

# Microstar DLMS Protocol Guide

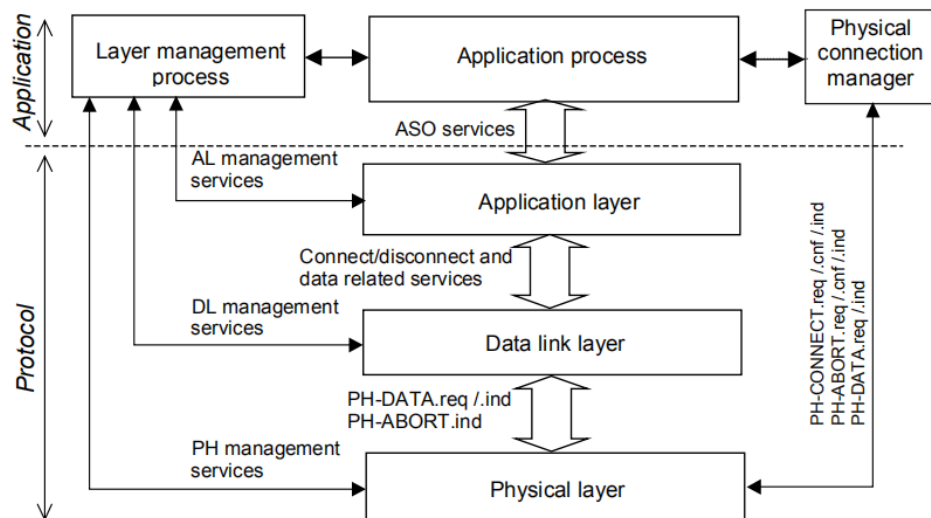
## Disclaimer:

*The information provided in this document is for reference purpose only and “as-is”. Microstar makes no warranty or whatsoever with the provided information. The readers assume their own risk in utilizing the document.*

## 1. Overview

DLMS/COSEM protocol includes 3 layers:

- Physical Layer,
- Data Link Layer, and
- Application Layer.



**Figure 1. DLMS/COSEM Protocol Layers (source: DLMS/COSEM Specifications)**

The communication uses client-server structure:

- The meter works as the “server” waiting for the incoming connection and requests;
- The inquiring software works as the “client” to initiate connection to the server and send requests.

This document provides a concise guide on the protocol details necessary to communicate with Microstar smart meters using DLMS/COSEM protocol:

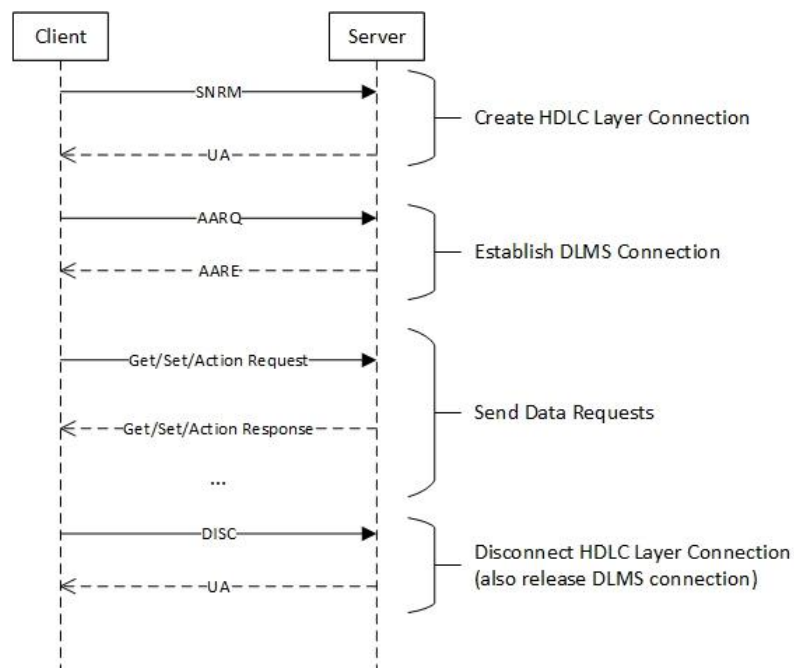
- Chapter 2 describes the protocol configurations for each layer.

- Chapter 3 provides example communication frames and their interpretations.
- Appendix A provides the OBIS list and their interpretations.

For the full protocol details, please refer to the DLMS/COSEM official documentation. The documentation is available for purchase on the DLMS website: <https://www.dlms.com/>.

## 2. Protocol Details

The overall communication process using HDLC profile and serial interface is as shown in Figure 2.



**Figure 2. Overall DLMS/COSEM Communication Process using HDLC profile.**

**Note:**

1. In the DLMS context, "Client" means the software; "Server" means the meter.
2. The message types and details are described in more details in Chapter 1.

### 2.1. Physical layer

The physical layer is the base layer of the DLMS protocol stack, taking charge of the physical transport of data. The physical layer could be serial port or via network protocol. This document describes mainly the serial connections.

The physical layer for serial connections (include both optical port and serial RS232/RS485 port) stipulates how to open, initialize, configure the serial port.

### 2.1.1. Serial Port Default Configuration

Port Type	Optical Port	RS232/RS485
Initial Baud Rate	300	9600
Data Bits	8	8
Stop Bits	1	1
Parity	None	None
Flow Control	None	None

**Note:**

*The optical port follows the IEC 62056-21 standard for optical port. Therefore it is required to first perform IEC 62056-21 handshake to enter Mode C DLMS protocol if optical port is used.*

The serial port minimum delay from sending a message to receiving a message is 30 ms.

## 2.2. Data Link layer

The data link layer is responsible for ensuring the messages are sent/received in sequence and correctly. The data link layer connection must be established first before upper layers (application layer) communication can start.

The DLMS protocol uses HDLC protocol as the data link layer protocol for serial communications.

### 2.2.1. HDLC Protocol

**Note:**

Refer to the DLMS Green Book Chapter 8 for full details on the HDLC protocol.

This document only provides a high-level overview and is not intended to replace the standard documentation.

The HDLC Frame Format is as follows:

Flag	Frame format	Dest. address	Src. address	Control	HCS	Information	FCS	Flag
------	--------------	---------------	--------------	---------	-----	-------------	-----	------

**Figure 3. HDLC Frame Format (Source: DLMS Green Book Chapter 8.4 Figure 49)**

The HDLC protocol contains several message types (refer to official document for the full list):

Type	Description	Comments
<b>SNRM</b>	<p>Set Normal Response Mode Command</p> <p>The SNRM command shall be used to place the addressed secondary station in the normal response mode (NRM) where all control fields shall be one octet in length. The secondary station shall confirm acceptance of the SNRM command by transmission of a UA response at the first respond opportunity. Upon acceptance of this command, the secondary station send and receive state variables shall be set to zero.</p>	The HDLC Frame Type to establish connection.
<b>DISC</b>	<p>Disconnect Command</p> <p>The DISC command shall be used to terminate an operational or initialization mode previously set by a command. In both switched and non-switched networks, it shall be used to inform the addressed secondary station(s) that the primary station is suspending operation and that the secondary station(s) should assume a logically disconnected mode. Prior to actioning the command, the secondary station shall confirm the acceptance of the DISC command by the transmission of a UA response.</p>	The HDLC Frame Type to terminate connection.
<b>UA</b>	<p>Unnumbered Acknowledgement Response</p> <p>The UA response shall be used by the secondary station to acknowledge the receipt and acceptance of SNRM and DISC commands.</p>	The HDLC Frame Type to reply to SNRM or DISC command.

	The UA response may contain an optional information field that is used for negotiation of data link parameters (max APDU size etc.)	
<b>I</b>	Information Frame  Carries the higher level protocol payload as information.	The frame type to send application layer payload.
<b>RR</b>	Receive Ready Command  The Receive ready, RR, frame shall be used by a data station to:  a) indicate that it is ready to receive an I frame(s); and  b) acknowledge previously received I frames numbered up to N(R) - 1 inclusive.  When transmitted, the RR frame shall indicate the clearance of any busy condition that was initiated by the earlier transmission of an RNR frame by the same data station.	The frame type to indicate reception of previous frame in case of sending a payload in multiple frames where the payload length is larger than the maximum APDU size agreed by the client and server.

The process to establish HDLC connection is as follows:

- Client (Software) send SNRM to request establishing the connection.
- Server (Meter) respond with UA to accept connection.
- Client (Software) send I frames to carry higher layer protocol payload; Server (Meter) respond with I frames also. In case of multiple frames to carry a longer payload, meter will reply with RR to confirm the reception of previous frame and request the next frame.
- After communication finished, Client (software)

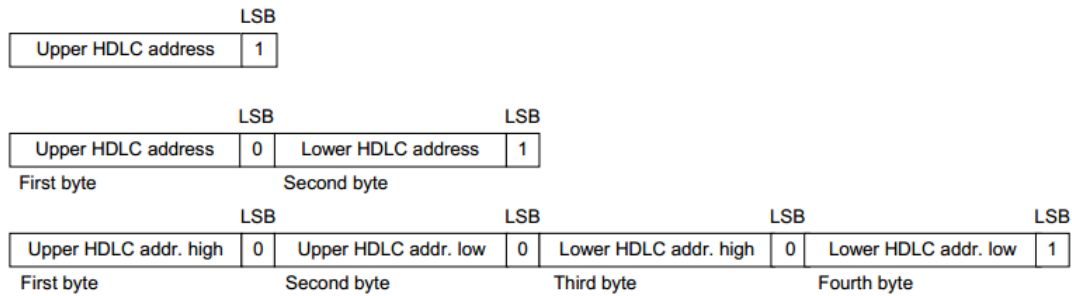
**Note:**

Refer to the DLMS Green Book Chapter 8 for full details on the HDLC protocol.

