*	*Unit (Display)*
P.01	Date - latest available day block	06.05.2016	
P.01	Date - 2nd to latest available day block	05.05.2016	
P.01	Date - 3rd to latest available day block	04.05.2016	
.....	.....	.....	
P.01	List End identifier	End	

Load Profile interval data display of the selected day

The display of the selected day block begins with the presentation of this days first stored load profile values (the value stored at 00:00).
Any further short [A]-Button press brings the next available measured value of the same registration period in the display. The data to display contains the timestamp, status and register values.
After displaying all available measurements of the period, the data of the next available registration period will follow.
In case of deactivation or power fail over several periods, the missing period data will not be shown as they are not actually recorded in the load profile.
The last value in the list is the list-end identifier, which is marked as text "End" in the value range of the display. It appears after the last load profile value for the selected day.

A long [A]-Button press returns to the currently selected date in the Load Profile date selection display.

Menue mode - Load Profile 1 data menue - LP entry selection display			
OBIS Code (Display)	*Description of the value displayed*	*Value (Display)*	*Unit (Display)*
P.01	Timestamp - first LP record	00:00	
P.01	Status - first LP record	00	
1.8.0	Active energy import (+A) - first LP record	123456,78	kWh
2.8.0	Active energy import (-A) - first LP record	123456,78	kWh
P.01	Timestamp - next LP record	00:15	
P.01	Status - next LP record	00	
1.8.0	Active energy import (+A) - next LP record	123456,78	kWh
2.8.0	Active energy import (-A) - next LP record	123456,78	kWh
.....	.....	.....	.....
.....	.....	.....	.....
.....	.....	.....	.....
P.01	Timestamp - last LP record	23:45	
P.01	Status - last LP record	00	
1.8.0	Active energy import (+A) - last LP record	123456,78	kWh
2.8.0	Active energy import (-A) - last LP record	123456,78	kWh
P.01	List End identifier	End	



2.2.3.1. **Menu item – Load Profile 2 Data (24h)**

This menu allows displaying of the 24h Load Profile data items.

Load Profile date selection display

The first displayed value is the date of the latest available day block in the load profile. Each additional short [A]-Button press will display the chronologically preceding day available in the load profile.
In case of deactivation or power fail over several days, the missing days will not be shown as they are not actually recorded in the load profile.
The last value in the list is the list-end identifier, which is marked as text "End" in the value range of the display. It appears after the oldest available Load Profile date.

A long [A]-Button press enters the detailed Load Profile interval data display.

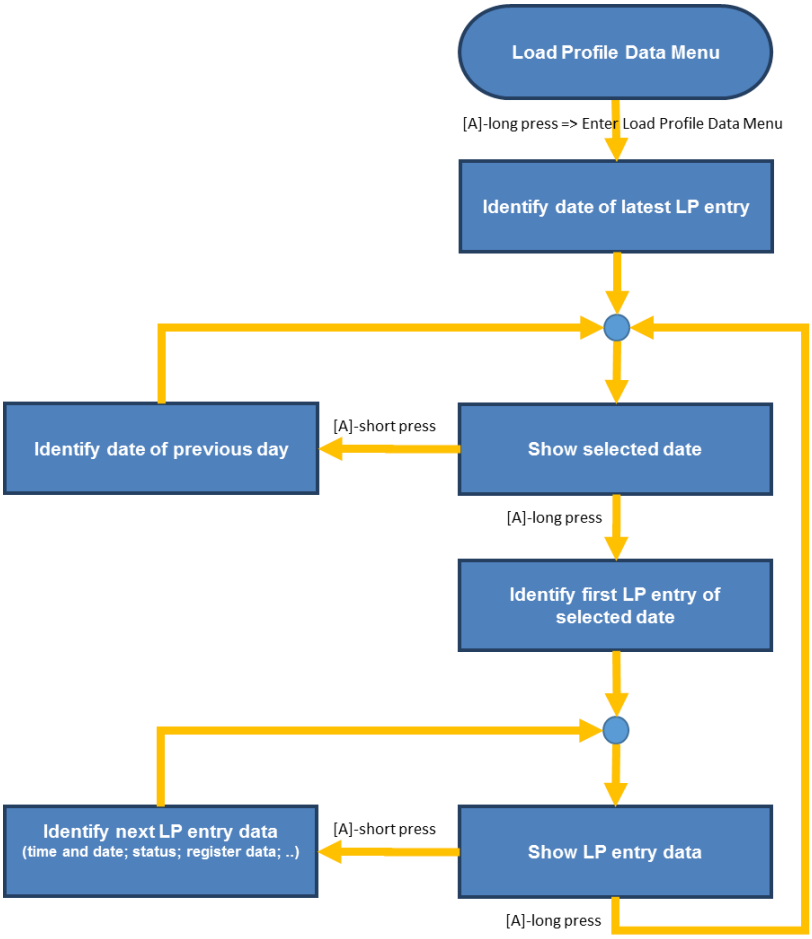
Menue mode - Load Profile 2 data menue - LP date selection display			
OBIS Code (Display)	*Description of the value displayed*	*Value (Display)*	*Unit (Display)*
P.02	Date - latest available day block	06.05.2016	
P.02	Date - 2nd to latest available day block	05.05.2016	
P.02	Date - 3rd to latest available day block	04.05.2016	
.....	.....	.....	
P.02	List End identifier	End	

