HAN Interface

Interface Description

Public

Version 1.1 A

Contents

1 Preface

1.1 About this document

This document describes the HAN-NVE interface on Aidon Energy Service Devices (ESD). The document is intended for HAN developers.

The HAN interface in the devices is activated from the Aidon head-end system.

1.2 References

Reference	Description
IEC 62056-7-5	IEC 62056-7-5:2016: Electricity metering data exchange - The DLMS/COSEM suite - Part 7-5: Local data transmission profiles for Local Networks (LN)
IEC 61334-6	IEC 61334-6:2000: Distribution automation using distribution line carrier systems - Part 6: A-XDR encoding rule
IEC 62056-46	IEC 62056-46:2002+AMD1:2006 CSV Consolidated version: Electricity metering - Data exchange for meter reading, tariff and load control - Part 46: Data link layer using HDLC protocol
IEC 62056-5-3	IEC 62056-5-3: Electricity metering data exchange – The DLMS/COSEM suite – Part 5-3: DLMS/COSEM application layer
	EXCERPT DLMS UA Blue Book: COSEM interface classes and OBIS identification system http://dlms.com/documents/Excerpt_BB12.pdf

2 HAN interface

2.1 Role of HAN interface in the AMI system

The role of the HAN interface in the AMI system is to provide near real time information for the customer of their energy usage.

2.2 HAN interface HW structure

The Aidon RF2 System Modules have a physical HAN interface that can be taken into use by external devices according to the M-Bus standard (EN 13757-2). The RJ45 connector on the System Modules is either integrated or can be wired outside the Aidon ESD with an HAN adapter.

On the RJ45 connector, 2 pins are used for HAN:

- RJ45 PIN1: +24V M-bus TX
- RJ45 PIN2: GND

The interface supplies power to a connected HAN device up to 700 mW. The interface is protected against short circuits. The Aidon System Module software can turn the power off from the interface in case of fault current.

The interface of the HAN device that is connected to the Aidon ESD must be double isolated from the mains.

The picture below shows the installation of the HAN solution using the System Module type where the HAN adapter cable is used.

Figure 1: Example installation of the HAN adapter solution.

The picture below shows Energy service device where HAN is available on the front of cover.

Figure 2: HAN interface integrated to ESD.

2.2.1 Recommended current limiter circuit for HAN device

The HAN interface is protected against a fault current. The protection is implemented using an over-current detector circuit, which triggers at just above 30 mA. If the current is above the 30-mA limit for ~50 µs, the HAN interface is shut down. After a 1-minute delay, the interface is re-enabled. This protection scheme limits the peak power that can be taken from the interface to 700 mW and minimizes the wasted power during a fault condition.

To prevent the HAN device from taking excessive peak currents from the interface, it is required to store the peak energy needed for the application at the device side. For this purpose, Aidon recommends the following **Constant current charge circuit** before the HAN device's energy storage capacitor (C1).

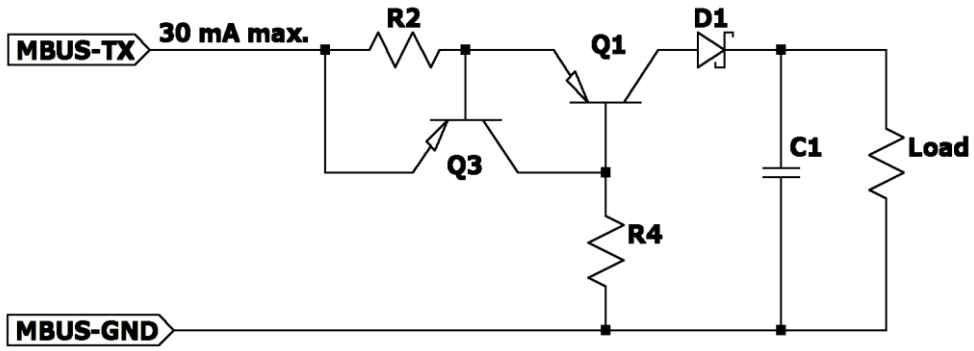

Figure 3: Recommended Constant current charge circuit for a HAN device.