This document only provides a high-level overview and is not intended to replace the standard documentation.

## 2.2.2. HDLC Address

The HDLC address includes both logical (upper) and physical (lower) address:



**Figure 4. HDLC Address Structure**

#### HDLC Address of the Meter (Server)

The physical address of the meter can be programmed. By default it is the last 4 digits of the meter serial number. For example, if the meter serial number is 000019001234, its factory default HDLC address is 1234 (or 0x04D2 in HEX).

The logical address of the meter is also known as the “Server SAP”. The server logical address is 1.

#### HDLC Address of the Software (Client)

The client HDLC Address normally only contains the upper (logical address). The client logical address is also known as the “Client SAP”. It depends on the login credentials.

- For no security (no password) read-only login, the client SAP is 0x10
- For low-level security (password) read-write login, the client SAP is 0x20

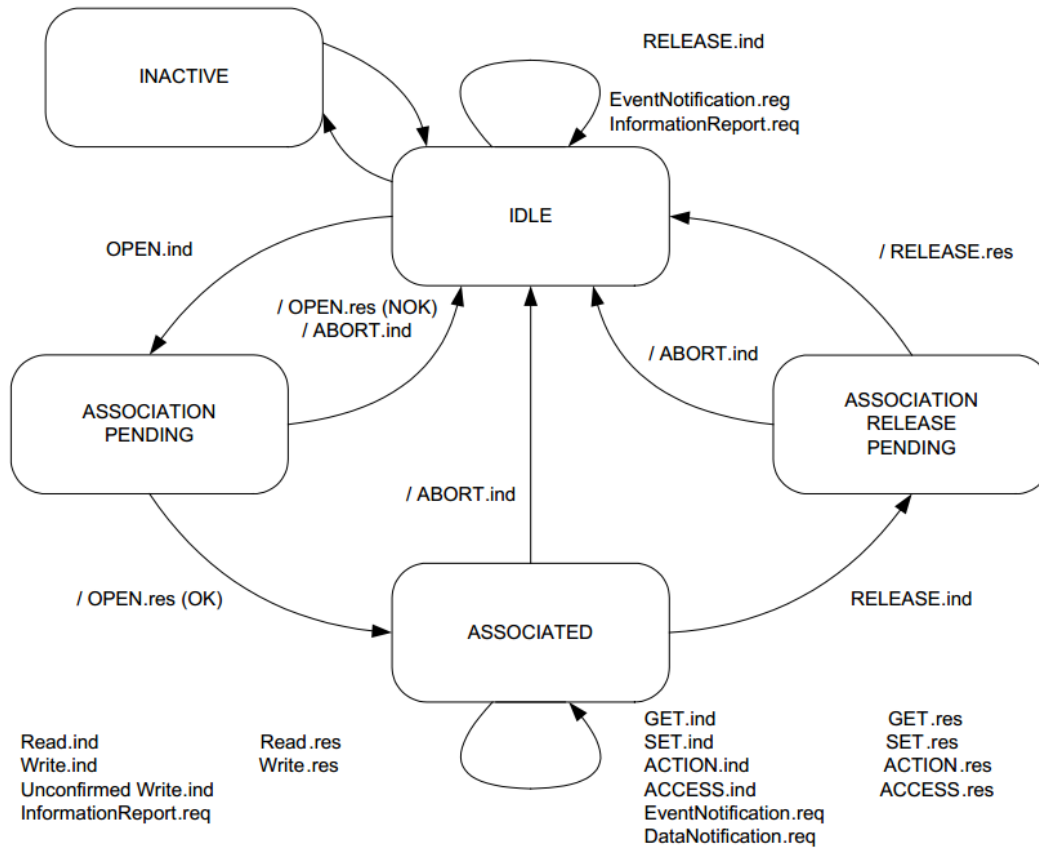
Role	Logical Address (SAP)	Security	Access
Public Client	0x10	No Password	Read-Only
LLS Client	0x20	Password	Read-Write

## 2.3. Application Layer

COSEM (Companion Specification for Energy Metering) is the application layer object model of the DLMS/COSEM protocol. It specifies the interface model and communication protocols for data exchange with metering equipment.

The DLMS/COSEM protocol uses ASN.1 encoding for the application layer messages. The details of the ASN.1 encoding standard is out of this document’s scope. Refer to the standard documentations for ASN.1 for details.

The overall state diagram for the application layer is as follows:



**Figure 5. DLMS Server (Meter) State Diagram (Source: DLMS/COSEM Specification Green Book Chapter 9 Figure 90)**

In other words, client (software) need to first send request to establish association, and server (meter) depending on the authentication and handshake results, can accept or reject the association request.

Once the association is established, the client can set GET / SET / ACTION requests to the server (meter). The server will response with relevant responses.

The sequence diagram for the DLMS/COSEM application layer is as follows:

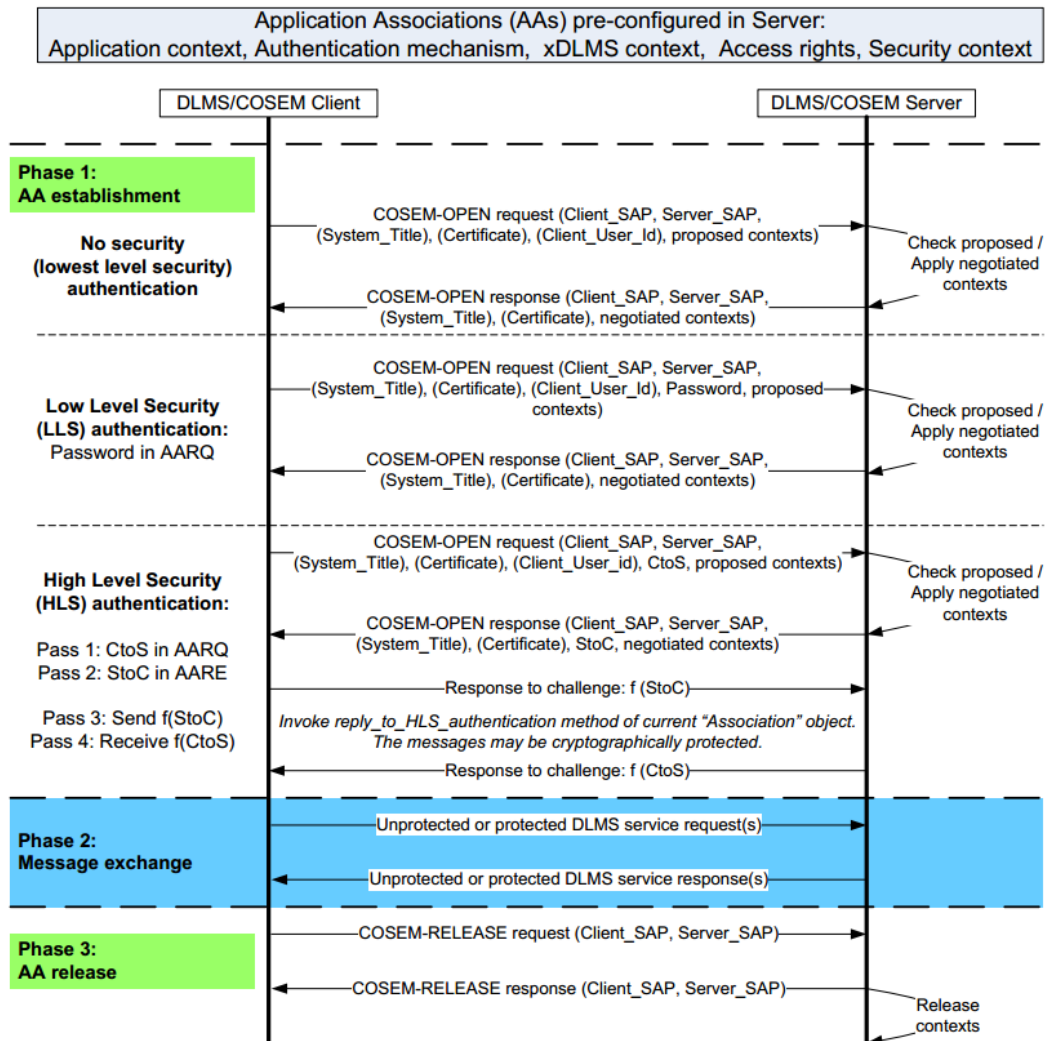


Figure 6. DLMS/COSEM Application Layer Sequence Diagram (Source: DLMS/COSEM Specification Green Book Chapter 9 Figure 64)

### 2.3.1. Authentication

The meter supports by default (customizable by order) read-only access for most metering data items with no security login.

The meter supports by default (customizable by order) read-write access with password protection.

Contact the meter distribution agent or Microstar support for the default meter password.



### 2.3.2. Communication Timeout

The meter will automatically disconnect the application layer association and the data-link layer connection if no messages are received after the timeout. This is both a security mechanism and a way to ensure reliable communications. The default timeout is 3 minutes, or 180 seconds.