Load Profile interval data display of the selected day

The display of the selected day block begins with the presentation of this days first stored load profile values (the value stored at 00:00).
Any further short [A]-Button press brings the next available measured value of the same registration period in the display. The data to display contains the timestamp, status and register values.
After displaying all available measurements of the period, the data of the next available registration period will follow.
In case of deactivation or power fail over several periods, the missing period data will not be shown as they are not actually recorded in the load profile.
The last value in the list is the list-end identifier, which is marked as text "End" in the value range of the display. It appears after the last load profile value for the selected day.

A long [A]-Button press returns to the currently selected date in the Load Profile date selection display.

Menue mode - Load Profile 2 data menue - LP entry selection display			
OBIS Code (Display)	*Description of the value displayed*	*Value (Display)*	*Unit (Display)*
P.02	Timestamp - first LP record	00:00	
P.02	Status - first LP record	00	
1.8.0	Active energy import (+A) - first LP record	123456,78	kWh
2.8.0	Active energy import (-A) - first LP record	123456,78	kWh
P.02	List End identifier	End	



2.2.3.2. Menu item – Certification Protected Log Data

This menu allows displaying of the Certification Protected Log data items.

Certification Protected Log date selection display

The first displayed value is the date of the latest available day block in the certification protected log. Each additional short [A]-Button press will display the next chronologically preceding date available in the Certification Protected Log.
The last value in the list is the list-end identifier, which is marked as text "End" in the value range of the display. It appears after the oldest available Certification Protected Log date.

A long [A]-Button press enters the detailed Certification Protected Log data display.