2.3 HAN Protocol interface according to NVE

Norwegian HAN spesification - OBIS List Information			
Item	**Description**	**Value**	**Remarks**
A	File name	Aidon_V0001.xlsx	Filename : OBIS List identifier.xlsx . Format for publication is pdf.
B	List version - date	10.05.2016	DD.MM.YYYY
C	OBIS List version identifier	AIDON_V0001	Shall be identical to corresponding OBIS code value in the meter
D	Meter type	Aidon 65XX	1P 6515, 3P3W 6525, 3P4W 6534, 3P3W CT 6540, 3P4W CT 6550
E	Number of metering systems	1,2,3	(1,2,3)
F	Direct connected meter	Yes, No	
G	Current Transformer connected meter(	Yes, No	
H	Voltage (V)	1x230, 3x230, 3x230/400	(1x 230, 3x230, 3x230/400)
I	Current Imax (A)	6, 100	(6, 80, 100 A) Imax on the meters nameplate
J	Baudrate M-BUS (HAN)	2400	
K	List 1 Stream out every	2.5 seconds	The value is measured between the messages
L	List 2 Stream out every	10 seconds	The values are measured between the messages
M	List 3 Stream out every	1 hour	The values are generated at XX:00:00 and streamed out from the HAN interface 10 second later (XX:00:10)
N	HAN maximum power to HEMS (mW)	700 mW	The largest power that the customer equipment (HEMS or display) can consume from the meter HAN interface
O	HAN maximum current to HEMS (mA)	30 mA	

Norwegian HAN spesification - OBIS Codes												
OBIS List version identifier:			AIDON_V0001									
List number			OBIS Code - Group Value						Object name	Attributes		Item
1	2	3	A	B	C	D	E	F		Unit	Data type	Numb.
1			1	0	1	7	0	255	Active power+ (Q1+Q4)	kW	double-long-unsigned	1
	1	1	1	1	0	2	129	255	OBIS List version identifier		visible-string	2
	2	2	0	0	96	1	0	255	Meter -ID (GIAI GS1 -16 digit)		visible-string	3
	3	3	0	0	96	1	7	255	Meter type		visible-string	4
	4	4	1	0	1	7	0	255	Active power+ (Q1+Q4)	kW	double-long-unsigned	5
	5	5	1	0	2	7	0	255	Active power - (Q2+Q3)	kW	double-long-unsigned	6
	6	6	1	0	3	7	0	255	Reactive power + (Q1+Q2)	kVAr	double-long-unsigned	7
	7	7	1	0	4	7	0	255	Reactive power - (Q3+Q4)	kVAr	double-long-unsigned	8
	8	8	1	0	31	7	0	255	IL1 Current phase L1	A	long-signed	9
	9	9	1	0	51	7	0	255	IL2 Current phase L2	A	long-signed	10
	10	10	1	0	71	7	0	255	IL3 Current phase L3	A	long-signed	11
	11	11	1	0	32	7	0	255	UL1 Phase voltage 4W meter , Line voltage 3W meter	V	long-unsigned	12
	12	12	1	0	52	7	0	255	UL2 Phase voltage 4W meter , Line voltage 3W meter	V	long-unsigned	13
	13	13	1	0	72	7	0	255	UL3 Phase voltage 4W meter , Line voltage 3W meter	V	long-unsigned	14
		14	0	0	1	0	0	255	Clock and date in meter		octet-string	15
		15	1	0	1	8	0	255	Cumulative hourly active import energy (A+) (Q1+Q4)	kWh	double-long-unsigned	16
		16	1	0	2	8	0	255	Cumulative hourly active export energy (A-) (Q2+Q3)	kWh	double-long-unsigned	17
		17	1	0	3	8	0	255	Cumulative hourly reactive import energy (R+) (Q1+Q2)	kVArh	double-long-unsigned	18
		18	1	0	4	8	0	255	Cumulative hourly reactive export energy (R-) (Q3+Q4)	kVArh	double-long-unsigned	19