To maintain the connection, send any valid DLMS/COSEM request to the server (meter) within the timeout.

### 2.3.3. Common Interface Classes

The DLMS models metering data and configurations in object-oriented fashion. The data are organized in Interface Classes. The commonly used Interface Classes includes:

Class ID	Class Name	Description
1	Data	Stores data without units, such as meter serial number etc.
3	Register	Stores data with scaler and unit, such as most energy and instant value register values in the meter.
4	Extended Register	Stores data with scaler unit and capture time, mostly used for maximum demand.
5	Demand Register	Stores the current demand data.
7	Profile Generic	Stores the load profile and event log type data.
8	Clock	Stores the meter clock and DST settings.

**Note:**

Refer to the DLMS Blue Book Chapter 4 for full list of Interface Classes.

This document only provides a high-level overview and is not intended to replace the standard documentation.

### 3. DLMS/COSEM Frame Examples

This chapter provides frame examples using HDLC protocol.

#### 3.1. HDLC SNRM/UA Frame Exchange

The SNRM/UA are used to establish HDLC connections and negotiate the HDLC parameters.

1. Sent frame:

7E A0 0A 00 02 00 23 21 93 18 71 7E

Comments:

7E // HDLC frame opening flag  
A00A // frame type and length  
0002 // destination address (server) upper HDLC address 0x0001  
0023 // destination address (server) lower HDLC address 0x0011  
21 // source address (client) 0x01  
93 // frame type SNRM (Set Normal Response Mode)  
// information field with HDLC parameters not present, defaults are proposed  
1871 // Frame check sequence  
7E // HDLC frame closing flag

2. Received frame:

7E A0 23 21 00 02 00 23 73 F6 C5 81 80 14 05 02 00 80 06 02 00 80 07 04 00 00 00 01  
08 04 00 00 00 01 CE 6A 7E

Comments:

7E // HDLC frame opening flag  
A023 // frame type and length  
21 // destination address (client) 0x01  
0002 // source address (server) upper HDLC address 0x0001  
0023 // source address (server) lower HDLC address 0x0011  
73 // frame type UA (Unnumbered acknowledge)  
F6C5 // Header check sequence

**818014** //format identifier / group identifier / group length  
**05020080** //parameter identifier/length/value – maximum information field length transmit  
**06020080** //parameter identifier/length /value – maximum information field length receive  
**070400000001**//parameter identifier/length/value – window size transmit  
**080400000001**//parameter identifier/length/value – window size receive  
**CE6A** // Frame check sequence  
**7E** // HDLC frame closing flag

## 3.2. DLMS AARQ/AARE Frame Exchange

The AARQ / AARE are used to establish DLMS application layer associations.

### 1. Sent frame: AARQ

7E A0 2E 00 02 00 23 21 10 7E CB E6 E6 00 60 1D A1 09 06 07 60 85 74 05 08 01 01 BE  
 10 04 0E 01 00 00 00 06 5F 1F 04 00 00 30 1D FF FF D4 C5 7E

Comments:

**7E** // HDLC flag  
**A02E** // frame type and length  
**0002002321** // destination and source addresses  
**10** // frame type I frame  
**7ECB** // Header check sequence  
**E6E600** // LLC bytes  
**601D** // AARQ tag and length  
**A109060760857405080101**//Application context name tag, length and encoded value  
 // This application association is established with lowest level security, so authentication components are not present  
**BE10** // tag and length for AARQ user field  
**040E** // encoding the choice for user-information (OCTET STRING,universal) and length  
**01** // tag for xDLMS-Initiate request  
**00** // usage field for dedicated-key component – not used

00 // usage field for the response allowed component – not used  
00 // usage field of the proposed-quality-of-service component – not used  
06 // proposed dlms version number 6  
5F1F // tag for conformance block  
04 // length of the conformance block  
00 // encoding the number of unused bits in the bit string  
00301D //conformance block  
FFFF // client-max-receive-pdu-size  
D4C5 // HDLC frame check sequence  
7E // closing flag

2. Received frame:

7E A0 3A 21 00 02 00 23 30 99 41 E6 E7 00 61 29 A1 09 06 07 60 85 74 05 08 01 01 A2  
03 02 01 00 A3 05 A1 03 02 01 00 BE 10 04 0E 08 00 06 5F 1F 04 00 00 30 1D 19 00 00  
07 0C 52 7E

Comments:

7EA03A2100020023309941 //HDLC frame header  
E6E700 // LLC bytes  
6129 //AARE tag and length  
A109060760857405080101//Application context name tag, length and encoded value  
A203 // tag and length of the result component  
02 //encoding the choice for result (INTEGER, universal)  
0100 // length and value of result (accepted)  
A305 // tag and length for the result-source-diagnostic component  
A103 // tag and length of the acse-service-user choice  
02 // encoding the choice for result-source-diagnostic  
(INTEGER,universal)  
0100 // length and value of result-souce-diagnostic  
BE10 //tag and length for AARE user-field  
040E // encoding the choice for user-information (OCTET STRING,  
universal) and length

08	// tag for xDLMS-Initiate.request
00	// usage field of the negotiated-quality-of-service component
06	// negotiated DLMS version number 6
5F1F	// tag for conformance block
04	// length of the conformance block
00	// encoding the number of unused bits in the bit string
00301D	//negotiated conformance block
1900	// server-max-receive-pdu-size
0007	// VAA name (0x0007 for LN referencing)
0C52	// HDLC frame check sequence
7E	// HDLC closing flag

### 3.3. DLMS GET Request / Response Frame Exchange

The Get Request / Responses are used to read data from the meters after established connection and association with the meter.

The example frames below reads the meter clock. The other data items can be read similarly.

1. Sent frame:

7E A0 19 95 75 76 78 37 E6 E6 00 C0 01 81 00 08 00 00 01 00 00 FF 02 00 65 D7 7E

Comments:

7EA0199575767837	// HDLC header
E6E600	// LLC bytes
C001	// GET.request.normal
81	// invoke-id and priority
0008	// interface class 8, clock
0000010000FF	// logical name, OBIS code of the clock 0-0:1.0.0
0200	// asking for 2nd attribute, date and Time
65D77E	// HDLC checksum and closing tag

2. Received frame:

```
7E A0 1E 75 95 96 6F 67 E6 E7 00 C4 01 81 00 09 0C 07 D2 0C 04 03 0A 06 0B FF 00 78
00 F3 30 7E
```

Comments:

```
7EA01E7595966F67E6E700 // HDLC header
C401 // GET.response.normal
81 // invoke-id and priority
00 // [0] Data
090C // octet-string (12)
07D2 // year 2002
0C // month December
04 // day 4th
03 // day of the week, Wednesday
0A060B // time 10:06:12
FF // hundredths not specified
0078 // deviation 120 minutes
00 // status OK
F3307E // HDLC checksum and closing tag
```

### 3.4. DLMS SET Request / Response Frame Exchange

#### Example

The DLMS Set-Requests and Set-Reponses are used to change the meter configurations. The below example sets the meter clock. Usually the set-requests are only accepted with password logins.

1. Sent frame:

```
7E A0 27 95 75 98 B8 DB E6 E6 00 C1 01 81 00 08 00 00 01 00 00 FF 02 00 09 0C 07 D2
0C 04 03 0A 06 0B FF 00 78 00 62 FB 7E
```

Comments:

```
7EA027957598B8DB // HDLC header
E6E600 // LLC bytes
C101 // SET.normal request
```

```
81          // invoke-id and priority
0008        // interface class 8, clock
0000010000FF // logical name, OBIS code of the clock 0-0:1.0.0
0200        // set the 2nd attribute, date-time
090C07D20C04030A060BFF007800 // Date-time value
62FB7E      // HDLC checksum and closing tag
```

2. Received frame:

7E A0 10 75 95 B8 51 01 E6 E7 00 C5 01 81 00 36 CF 7E

Comments:

```
7EA0107595B85101 // HDLC header
E6E700            // LLC bytes
C501              // SET. response normal
81                // invoke-id and priority
00                // 00 - success
36CF7E           // HDLC checksum and closing tag
```

### 3.5. HDLC DISC/UA Frame Exchange

The HDLC DISC/UA frames are used to disconnect the connection from the meters.

1. Sent frame:

7E A0 0A 00 02 36 59 21 53 DE 43 7E

Comments:

```
7E          // HDLC frame opening flag
A00A        // frame type and length
00 02       // destination address (server) upper HDLC address 0x0001
36 59       // destination address (server) lower HDLC address 0x0011
21          // source address (client) 0x01
53          // frame type DISC (Set Normal Response Mode)
```

DE43      // Frame check sequence  
7E        // HDLC frame closing flag

2. Received frame:

7E A0 21 21 00 02 36 59 73 8E AF 81 80 12 05 01 C8 06 01 8C 07 04 00 00 00 01 08 04  
00 00 00 01 49 C6 7E

UA Frame.



## Appendix A OBIS Codes

The DLMS models the meter data and configurations using Interface Classes, and identify them using the OBIS (Object Identification System).

The OBIS codes for various meter data and configurations are listed in this appendix.