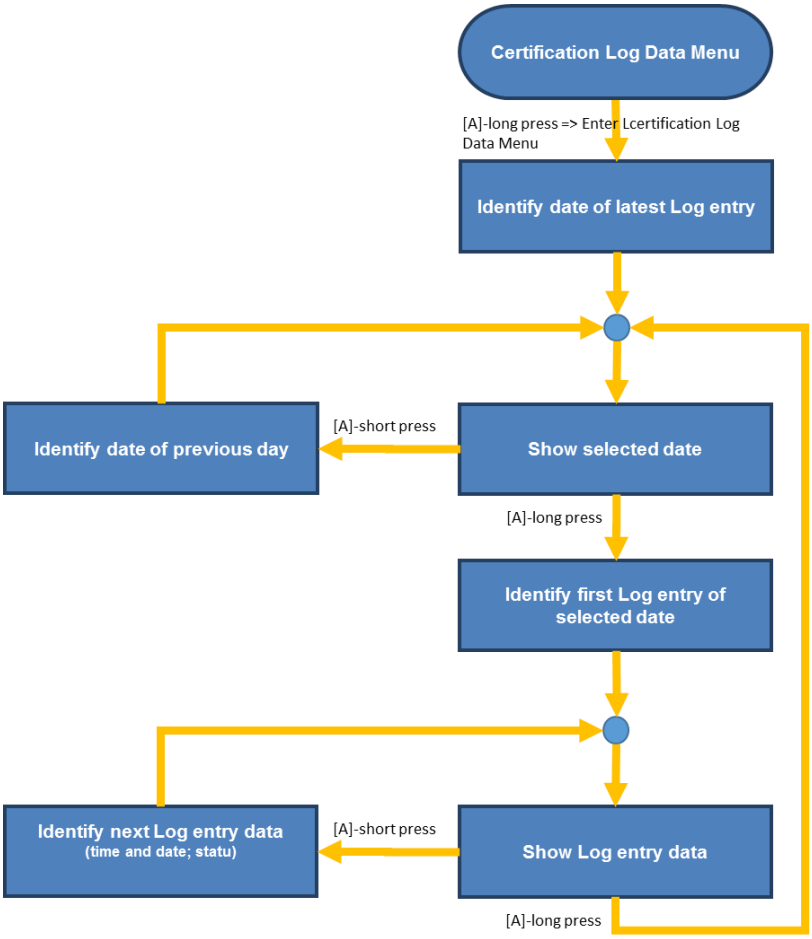
Menue mode - Certification Protected Log data menue - date selection display			
OBIS Code (Display)	*Description of the value displayed*	*Value (Display)*	*Unit (Display)*
P.98	Date - latest available day block	06.05.2016	
P.98	Date - 2nd to latest available day block	05.05.2016	
P.98	Date - 3rd to latest available day block	04.05.2016	
.....	.....	.....	
P.98	List End identifier	End	

Certification Protected Log event data display of the selected day

The display of the selected day block begins with the presentation of this day's first stored event entry.
Any further short [A]-Button press brings the next available event detail in the display. The data to display contains the timestamp and status.
After displaying all available details of the event, the data of the next available event will follow.
The last value in the list is the list-end identifier, which is marked as text "End" in the value range of the display. It appears after the last event detail for the selected day.

A long [A]-Button press returns to the currently selected date in the Certification Protected log date selection display.

Menue mode - Certification Protected Log data menue - entry selection display			
OBIS Code (Display)	*Description of the value displayed*	*Value (Display)*	*Unit (Display)*
P.98	Timestamp - first log entry	12:42	
P.98	Status - first log entry	05	
43.0.0	client system title	A1B2C3D4	
0.2.0	Active firmware version (LR)	V0123	
P.98	Timestamp - next log entry	12:43	
P.98	Status - next log entry	00	
43.0.0	client system title	A1B2C3D4	
0.2.0	Active firmware version (LR)	V0123	
.....	.....	.....	.....
.....	.....	.....	.....
.....	.....	.....	.....
P.98	Timestamp - last log entry	13:24	
P.98	Status - last log entry	00	
43.0.0	client system title	A1B2C3D4	
0.2.0	Active firmware version (LR)	V0123	
P.98	List End identifier	End	



2.3. Display presentation, resolution and units

The certification mode allows increasing of the energy and demand register resolution on the display.

The following resolution is applicable for direct connected meters:

Register resolution DC meters		Normal Mode		Certification Mode	
OBIS Code (Display)	*Description of the value displayed*	*Value (Display)*	*Unit (Display)*	*Value (Display)*	*Unit (Display)*
x.8.x.xx	Energy registers (kWh/kvarh)	123456.78	kWh kvarh	23456.789	kWh kvarh
x.4.0	Expired part of the measurement period (min) Demand registers (kW/kvar)	xxx 12.34	kW kvar	xxx 12.34	kW kvar
x.6.x.xx	Max Demand registers (kW/kvar)	12.34	kW kvar	12.34	kW kvar
x.2.x	Cumulative Demand Registers (kW/kvar)	1234.56	kW kvar	1234.56	kW kvar
x.8.0	Load Profile - Energy registers (kWh/kvarh)	123456.78	kWh kvarh	123456.78	kWh kvarh
x.7.0	Instantanious Power (kWh/kvarh/kVA)	12.34	kW kvar kVA	12.34	kW kvar kVA
x.7.0	Instantanious Current (A)	123,4	A	123,4	A
x.7.0	Instantanious Voltage (V)	123,4	V	123,4	V
x.7.0	Instantanious Net Frequency (Hz)	12,34	Hz	12,34	Hz
x.7.0	Instantanious Power Factor ()	1,234		1,234	
x.7.0	Instantanious Phase Angle(°)	123	°	123	°

The following resolution is applicable for CT connected meters:

Register resolution CT meters		Normal Mode		Certification Mode	
OBIS Code (Display)	*Description of the value displayed*	*Value (Display)*	*Unit (Display)*	*Value (Display)*	*Unit (Display)*
x.8.x.xx	Energy registers (kWh/kvarh)	12345.678	kWh kvarh	2345.6789	kWh kvarh
x.4.0	Expired part of the measurement period (min) Demand registers (kW/kvar)	xxx 1.234	kW kvar	xxx 1.234	kW kvar
x.6.x.xx	Max Demand registers (kW/kvar)	1.234	kW kvar	1.234	kW kvar
x.2.x	Cumulative Demand Registers (kW/kvar)	123.456	kW kvar	123.456	kW kvar
x.8.0	Load Profile - Energy registers (kWh/kvarh)	12345.678	kWh kvarh	12345.678	kWh kvarh
x.7.0	Instantanious Power (kWh/kvarh/kVA)	1.234	kW kvar kVA	1.234	kW kvar kVA
x.7.0	Instantanious Current (A)	12,34	A	12,34	A
x.7.0	Instantanious Voltage (V)	123,4	V	123,4	V
x.7.0	Instantanious Net Frequency (Hz)	12,34	Hz	12,34	Hz
x.7.0	Instantanious Power Factor ()	1,234		1,234	
x.7.0	Instantanious Phase Angle(°)	123	°	123	°

Demand Measurement:
x.4.0 Registers show the expired part of the measurement period in minutes before the actual demand value of the demand register.

Leading zeros:
All energy and demand register values show the leading zeros on the display.
For example, a register value of 23,56kWh shows 000023.56 kWh on the display.

Long display data:
If the data to show is longer than the visible number of characters on the display, the following handling shall be applied:

1. Display the first maximum characters from the text statically for 1 second (starting its left side, trimming the remaining X characters from the message
2. Start scrolling automatically to the left using an update interval of 500ms until the entire X characters are displayed (shift the text from right to left, adding another character at the end, from those X hidden at previous step)
3. Display the last maximum characters from the text statically for 1 second (finishing its right side)
4. Restart the sequence

3. Display indicators

3.1. Manipulation Indicator

The manipulation indicator is the visual representation of the 'Fraud attempt' flag (bit 13) in the error register (0-0:97.97.0.255)

- Indicator ON, if the Fraud attempt flag = 1
- Indicator OFF, if the Fraud attempt flag = 0

3.2. Energy Tariff Rate Indicator

The displaying of the Energy Tariff Rate Indicator is depending on the current tariffication scheme and the currently active energy tariff rate:

- NO rate is shown when ‘central’ tariffication scheme is active
- ‘T1’ rate is shown when ‘local’ tariffication scheme and tariff rate ‘T1’ is active
- ‘T2’ rate is shown when ‘local’ tariffication scheme and tariff rate ‘T2’ is active

The tariffication scheme is configurable using the object

⇨ 0-0:94.43.130.255 - Tariffication Scheme

4. Display backlight

The display backlight is turned ON when a key press event is detected.
It stays ON for the duration of 20 seconds (backlight timeout).
The timer is retriggered on each key press.
The display backlight is turned OFF when no key press is detected within 20 seconds.