Norwegian HAN spesification - OBIS Codes	
Item Number	Long description OBIS Code
1	Active power in import direction, with resolution of W, Format 4.3 (xxxx,xxx kW)
2	Version number of this OBIS list to track the changes
3	Serial number of the meter point:16 digits 9999999999999999
4	Type number of the meter: "6515 , 6525, 6534, 6540, 6550"
5	Active power in import direction, with resolution of W, Format 4.3 (xxxx,xxx kW)
6	Active power in export direction, with resolution of W, Format 4.3 (xxxx,xxx kW)
7	Reactive power in import direction with resolution of VAr, Format 4.3 (xxxx,xxx kVAr)
8	Reactive power in export direction, with resolution of VAr, Format 4.3 (xxxx,xxx kVAr)
9	0,5 second RMS current L1, with resolution of 0.1 A, Format 3.1 (xxx.x A) (3P3W Current between L1 and L2 and part from current between L1 and L3)
10	0,5 second RMS current L2, with resolution of 0.1 A, Format 3.1 (xxx.x A) (3P3W Not supported)
11	0,5 second RMS current L3, with resolution of 0.1 A, Format 3.1 (xxx.x A) (3P3W Current between L2 and L3 and part from current between L1 and L3)
12	0,5 second RMS voltage L1, with resolution of 0.1 V, Format 3.1 (xxx.x V) (3P3W Line voltage L1-L2)
13	0,5 second RMS voltage L2, with resolution of 0.1 V, Format 3.1 (xxx.x V) (3P3W Line voltage L1-L3)
14	0,5 second RMS voltage L3, with resolution of 0.1 V, Format 3.1 (xxx.x V) (3P3W Line voltage L2-L3)
15	Local date and time of Norway
16	Active energy import, with resolution of 10 Wh, Format 7.2 (xxxxxxx.xx kWh)
17	Active energy export, with resolution of 10 Wh, Format 7.2 (xxxxxxx.xx kWh)
18	Reactive Energy import, with resolution of 10 Varh, Format 7.2 (xxxxxxx.xx kVArh)
19	Reactive Energy export, with resolution of 10 Varh, Format 7.2 (xxxxxxx.xx kVArh)

2.4 HAN interface activation

By default, the interface is not activated and even the power supply to the HAN device is not activated. The activation can be done from the Aidon head-end system.

When the HAN interface is activated:

- The power supply is active and power up to 0.7 W can be drawn from the interface
- Specified versions of lists are continuously pushed

2.4.1 List sending interval

The table below is an example of list sending intervals.

Time	List
09:00:00	List2
09:00:02,5	List1
09:00:05	List1
09:00:07	List1
09:00:10	List3
09:00:12,5	List1
09:00:15	List1
16:00:17,5	List1
16:00:20	List2

2.5 Data encryption

It is possible to encrypt the data using AES-128 keys. Key handling between the connected HAN device and the system is out of the scope in this feature.

3 Data format

3.1 Data framing

HAN data packets are sent inside an HDLC frame. The following COSEM classes are used:

- Data (class_id 1)
- Register (class_id 3)
- Clock (class_id 9)