### A.1. OBIS Codes - Parameter and Information

OBIS	Class	Descriptions
<b>1-0:0.0.0</b>	1 : Data	Meter Serial Number
<b>1-0:0.1.0</b>	3 : Register	Billing period counter
<b>1-0:0.1.2</b>	3 : Register	Time stamp of the most recent billing period (EOB)
<b>1-0:0.3.3</b>	3 : Register	Meter constant; Active energy, output pulse
<b>1-0:0.3.4</b>	3 : Register	Meter constant; Reactive energy, output pulse
<b>1-0:0.4.2</b>	3 : Register	CT Primary
<b>1-0:0.4.3</b>	3 : Register	VT Primary
<b>1-0:0.4.5</b>	3 : Register	CT Secondary
<b>1-0:0.4.6</b>	3 : Register	VT Secondary
<b>0-0:96.2.0</b>	3 : Register	No. of configuration program changes
<b>0-0:96.2.1</b>	3 : Register	Date of last configuration program change
<b>0-0:96.3.0</b>	3 : Register	Dual Source Channel Selection Mode
<b>0-0:96.3.3</b>	3 : Register	Dual Source Current Channel
<b>0-0:96.14.0</b>	3 : Register	Currently active tariff
<b>0-0:96.20.5</b>	3 : Register	Terminal cover open event count
<b>0-0:96.20.6</b>	3 : Register	Terminal cover open event Timestamp
<b>0-0:96.51.4</b>	3 : Register	Meter Cover Open Event Timestamp
<b>0-0:96.51.4*X</b>	3 : Register	Meter Cover Open Event Timestamp (History X)
<b>0-0:97.97.0</b>	3 : Register	Error Code

## A.2. OBIS Codes - Channel 1

Channel 1 is the default channel, or the sum of the channels if there are multiple channels.

OBIS	Class	Channel	Descriptions
1-1:1.2.0	3 : Register	Ch. 1	Import Active Cumulative Maximum Demand Total
1-1:1.2.1	3 : Register	Ch. 1	Import Active Cumulative Maximum Demand Rate 1
1-1:1.2.2	3 : Register	Ch. 1	Import Active Cumulative Maximum Demand Rate 2
1-1:1.2.3	3 : Register	Ch. 1	Import Active Cumulative Maximum Demand Rate 3
1-1:1.2.4	3 : Register	Ch. 1	Import Active Cumulative Maximum Demand Rate 4
1-1:1.7.0	3 : Register	Ch. 1	Instantaneous import Active Power Sum
1-1:1.8.0	3 : Register	Ch. 1	Import Active Energy Total
1-1:1.8.1	3 : Register	Ch. 1	Import Active Energy Rate 1
1-1:1.8.2	3 : Register	Ch. 1	Import Active Energy Rate 2
1-1:1.8.3	3 : Register	Ch. 1	Import Active Energy Rate 3
1-1:1.8.4	3 : Register	Ch. 1	Import Active Energy Rate 4
1-1:1.9.0	3 : Register	Ch. 1	Import Active Monthly Energy Consumption Total
1-1:1.9.1	3 : Register	Ch. 1	Import Active Monthly Energy Consumption Rate 1
1-1:1.9.2	3 : Register	Ch. 1	Import Active Monthly Energy Consumption Rate 2
1-1:1.9.3	3 : Register	Ch. 1	Import Active Monthly Energy Consumption Rate 3
1-1:1.9.4	3 : Register	Ch. 1	Import Active Monthly Energy Consumption Rate 4
1-1:1.16.0	3 : Register	Ch. 1	Import Active Rising Demand
1-1:2.2.0	3 : Register	Ch. 1	Export Active Cumulative Maximum Demand Total
1-1:2.2.1	3 : Register	Ch. 1	Export Active Cumulative Maximum Demand Rate 1
1-1:2.2.2	3 : Register	Ch. 1	Export Active Cumulative Maximum Demand Rate 2
1-1:2.2.3	3 : Register	Ch. 1	Export Active Cumulative Maximum Demand Rate 3
1-1:2.2.4	3 : Register	Ch. 1	Export Active Cumulative Maximum Demand Rate 4
1-1:2.7.0	3 : Register	Ch. 1	Instantaneous Export Active Power sum
1-1:2.8.0	3 : Register	Ch. 1	Export Active Energy Total
1-1:2.8.1	3 : Register	Ch. 1	Export Active Energy Rate 1

OBIS	Class	Channel	Descriptions
1-1:2.8.2	3 : Register	Ch. 1	Export Active Energy Rate 2
1-1:2.8.3	3 : Register	Ch. 1	Export Active Energy Rate 3
1-1:2.8.4	3 : Register	Ch. 1	Export Active Energy Rate 4
1-1:2.9.0	3 : Register	Ch. 1	Export Active Monthly Energy Consumption Total
1-1:2.9.1	3 : Register	Ch. 1	Export Active Monthly Energy Consumption Rate 1
1-1:2.9.2	3 : Register	Ch. 1	Export Active Monthly Energy Consumption Rate 2
1-1:2.9.3	3 : Register	Ch. 1	Export Active Monthly Energy Consumption Rate 3
1-1:2.9.4	3 : Register	Ch. 1	Export Active Monthly Energy Consumption Rate 4
1-1:2.16.0	3 : Register	Ch. 1	Export Active Rising Demand
1-1:3.2.0	3 : Register	Ch. 1	Import Reactive Cumulative Maximum Demand Total
1-1:3.2.1	3 : Register	Ch. 1	Import Reactive Cumulative Maximum Demand Rate 1
1-1:3.2.2	3 : Register	Ch. 1	Import Reactive Cumulative Maximum Demand Rate 2
1-1:3.2.3	3 : Register	Ch. 1	Import Reactive Cumulative Maximum Demand Rate 3
1-1:3.2.4	3 : Register	Ch. 1	Import Reactive Cumulative Maximum Demand Rate 4
1-1:3.7.0	3 : Register	Ch. 1	Instantaneous Import Reactive Power Sum
1-1:3.8.0	3 : Register	Ch. 1	Import Reactive Energy Total
1-1:3.8.1	3 : Register	Ch. 1	Import Reactive Energy Rate 1
1-1:3.8.2	3 : Register	Ch. 1	Import Reactive Energy Rate 2
1-1:3.8.3	3 : Register	Ch. 1	Import Reactive Energy Rate 3
1-1:3.8.4	3 : Register	Ch. 1	Import Reactive Energy Rate 4
1-1:3.9.0	3 : Register	Ch. 1	Import Reactive Monthly Energy Consumption Total
1-1:3.9.1	3 : Register	Ch. 1	Import Reactive Monthly Energy Consumption Rate 1
1-1:3.9.2	3 : Register	Ch. 1	Import Reactive Monthly Energy Consumption Rate 2
1-1:3.9.3	3 : Register	Ch. 1	Import Reactive Monthly Energy Consumption Rate 3
1-1:3.9.4	3 : Register	Ch. 1	Import Reactive Monthly Energy Consumption Rate 4
1-1:3.16.0	3 : Register	Ch. 1	Import Reactive Rising Demand
1-1:4.2.0	3 : Register	Ch. 1	Export Reactive Cumulative Maximum Demand Total
1-1:4.2.1	3 : Register	Ch. 1	Export Reactive Cumulative Maximum Demand Rate 1

OBIS	Class	Channel	Descriptions
1-1:4.2.2	3 : Register	Ch. 1	Export Reactive Cumulative Maximum Demand Rate 2
1-1:4.2.3	3 : Register	Ch. 1	Export Reactive Cumulative Maximum Demand Rate 3
1-1:4.2.4	3 : Register	Ch. 1	Export Reactive Cumulative Maximum Demand Rate 4
1-1:4.7.0	3 : Register	Ch. 1	Instantaneous Export Reactive Power Sum
1-1:4.8.0	3 : Register	Ch. 1	Export Reactive Energy Total
1-1:4.8.1	3 : Register	Ch. 1	Export Reactive Energy Rate 1
1-1:4.8.2	3 : Register	Ch. 1	Export Reactive Energy Rate 2
1-1:4.8.3	3 : Register	Ch. 1	Export Reactive Energy Rate 3
1-1:4.8.4	3 : Register	Ch. 1	Export Reactive Energy Rate 4
1-1:4.9.0	3 : Register	Ch. 1	Export Reactive Monthly Energy Consumption Total
1-1:4.9.1	3 : Register	Ch. 1	Export Reactive Monthly Energy Consumption Rate 1
1-1:4.9.2	3 : Register	Ch. 1	Export Reactive Monthly Energy Consumption Rate 2
1-1:4.9.3	3 : Register	Ch. 1	Export Reactive Monthly Energy Consumption Rate 3
1-1:4.9.4	3 : Register	Ch. 1	Export Reactive Monthly Energy Consumption Rate 4
1-1:4.16.0	3 : Register	Ch. 1	Export Reactive Rising Demand
1-1:9.2.0	3 : Register	Ch. 1	Import Apparent Cumulative Maximum Demand Total
1-1:9.2.1	3 : Register	Ch. 1	Import Apparent Cumulative Maximum Demand Rate 1
1-1:9.2.2	3 : Register	Ch. 1	Import Apparent Cumulative Maximum Demand Rate 2
1-1:9.2.3	3 : Register	Ch. 1	Import Apparent Cumulative Maximum Demand Rate 3
1-1:9.2.4	3 : Register	Ch. 1	Import Apparent Cumulative Maximum Demand Rate 4
1-1:9.7.0	3 : Register	Ch. 1	Instantaneous Import Apparent Power Sum
1-1:9.8.0	3 : Register	Ch. 1	Import Apparent Energy Total
1-1:9.8.1	3 : Register	Ch. 1	Import Apparent Energy Rate 1
1-1:9.8.2	3 : Register	Ch. 1	Import Apparent Energy Rate 2
1-1:9.8.3	3 : Register	Ch. 1	Import Apparent Energy Rate 3
1-1:9.8.4	3 : Register	Ch. 1	Import Apparent Energy Rate 4
1-1:9.9.0	3 : Register	Ch. 1	Import Apparent Monthly Energy Consumption Total
1-1:9.9.1	3 : Register	Ch. 1	Import Apparent Monthly Energy Consumption Rate 1

OBIS	Class	Channel	Descriptions
1-1:9.9.2	3 : Register	Ch. 1	Import Apparent Monthly Energy Consumption Rate 2
1-1:9.9.3	3 : Register	Ch. 1	Import Apparent Monthly Energy Consumption Rate 3
1-1:9.9.4	3 : Register	Ch. 1	Import Apparent Monthly Energy Consumption Rate 4
1-1:9.16.0	3 : Register	Ch. 1	Import Apparent Rising Maximum Demand
1-1:10.2.0	3 : Register	Ch. 1	Export Apparent Cumulative Maximum Demand Total
1-1:10.2.1	3 : Register	Ch. 1	Export Apparent Cumulative Maximum Demand Rate 1
1-1:10.2.2	3 : Register	Ch. 1	Export Apparent Cumulative Maximum Demand Rate 2
1-1:10.2.3	3 : Register	Ch. 1	Export Apparent Cumulative Maximum Demand Rate 3
1-1:10.2.4	3 : Register	Ch. 1	Export Apparent Cumulative Maximum Demand Rate 4
1-1:10.7.0	3 : Register	Ch. 1	Export Apparent Power - Sum
1-1:10.8.0	3 : Register	Ch. 1	Export Apparent Energy Total
1-1:10.8.1	3 : Register	Ch. 1	Export Apparent Energy Rate 1
1-1:10.8.2	3 : Register	Ch. 1	Export Apparent Energy Rate 2
1-1:10.8.3	3 : Register	Ch. 1	Export Apparent Energy Rate 3
1-1:10.8.4	3 : Register	Ch. 1	Export Apparent Energy Rate 4
1-1:10.9.0	3 : Register	Ch. 1	Export Apparent Monthly Energy Consumption Total
1-1:10.9.1	3 : Register	Ch. 1	Export Apparent Monthly Energy Consumption Rate 1
1-1:10.9.2	3 : Register	Ch. 1	Export Apparent Monthly Energy Consumption Rate 2
1-1:10.9.3	3 : Register	Ch. 1	Export Apparent Monthly Energy Consumption Rate 3
1-1:10.9.4	3 : Register	Ch. 1	Export Apparent Monthly Energy Consumption Rate 4
1-1:10.16.0	3 : Register	Ch. 1	Export Apparent Rising Demand
1-1:13.0.0	3 : Register	Ch. 1	Monthly Average Power Factor
1-1:13.0.1	3 : Register	Ch. 1	Monthly Average Power Factor Rate 1
1-1:13.0.2	3 : Register	Ch. 1	Monthly Average Power Factor Rate 2
1-1:13.0.3	3 : Register	Ch. 1	Monthly Average Power Factor Rate 3
1-1:13.0.4	3 : Register	Ch. 1	Monthly Average Power Factor Rate 4
1-1:13.7.0	3 : Register	Ch. 1	Instantaneous Power Factor
1-1:14.7.0	3 : Register	Ch. 1	Instantaneous Frequency

OBIS	Class	Channel	Descriptions
<b>1-1:15.7.0</b>	3 : Register	Ch. 1	Instantaneous Total Active Power
<b>1-1:21.7.0</b>	3 : Register	Ch. 1	Phase A Instantaneous Import Active Power
<b>1-1:22.7.0</b>	3 : Register	Ch. 1	Phase A Instantaneous Export Active Power
<b>1-1:23.7.0</b>	3 : Register	Ch. 1	Phase A Instantaneous Import Reactive Power
<b>1-1:24.7.0</b>	3 : Register	Ch. 1	Phase A Instantaneous Export Reactive Power
<b>1-1:29.7.0</b>	3 : Register	Ch. 1	Phase A Instantaneous Import Apparent Power
<b>1-1:30.7.0</b>	3 : Register	Ch. 1	Phase A Instantaneous Export Apparent Power
<b>1-1:31.7.0</b>	3 : Register	Ch. 1	Current - Phase A
<b>1-1:32.7.0</b>	3 : Register	Ch. 1	Voltage - Phase A
<b>1-1:33.7.0</b>	3 : Register	Ch. 1	Power Factor - Phase A
<b>1-1:41.7.0</b>	3 : Register	Ch. 1	Phase B Instantaneous Import Active Power
<b>1-1:42.7.0</b>	3 : Register	Ch. 1	Phase B Instantaneous Export Active Power
<b>1-1:43.7.0</b>	3 : Register	Ch. 1	Phase B Instantaneous Import Reactive Power
<b>1-1:44.7.0</b>	3 : Register	Ch. 1	Phase B Instantaneous Export Reactive Power
<b>1-1:49.7.0</b>	3 : Register	Ch. 1	Phase B Instantaneous Import Apparent Power
<b>1-1:50.7.0</b>	3 : Register	Ch. 1	Phase B Instantaneous Export Apparent Power
<b>1-1:51.7.0</b>	3 : Register	Ch. 1	Current - Phase B
<b>1-1:52.7.0</b>	3 : Register	Ch. 1	Voltage - Phase B
<b>1-1:53.7.0</b>	3 : Register	Ch. 1	Power Factor - Phase B
<b>1-1:61.7.0</b>	3 : Register	Ch. 1	Phase C Instantaneous Import Active Power
<b>1-1:62.7.0</b>	3 : Register	Ch. 1	Phase C Instantaneous Export Active Power
<b>1-1:63.7.0</b>	3 : Register	Ch. 1	Phase C Instantaneous Import Reactive Power
<b>1-1:64.7.0</b>	3 : Register	Ch. 1	Phase C Instantaneous Export Reactive Power
<b>1-1:69.7.0</b>	3 : Register	Ch. 1	Phase C Instantaneous Import Apparent Power
<b>1-1:70.7.0</b>	3 : Register	Ch. 1	Phase C Instantaneous Export Apparent Power
<b>1-1:71.7.0</b>	3 : Register	Ch. 1	Current - Phase C
<b>1-1:72.7.0</b>	3 : Register	Ch. 1	Voltage - Phase C
<b>1-1:73.7.0</b>	3 : Register	Ch. 1	Power Factor - Phase C

OBIS	Class	Channel	Descriptions
1-1:81.7.1	3 : Register	Ch. 1	Angle of U(L2) - U(L1)
1-1:81.7.2	3 : Register	Ch. 1	Angle of U(L3) - U(L1)
1-1:81.7.4	3 : Register	Ch. 1	Angle of I(L1) - U(L1)
1-1:81.7.15	3 : Register	Ch. 1	Angle of I(L2) - U(L2)
1-1:81.7.26	3 : Register	Ch. 1	Angle of I(L3) - U(L3)
1-1:81.7.45	3 : Register	Ch. 1	Angle of I(L2) - I(L1)
1-1:81.7.46	3 : Register	Ch. 1	Angle of I(L3) - I(L1)

### A.3. OBIS Codes - Channel 2

Channel 2 is for the data of the 1<sup>st</sup> channel of the dual channel.

OBIS	Class	Channel	Description
1-2:1.2.0	3 : Register	Ch. 2	Import Active Cumulative Maximum Demand Total
1-2:1.2.1	3 : Register	Ch. 2	Import Active Cumulative Maximum Demand Rate 1
1-2:1.2.2	3 : Register	Ch. 2	Import Active Cumulative Maximum Demand Rate 2
1-2:1.2.3	3 : Register	Ch. 2	Import Active Cumulative Maximum Demand Rate 3
1-2:1.2.4	3 : Register	Ch. 2	Import Active Cumulative Maximum Demand Rate 4
1-2:1.7.0	3 : Register	Ch. 2	Instantaneous import Active Power Sum
1-2:1.8.0	3 : Register	Ch. 2	Import Active Energy Total
1-2:1.8.1	3 : Register	Ch. 2	Import Active Energy Rate 1
1-2:1.8.2	3 : Register	Ch. 2	Import Active Energy Rate 2
1-2:1.8.3	3 : Register	Ch. 2	Import Active Energy Rate 3
1-2:1.8.4	3 : Register	Ch. 2	Import Active Energy Rate 4
1-2:1.9.0	3 : Register	Ch. 2	Import Active Monthly Energy Consumption Total
1-2:1.9.1	3 : Register	Ch. 2	Import Active Monthly Energy Consumption Rate 1
1-2:1.9.2	3 : Register	Ch. 2	Import Active Monthly Energy Consumption Rate 2
1-2:1.9.3	3 : Register	Ch. 2	Import Active Monthly Energy Consumption Rate 3
1-2:1.9.4	3 : Register	Ch. 2	Import Active Monthly Energy Consumption Rate 4