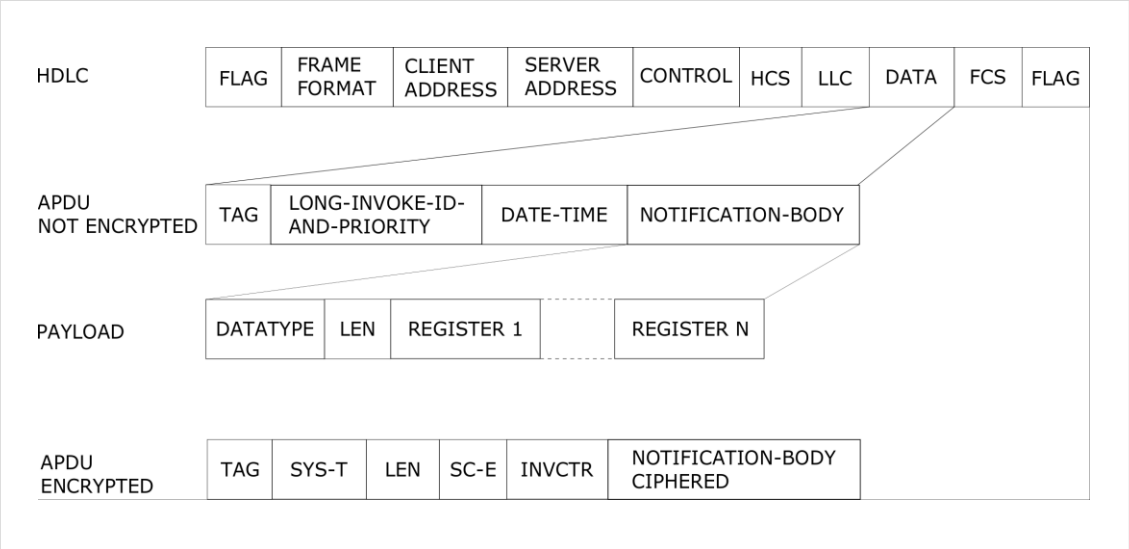

Figure 4: Data format

3.2 Push setup

The following chapters describe the push setups for AIDON_V0001 lists. COSEM objects that do not exist for a specific meter type, are not pushed.

3.2.1 List 1

COSEM object	class_id	OBIS code	Attribute
Active power+ (Q1+Q4)	3	1-1:1.7.0.255	0

3.2.2 List 2

COSEM object	class_id	OBIS code	Attribute
Active power+ (Q1+Q4)	3	1-0:1.7.0.255	0
OBIS List version identifier	1	1-1:0.2.129.255	0
Meter -ID (GIAI GS1 -16 digit)	1	0-0:96.1.0.255	0
Meter type	1	0-0:96.1.7.255	0
Active power+ (Q1+Q4)	3	1-0:1.7.0.255	0
Active power - (Q2+Q3)	3	1-0:2.7.0.255	0
Reactive power + (Q1+Q2)	3	1-0:3.7.0.255	0
Reactive power - (Q3+Q4)	3	1-0:4.7.0.255	0
IL1 Current phase L1	3	1-0:31.7.0.255	0
IL2 Current phase L2**	3	1-0:51.7.0.255	0
IL3 Current phase L3*	3	1-0:71.7.0.255	0
UL1 Phase voltage 4W meter, line voltage 3W meter	3	1-0:32.7.0.255	0
UL2 Phase voltage 4W meter, line voltage 3W meter*	3	1-0:52.7.0.255	0
UL3 Phase voltage 4W meter, line voltage 3W meter*	3	1-0:72.7.0.255	0

3.2.3 List 3

COSEM object	class_id	OBIS code	Attribute
Active power+ (Q1+Q4)	3	1-0:1.7.0.255	0
OBIS List version identifier	1	1-1:0.2.129.255	0
Meter -ID (GIAI GS1 -16 digit)	1	0-0:96.1.0.255	0
Meter type	1	0-0:96.1.7.255	0
Active power+ (Q1+Q4)	3	1-0:1.7.0.255	0
Active power - (Q2+Q3)	3	1-0:2.7.0.255	0
Reactive power + (Q1+Q2)	3	1-0:3.7.0.255	0
Reactive power - (Q3+Q4)	3	1-0:4.7.0.255	0
IL1 Current phase L1	3	1-0:31.7.0.255	0
IL2 Current phase L2**	3	1-0:51.7.0.255	0
IL3 Current phase L3*	3	1-0:71.7.0.255	0

COSEM object	class_id	OBIS code	Attribute
UL1 Phase voltage 4W meter, line voltage 3W meter	3	1-0:32.7.0.255	0
UL2 Phase voltage 4W meter, line voltage 3W meter*	3	1-0:52.7.0.255	0
UL3 Phase voltage 4W meter, line voltage 3W meter*	3	1-0:72.7.0.255	0
Clock and date in meter	8	0-0:1.0.0.255	1,2
Cumulative hourly active import energy (A+) (Q1+Q4)	3	1-0:1.8.0.255	0
Cumulative hourly active export energy (A-) (Q2+Q3)	3	1-0:2.8.0.255	0
Cumulative hourly reactive import energy (R+) (Q1+Q2)	3	1-0:3.8.0.255	0
Cumulative hourly reactive export energy (R-) (Q3+Q4)	3	1-0:4.8.0.255	0