OBIS	Class	Channel	Description
1-2:2.2.0	3 : Register	Ch. 2	Export Active Cumulative Maximum Demand Total
1-2:2.2.1	3 : Register	Ch. 2	Export Active Cumulative Maximum Demand Rate 1
1-2:2.2.2	3 : Register	Ch. 2	Export Active Cumulative Maximum Demand Rate 2
1-2:2.2.3	3 : Register	Ch. 2	Export Active Cumulative Maximum Demand Rate 3
1-2:2.2.4	3 : Register	Ch. 2	Export Active Cumulative Maximum Demand Rate 4
1-2:2.7.0	3 : Register	Ch. 2	Instantaneous Export Active Power sum
1-2:2.8.0	3 : Register	Ch. 2	Export Active Energy Total
1-2:2.8.1	3 : Register	Ch. 2	Export Active Energy Rate 1
1-2:2.8.2	3 : Register	Ch. 2	Export Active Energy Rate 2
1-2:2.8.3	3 : Register	Ch. 2	Export Active Energy Rate 3
1-2:2.8.4	3 : Register	Ch. 2	Export Active Energy Rate 4
1-2:2.9.0	3 : Register	Ch. 2	Export Active Monthly Energy Consumption Total
1-2:2.9.1	3 : Register	Ch. 2	Export Active Monthly Energy Consumption Rate 1
1-2:2.9.2	3 : Register	Ch. 2	Export Active Monthly Energy Consumption Rate 2
1-2:2.9.3	3 : Register	Ch. 2	Export Active Monthly Energy Consumption Rate 3
1-2:2.9.4	3 : Register	Ch. 2	Export Active Monthly Energy Consumption Rate 4
1-2:3.2.0	3 : Register	Ch. 2	Import Reactive Cumulative Maximum Demand Total
1-2:3.2.1	3 : Register	Ch. 2	Import Reactive Cumulative Maximum Demand Rate 1
1-2:3.2.2	3 : Register	Ch. 2	Import Reactive Cumulative Maximum Demand Rate 2
1-2:3.2.3	3 : Register	Ch. 2	Import Reactive Cumulative Maximum Demand Rate 3
1-2:3.2.4	3 : Register	Ch. 2	Import Reactive Cumulative Maximum Demand Rate 4
1-2:3.7.0	3 : Register	Ch. 2	Instantaneous Import Reactive Power Sum
1-2:3.8.0	3 : Register	Ch. 2	Import Reactive Energy Total
1-2:3.8.1	3 : Register	Ch. 2	Import Reactive Energy Rate 1
1-2:3.8.2	3 : Register	Ch. 2	Import Reactive Energy Rate 2
1-2:3.8.3	3 : Register	Ch. 2	Import Reactive Energy Rate 3
1-2:3.8.4	3 : Register	Ch. 2	Import Reactive Energy Rate 4
1-2:3.9.0	3 : Register	Ch. 2	Import Reactive Monthly Energy Consumption Total



OBIS	Class	Channel	Description
1-2:3.9.1	3 : Register	Ch. 2	Import Reactive Monthly Energy Consumption Rate 1
1-2:3.9.2	3 : Register	Ch. 2	Import Reactive Monthly Energy Consumption Rate 2
1-2:3.9.3	3 : Register	Ch. 2	Import Reactive Monthly Energy Consumption Rate 3
1-2:3.9.4	3 : Register	Ch. 2	Import Reactive Monthly Energy Consumption Rate 4
1-2:4.2.0	3 : Register	Ch. 2	Import Reactive Rising Demand
1-2:4.2.1	3 : Register	Ch. 2	Export Reactive Cumulative Maximum Demand Total
1-2:4.2.2	3 : Register	Ch. 2	Export Reactive Cumulative Maximum Demand Rate 1
1-2:4.2.3	3 : Register	Ch. 2	Export Reactive Cumulative Maximum Demand Rate 2
1-2:4.2.4	3 : Register	Ch. 2	Export Reactive Cumulative Maximum Demand Rate 3
1-2:4.7.0	3 : Register	Ch. 2	Instantaneous Export Reactive Power Sum
1-2:4.8.0	3 : Register	Ch. 2	Export Reactive Energy Total
1-2:4.8.1	3 : Register	Ch. 2	Export Reactive Energy Rate 1
1-2:4.8.2	3 : Register	Ch. 2	Export Reactive Energy Rate 2
1-2:4.8.3	3 : Register	Ch. 2	Export Reactive Energy Rate 3
1-2:4.8.4	3 : Register	Ch. 2	Export Reactive Energy Rate 4
1-2:4.9.0	3 : Register	Ch. 2	Export Reactive Monthly Energy Consumption Total
1-2:4.9.1	3 : Register	Ch. 2	Export Reactive Monthly Energy Consumption Rate 1
1-2:4.9.2	3 : Register	Ch. 2	Export Reactive Monthly Energy Consumption Rate 2
1-2:4.9.3	3 : Register	Ch. 2	Export Reactive Monthly Energy Consumption Rate 3
1-2:4.9.4	3 : Register	Ch. 2	Export Reactive Monthly Energy Consumption Rate 4
1-2:9.2.0	3 : Register	Ch. 2	Import Apparent Cumulative Maximum Demand Total
1-2:9.2.1	3 : Register	Ch. 2	Import Apparent Cumulative Maximum Demand Rate 1
1-2:9.2.2	3 : Register	Ch. 2	Import Apparent Cumulative Maximum Demand Rate 2
1-2:9.2.3	3 : Register	Ch. 2	Import Apparent Cumulative Maximum Demand Rate 3
1-2:9.2.4	3 : Register	Ch. 2	Import Apparent Cumulative Maximum Demand Rate 4
1-2:9.7.0	3 : Register	Ch. 2	Instantaneous Import Apparent Power Sum
1-2:9.8.0	3 : Register	Ch. 2	Import Apparent Energy Total
1-2:9.8.1	3 : Register	Ch. 2	Import Apparent Energy Rate 1

OBIS	Class	Channel	Description
1-2:9.8.2	3 : Register	Ch. 2	Import Apparent Energy Rate 2
1-2:9.8.3	3 : Register	Ch. 2	Import Apparent Energy Rate 3
1-2:9.8.4	3 : Register	Ch. 2	Import Apparent Energy Rate 4
1-2:9.9.0	3 : Register	Ch. 2	Import Apparent Monthly Energy Consumption Total
1-2:9.9.1	3 : Register	Ch. 2	Import Apparent Monthly Energy Consumption Rate 1
1-2:9.9.2	3 : Register	Ch. 2	Import Apparent Monthly Energy Consumption Rate 2
1-2:9.9.3	3 : Register	Ch. 2	Import Apparent Monthly Energy Consumption Rate 3
1-2:9.9.4	3 : Register	Ch. 2	Import Apparent Monthly Energy Consumption Rate 4
1-2:10.2.0	3 : Register	Ch. 2	Export Apparent Cumulative Maximum Demand Total
1-2:10.2.1	3 : Register	Ch. 2	Export Apparent Cumulative Maximum Demand Rate 1
1-2:10.2.2	3 : Register	Ch. 2	Export Apparent Cumulative Maximum Demand Rate 2
1-2:10.2.3	3 : Register	Ch. 2	Export Apparent Cumulative Maximum Demand Rate 3
1-2:10.2.4	3 : Register	Ch. 2	Export Apparent Cumulative Maximum Demand Rate 4
1-2:10.7.0	3 : Register	Ch. 2	Export Apparent Power - Sum
1-2:10.8.0	3 : Register	Ch. 2	Export Apparent Energy Total
1-2:10.8.1	3 : Register	Ch. 2	Export Apparent Energy Rate 1
1-2:10.8.2	3 : Register	Ch. 2	Export Apparent Energy Rate 2
1-2:10.8.3	3 : Register	Ch. 2	Export Apparent Energy Rate 3
1-2:10.8.4	3 : Register	Ch. 2	Export Apparent Energy Rate 4
1-2:10.9.0	3 : Register	Ch. 2	Export Apparent Monthly Energy Consumption Total
1-2:10.9.1	3 : Register	Ch. 2	Export Apparent Monthly Energy Consumption Rate 1
1-2:10.9.2	3 : Register	Ch. 2	Export Apparent Monthly Energy Consumption Rate 2
1-2:10.9.3	3 : Register	Ch. 2	Export Apparent Monthly Energy Consumption Rate 3
1-2:10.9.4	3 : Register	Ch. 2	Export Apparent Monthly Energy Consumption Rate 4
1-2:13.0.0	3 : Register	Ch. 2	Monthly Average Power Factor
1-2:13.0.1	3 : Register	Ch. 2	Monthly Average Power Factor Rate 1
1-2:13.0.2	3 : Register	Ch. 2	Monthly Average Power Factor Rate 2
1-2:13.0.3	3 : Register	Ch. 2	Monthly Average Power Factor Rate 3

OBIS	Class	Channel	Description
1-2:13.0.4	3 : Register	Ch. 2	Monthly Average Power Factor Rate 4
1-2:13.7.0	3 : Register	Ch. 2	Instantaneous Power Factor
1-2:14.7.0	3 : Register	Ch. 2	Instantaneous Frequency
1-2:15.7.0	3 : Register	Ch. 2	Instantaneous Total Active Power
1-2:21.7.0	3 : Register	Ch. 2	Phase A Instantaneous Import Active Power
1-2:22.7.0	3 : Register	Ch. 2	Phase A Instantaneous Export Active Power
1-2:23.7.0	3 : Register	Ch. 2	Phase A Instantaneous Import Reactive Power
1-2:24.7.0	3 : Register	Ch. 2	Phase A Instantaneous Export Reactive Power
1-2:29.7.0	3 : Register	Ch. 2	Phase A Instantaneous Import Apparent Power
1-2:30.7.0	3 : Register	Ch. 2	Phase A Instantaneous Export Apparent Power
1-2:31.7.0	3 : Register	Ch. 2	Current - Phase A
1-2:32.7.0	3 : Register	Ch. 2	Voltage - Phase A
1-2:33.7.0	3 : Register	Ch. 2	Power Factor - Phase A
1-2:41.7.0	3 : Register	Ch. 2	Phase B Instantaneous Import Active Power
1-2:42.7.0	3 : Register	Ch. 2	Phase B Instantaneous Export Active Power
1-2:43.7.0	3 : Register	Ch. 2	Phase B Instantaneous Import Reactive Power
1-2:44.7.0	3 : Register	Ch. 2	Phase B Instantaneous Export Reactive Power
1-2:49.7.0	3 : Register	Ch. 2	Phase B Instantaneous Import Apparent Power
1-2:50.7.0	3 : Register	Ch. 2	Phase B Instantaneous Export Apparent Power
1-2:51.7.0	3 : Register	Ch. 2	Current - Phase B
1-2:52.7.0	3 : Register	Ch. 2	Voltage - Phase B
1-2:53.7.0	3 : Register	Ch. 2	Power Factor - Phase B
1-2:61.7.0	3 : Register	Ch. 2	Phase C Instantaneous Import Active Power
1-2:62.7.0	3 : Register	Ch. 2	Phase C Instantaneous Export Active Power
1-2:63.7.0	3 : Register	Ch. 2	Phase C Instantaneous Import Reactive Power
1-2:64.7.0	3 : Register	Ch. 2	Phase C Instantaneous Export Reactive Power
1-2:69.7.0	3 : Register	Ch. 2	Phase C Instantaneous Import Apparent Power
1-2:70.7.0	3 : Register	Ch. 2	Phase C Instantaneous Export Apparent Power

OBIS	Class	Channel	Description
1-2:71.7.0	3 : Register	Ch. 2	Current - Phase C
1-2:72.7.0	3 : Register	Ch. 2	Voltage - Phase C
1-2:73.7.0	3 : Register	Ch. 2	Power Factor - Phase C
1-2:81.7.1	3 : Register	Ch. 2	Angle of U(L2) - U(L1)
1-2:81.7.2	3 : Register	Ch. 2	Angle of U(L3) - U(L1)
1-2:81.7.4	3 : Register	Ch. 2	Angle of I(L1) - U(L1)
1-2:81.7.15	3 : Register	Ch. 2	Angle of I(L2) - U(L2)
1-2:81.7.26	3 : Register	Ch. 2	Angle of I(L3) - U(L3)
1-2:81.7.45	3 : Register	Ch. 2	Angle of I(L2) - I(L1)
1-2:81.7.46	3 : Register	Ch. 2	Angle of I(L3) - I(L1)

### A.3. OBIS Codes - Channel 3

Channel 3 is for the data of the 2<sup>nd</sup> channel of the dual channel.

OBIS	Class	Channel	Description
1-3:1.2.0	3 : Register	Ch. 3	Import Active Cumulative Maximum Demand Total
1-3:1.2.1	3 : Register	Ch. 3	Import Active Cumulative Maximum Demand Rate 1
1-3:1.2.2	3 : Register	Ch. 3	Import Active Cumulative Maximum Demand Rate 2
1-3:1.2.3	3 : Register	Ch. 3	Import Active Cumulative Maximum Demand Rate 3
1-3:1.2.4	3 : Register	Ch. 3	Import Active Cumulative Maximum Demand Rate 4
1-3:1.7.0	3 : Register	Ch. 3	Instantaneous import Active Power Sum
1-3:1.8.0	3 : Register	Ch. 3	Import Active Energy Total
1-3:1.8.1	3 : Register	Ch. 3	Import Active Energy Rate 1
1-3:1.8.2	3 : Register	Ch. 3	Import Active Energy Rate 2
1-3:1.8.3	3 : Register	Ch. 3	Import Active Energy Rate 3
1-3:1.8.4	3 : Register	Ch. 3	Import Active Energy Rate 4
1-3:1.9.0	3 : Register	Ch. 3	Import Active Monthly Energy Consumption Total

OBIS	Class	Channel	Description
1-3:1.9.1	3 : Register	Ch. 3	Import Active Monthly Energy Consumption Rate 1
1-3:1.9.2	3 : Register	Ch. 3	Import Active Monthly Energy Consumption Rate 2
1-3:1.9.3	3 : Register	Ch. 3	Import Active Monthly Energy Consumption Rate 3
1-3:1.9.4	3 : Register	Ch. 3	Import Active Monthly Energy Consumption Rate 4
1-3:2.2.0	3 : Register	Ch. 3	Export Active Cumulative Maximum Demand Total
1-3:2.2.1	3 : Register	Ch. 3	Export Active Cumulative Maximum Demand Rate 1
1-3:2.2.2	3 : Register	Ch. 3	Export Active Cumulative Maximum Demand Rate 2
1-3:2.2.3	3 : Register	Ch. 3	Export Active Cumulative Maximum Demand Rate 3
1-3:2.2.4	3 : Register	Ch. 3	Export Active Cumulative Maximum Demand Rate 4
1-3:2.7.0	3 : Register	Ch. 3	Instantaneous Export Active Power sum
1-3:2.8.0	3 : Register	Ch. 3	Export Active Energy Total
1-3:2.8.1	3 : Register	Ch. 3	Export Active Energy Rate 1
1-3:2.8.2	3 : Register	Ch. 3	Export Active Energy Rate 2
1-3:2.8.3	3 : Register	Ch. 3	Export Active Energy Rate 3
1-3:2.8.4	3 : Register	Ch. 3	Export Active Energy Rate 4
1-3:2.9.0	3 : Register	Ch. 3	Export Active Monthly Energy Consumption Total
1-3:2.9.1	3 : Register	Ch. 3	Export Active Monthly Energy Consumption Rate 1
1-3:2.9.2	3 : Register	Ch. 3	Export Active Monthly Energy Consumption Rate 2
1-3:2.9.3	3 : Register	Ch. 3	Export Active Monthly Energy Consumption Rate 3
1-3:2.9.4	3 : Register	Ch. 3	Export Active Monthly Energy Consumption Rate 4
1-3:3.2.0	3 : Register	Ch. 3	Import Reactive Cumulative Maximum Demand Total
1-3:3.2.1	3 : Register	Ch. 3	Import Reactive Cumulative Maximum Demand Rate 1
1-3:3.2.2	3 : Register	Ch. 3	Import Reactive Cumulative Maximum Demand Rate 2
1-3:3.2.3	3 : Register	Ch. 3	Import Reactive Cumulative Maximum Demand Rate 3
1-3:3.2.4	3 : Register	Ch. 3	Import Reactive Cumulative Maximum Demand Rate 4
1-3:3.7.0	3 : Register	Ch. 3	Instantaneous Import Reactive Power Sum
1-3:3.8.0	3 : Register	Ch. 3	Import Reactive Energy Total
1-3:3.8.1	3 : Register	Ch. 3	Import Reactive Energy Rate 1

OBIS	Class	Channel	Description
1-3:3.8.2	3 : Register	Ch. 3	Import Reactive Energy Rate 2
1-3:3.8.3	3 : Register	Ch. 3	Import Reactive Energy Rate 3
1-3:3.8.4	3 : Register	Ch. 3	Import Reactive Energy Rate 4
1-3:3.9.0	3 : Register	Ch. 3	Import Reactive Monthly Energy Consumption Total
1-3:3.9.1	3 : Register	Ch. 3	Import Reactive Monthly Energy Consumption Rate 1
1-3:3.9.2	3 : Register	Ch. 3	Import Reactive Monthly Energy Consumption Rate 2
1-3:3.9.3	3 : Register	Ch. 3	Import Reactive Monthly Energy Consumption Rate 3
1-3:3.9.4	3 : Register	Ch. 3	Import Reactive Monthly Energy Consumption Rate 4
1-3:4.2.0	3 : Register	Ch. 3	Export Reactive Cumulative Maximum Demand Total
1-3:4.2.1	3 : Register	Ch. 3	Export Reactive Cumulative Maximum Demand Rate 1
1-3:4.2.2	3 : Register	Ch. 3	Export Reactive Cumulative Maximum Demand Rate 2
1-3:4.2.3	3 : Register	Ch. 3	Export Reactive Cumulative Maximum Demand Rate 3
1-3:4.2.4	3 : Register	Ch. 3	Export Reactive Cumulative Maximum Demand Rate 4
1-3:4.7.0	3 : Register	Ch. 3	Instantaneous Export Reactive Power Sum
1-3:4.8.0	3 : Register	Ch. 3	Export Reactive Energy Total
1-3:4.8.1	3 : Register	Ch. 3	Export Reactive Energy Rate 1
1-3:4.8.2	3 : Register	Ch. 3	Export Reactive Energy Rate 2
1-3:4.8.3	3 : Register	Ch. 3	Export Reactive Energy Rate 3
1-3:4.8.4	3 : Register	Ch. 3	Export Reactive Energy Rate 4
1-3:4.9.0	3 : Register	Ch. 3	Export Reactive Monthly Energy Consumption Total
1-3:4.9.1	3 : Register	Ch. 3	Export Reactive Monthly Energy Consumption Rate 1
1-3:4.9.2	3 : Register	Ch. 3	Export Reactive Monthly Energy Consumption Rate 2
1-3:4.9.3	3 : Register	Ch. 3	Export Reactive Monthly Energy Consumption Rate 3
1-3:4.9.4	3 : Register	Ch. 3	Export Reactive Monthly Energy Consumption Rate 4
1-3:9.2.0	3 : Register	Ch. 3	Import Apparent Cumulative Maximum Demand Total
1-3:9.2.1	3 : Register	Ch. 3	Import Apparent Cumulative Maximum Demand Rate 1
1-3:9.2.2	3 : Register	Ch. 3	Import Apparent Cumulative Maximum Demand Rate 2
1-3:9.2.3	3 : Register	Ch. 3	Import Apparent Cumulative Maximum Demand Rate 3