*missing from 1-phase meter
**missing from 3-phase 3W meters and 1-phase meters

3.3 Examples of sent data

3.3.1 List 2 sending (1-phase)

```
7e a0d2 41 0883 13 82d6 e6e700
  0f 40000000 00
  0109
    0202 0906 0101000281ff 0a0b 4149444f4e5f5630303031
    0202 0906 0000600100ff 0a10 37333539393932383930393431373432
    0202 0906 0000600107ff 0a04 36353135
    0203 0906 0100010700ff 06 00000552 0202 0f00 161b
    0203 0906 0100020700ff 06 00000000 0202 0f00 161b
    0203 0906 0100030700ff 06 000003e4 0202 0f00 161d
    0203 0906 0100040700ff 06 00000000 0202 0f00 161d
    0203 0906 01001f0700ff 10 005d     0202 0fff 1621
    0203 0906 0100200700ff 12 09c4     0202 0fff 1623
e0c4 7e
```

4 HAN development kit

The HAN interface software development kit (SDK) is meant to be used for development purposes. The Aidon HAN SDK consists of an Aidon ESD with HAN development System Module software, and it is used to allow design houses to independently test the HAN interface on Aidon's devices.

The HAN SDK software enables the activation of the HAN interface locally without the need of system activation.

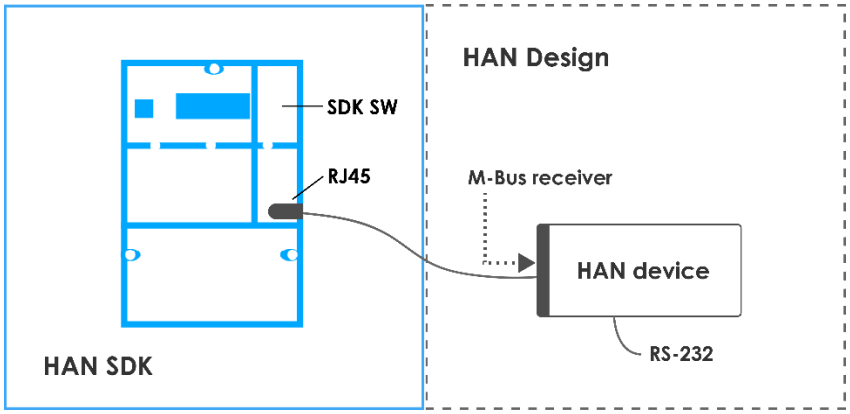

Figure 5: HAN development environment.

4.1 Aidon HAN SDK devices

The Aidon System Module type with the HAN SDK software is the following:

- Aidon 6901 HAN Development System Module

The following Aidon Meters can be equipped with the 6901 System Module:

- Aidon 6515 1-phase Meter with CB on both lines and Earth Fault Current Measurement
- Aidon 6525 3-phase Meter with CB and Earth Fault Measurement
- Aidon 6534 3-phase Meter with CB and Neutral Current Measurement
- Aidon 6540 3-phase CT Meter
- Aidon 6550 3-phase CT Meter

4.2 RS-232 port for activation

An RS-232 port is used from the device to simulate HES interface. The RS-232 signals are located in same RJ45 connector. A standard RS-232 cable shall be wired via the HAN device to a PC.

On the RJ45 connector, 3 pins are used for RS-232:

- RJ45 PIN6: RS-232 RX to device / TX from PC
- RJ45 PIN7: RS-232 TX from device / RX to PC
- RJ45 PIN8: GND for RS-232

4.3 RS-232 port activation commands

Communication settings for RS-232 port are 115200/8-N-1.

The following table describes the commands available via the RS-232 interface. Note that the commands are case sensitive.

Command	Output	Description
HAN ENABLE:0	HAN DISABLED	Disables HAN interface
HAN ENABLE:1	HAN ENABLED	Enables HAN interface without encryption
HAN ENABLE:2 <key>	HAN ENABLED WITH ENCRYPTION or KEY SETTING FAILED or WRONG KEY LENGTH	Enables HAN interface with security key. Key must be given as 16 byte hex-string. Example: HAN ENABLE:2 00112233445566778899AABBCCDDEEFF
TIME	CURRENT TIME: YYYY-MM-DD HH:mm:ss	Prints current date and time in ESD
TIME: <YYYY-MM-DD HH:mm:ss>	SETTING TIME: YYYY-MM-DD HH:mm:ss TIME SETTING SUCCESS or TIME SETTING FAILED	Sets ESD date and time. Example: TIME 2018-05-01 12:00:00
	HAN FAULT	Overcurrent situation detected