OBIS	Class	Channel	Description
1-3:9.2.4	3 : Register	Ch. 3	Import Apparent Cumulative Maximum Demand Rate 4
1-3:9.7.0	3 : Register	Ch. 3	Instantaneous Import Apparent Power Sum
1-3:9.8.0	3 : Register	Ch. 3	Import Apparent Energy Total
1-3:9.8.1	3 : Register	Ch. 3	Import Apparent Energy Rate 1
1-3:9.8.2	3 : Register	Ch. 3	Import Apparent Energy Rate 2
1-3:9.8.3	3 : Register	Ch. 3	Import Apparent Energy Rate 3
1-3:9.8.4	3 : Register	Ch. 3	Import Apparent Energy Rate 4
1-3:9.9.0	3 : Register	Ch. 3	Import Apparent Monthly Energy Consumption Total
1-3:9.9.1	3 : Register	Ch. 3	Import Apparent Monthly Energy Consumption Rate 1
1-3:9.9.2	3 : Register	Ch. 3	Import Apparent Monthly Energy Consumption Rate 2
1-3:9.9.3	3 : Register	Ch. 3	Import Apparent Monthly Energy Consumption Rate 3
1-3:9.9.4	3 : Register	Ch. 3	Import Apparent Monthly Energy Consumption Rate 4
1-3:10.2.0	3 : Register	Ch. 3	Export Apparent Cumulative Maximum Demand Total
1-3:10.2.1	3 : Register	Ch. 3	Export Apparent Cumulative Maximum Demand Rate 1
1-3:10.2.2	3 : Register	Ch. 3	Export Apparent Cumulative Maximum Demand Rate 2
1-3:10.2.3	3 : Register	Ch. 3	Export Apparent Cumulative Maximum Demand Rate 3
1-3:10.2.4	3 : Register	Ch. 3	Export Apparent Cumulative Maximum Demand Rate 4
1-3:10.7.0	3 : Register	Ch. 3	Export Apparent Power - Sum
1-3:10.8.0	3 : Register	Ch. 3	Export Apparent Energy Total
1-3:10.8.1	3 : Register	Ch. 3	Export Apparent Energy Rate 1
1-3:10.8.2	3 : Register	Ch. 3	Export Apparent Energy Rate 2
1-3:10.8.3	3 : Register	Ch. 3	Export Apparent Energy Rate 3
1-3:10.8.4	3 : Register	Ch. 3	Export Apparent Energy Rate 4
1-3:10.9.0	3 : Register	Ch. 3	Export Apparent Monthly Energy Consumption Total
1-3:10.9.1	3 : Register	Ch. 3	Export Apparent Monthly Energy Consumption Rate 1
1-3:10.9.2	3 : Register	Ch. 3	Export Apparent Monthly Energy Consumption Rate 2
1-3:10.9.3	3 : Register	Ch. 3	Export Apparent Monthly Energy Consumption Rate 3
1-3:10.9.4	3 : Register	Ch. 3	Export Apparent Monthly Energy Consumption Rate 4

OBIS	Class	Channel	Description
1-3:13.0.0	3 : Register	Ch. 3	Monthly Average Power Factor
1-3:13.0.1	3 : Register	Ch. 3	Monthly Average Power Factor Rate 1
1-3:13.0.2	3 : Register	Ch. 3	Monthly Average Power Factor Rate 2
1-3:13.0.3	3 : Register	Ch. 3	Monthly Average Power Factor Rate 3
1-3:13.0.4	3 : Register	Ch. 3	Monthly Average Power Factor Rate 4
1-3:13.7.0	3 : Register	Ch. 3	Instantaneous Power Factor
1-3:14.7.0	3 : Register	Ch. 3	Instantaneous Frequency
1-3:15.7.0	3 : Register	Ch. 3	Instantaneous Total Active Power
1-3:21.7.0	3 : Register	Ch. 3	Phase A Instantaneous Import Active Power
1-3:22.7.0	3 : Register	Ch. 3	Phase A Instantaneous Export Active Power
1-3:23.7.0	3 : Register	Ch. 3	Phase A Instantaneous Import Reactive Power
1-3:24.7.0	3 : Register	Ch. 3	Phase A Instantaneous Export Reactive Power
1-3:29.7.0	3 : Register	Ch. 3	Phase A Instantaneous Import Apparent Power
1-3:30.7.0	3 : Register	Ch. 3	Phase A Instantaneous Export Apparent Power
1-3:31.7.0	3 : Register	Ch. 3	Current - Phase A
1-3:32.7.0	3 : Register	Ch. 3	Voltage - Phase A
1-3:33.7.0	3 : Register	Ch. 3	Power Factor - Phase A
1-3:41.7.0	3 : Register	Ch. 3	Phase B Instantaneous Import Active Power
1-3:42.7.0	3 : Register	Ch. 3	Phase B Instantaneous Export Active Power
1-3:43.7.0	3 : Register	Ch. 3	Phase B Instantaneous Import Reactive Power
1-3:44.7.0	3 : Register	Ch. 3	Phase B Instantaneous Export Reactive Power
1-3:49.7.0	3 : Register	Ch. 3	Phase B Instantaneous Import Apparent Power
1-3:50.7.0	3 : Register	Ch. 3	Phase B Instantaneous Export Apparent Power
1-3:51.7.0	3 : Register	Ch. 3	Current - Phase B
1-3:52.7.0	3 : Register	Ch. 3	Voltage - Phase B
1-3:53.7.0	3 : Register	Ch. 3	Power Factor - Phase B
1-3:61.7.0	3 : Register	Ch. 3	Phase C Instantaneous Import Active Power
1-3:62.7.0	3 : Register	Ch. 3	Phase C Instantaneous Export Active Power



OBIS	Class	Channel	Description
<b>1-3:63.7.0</b>	3 : Register	Ch. 3	Phase C Instantaneous Import Reactive Power
<b>1-3:64.7.0</b>	3 : Register	Ch. 3	Phase C Instantaneous Export Reactive Power
<b>1-3:69.7.0</b>	3 : Register	Ch. 3	Phase C Instantaneous Import Apparent Power
<b>1-3:70.7.0</b>	3 : Register	Ch. 3	Phase C Instantaneous Export Apparent Power
<b>1-3:71.7.0</b>	3 : Register	Ch. 3	Current - Phase C
<b>1-3:72.7.0</b>	3 : Register	Ch. 3	Voltage - Phase C
<b>1-3:73.7.0</b>	3 : Register	Ch. 3	Power Factor - Phase C
<b>1-3:81.7.1</b>	3 : Register	Ch. 3	Angle of U(L2) - U(L1)
<b>1-3:81.7.2</b>	3 : Register	Ch. 3	Angle of U(L3) - U(L1)
<b>1-3:81.7.4</b>	3 : Register	Ch. 3	Angle of I(L1) - U(L1)
<b>1-3:81.7.15</b>	3 : Register	Ch. 3	Angle of I(L2) - U(L2)
<b>1-3:81.7.26</b>	3 : Register	Ch. 3	Angle of I(L3) - U(L3)
<b>1-3:81.7.45</b>	3 : Register	Ch. 3	Angle of I(L2) - I(L1)
<b>1-3:81.7.46</b>	3 : Register	Ch. 3	Angle of I(L3) - I(L1)

## A.4. OBIS Codes - Manufacturer Specific

OBIS	Class	Channel	Description
<b>0-0:10.138.103</b>	3 : Register	Ch. 0	LED Alarm Control
<b>0-0:240.23.0</b>	3 : Register	Ch. 0	Timing task start Date Time
<b>0-0:240.26.0</b>	3 : Register	Ch. 0	Event Alarm Control
<b>0-0:240.26.1</b>	3 : Register	Ch. 0	Trigger Events of Event log 1
<b>0-0:240.26.2</b>	3 : Register	Ch. 0	Trigger Events of Event log 2
<b>0-0:240.26.3</b>	3 : Register	Ch. 0	Trigger Events of Event log 3
<b>0-0:240.26.4</b>	3 : Register	Ch. 0	Trigger Events of Event log 4