CONTADORES DE ENERGIA ELÉTRICA

Equipamentos de monitorização de rede, de telegestão e de contagem, estáticos, combinados, para pontos de BTN monofásicos / trifásicos

EDP Box - Protocolo da interface HAN | *EDP Box - HAN protocol specification*

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REVISION HISTORY

Edition	Date	Changes description
0	MAR 2013	Edition with no reference code.
1	FEV 2017	Document renaming to DEF-C44-509/N. **3.1 Physical interface** - Clarification of the polarization of communication pins A and B and the tolerance of supply voltage on pin 6. Definition of the HAN interface isolation as an auxiliary circuit. **3.2 HAN communication module** - Definition of the HAN communication module maximum dimensions. **4.1 Addresssing** - Correction of the maximum limit of slave address. **5.1.1 General types of data** - Correction of the bit string transmission order. **5.2 Access profile** - Correction in the HAN access profile definition, that must be implemented from left to right. In the filter “HAN interface - Access profile”, the left-most byte contains the low order indexes and the right-most byte the high order indexes. **5.4.2 Load Profile** - Correction of the attribute of "average value" objects used as "capture_object" in the load profile, it should be 3 and not 2: {5,1.0.x.5.0.255,3}.

INDEX

0. INTRODUCTION

This document provides the technical specification of the HAN "Home Area Network" interface of the EDP Box.

This edition cancels and replaces the one from March of 2013, which don't has reference code attributed.

1. PURPOSE

This document defines the functional data model and communication protocol of the HAN interface of the EDP Box, a part of the InovGrid solution developed by EDP Distribuição.

The communication protocol used in this interface is Modbus with some specificities.

2. STANDARDS AND REFERENCE DOCUMENTS

This document includes provisions of other documents referenced in the appropriate places in the text, which are listed below, indicating the issue dates.

[1]	2006	MODBUS over serial line specification and implementation guide V1.02
[2]	2006	MODBUS APPLICATION PROTOCOL SPECIFICATION, V1.1b
[3]	2013	DEF-C44-506/N: Contadores de energia elétrica. Equipamentos de monitorização de rede, de telegestão e de contagem, estáticos, combinados, para pontos de BTN monofásicos / trifásicos – Especificação funcional
[4]	2015	DEF-C44-507/N: Contadores de energia elétrica. Equipamentos de monitorização de rede e de telegestão estáticos, combinados, para pontos de BTN monofásicos / trifásicos – Complemento aos standards para modelo de dados e *interfaces* de comunicação
[5]	2013	DMA-C44-506/N: Contadores de energia elétrica. Equipamentos de monitorização de rede, de telegestão e de contagem, estáticos, combinados, para pontos de BTN monofásicos / trifásicos – Características e ensaios

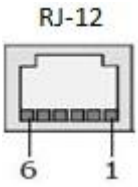
3. HAN INTERFACE

3.1 Physical interface

The physical interface in the EDP Box is available through an RJ-12 socket, uses a one pair EIA-485 specification for half-duplex communication, and has a 5 Volt supply with a tolerance of ± 10%.

The RJ-12 socket pin-out is available as follows:

Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6
GND	A (+)	B (-)	B (-)	A (+)	+5 VDC ± 10%



The EDP Box must have an internal line termination resistor of 120Ω between A and B, and the interface should be able to supply current up to 150mA through the "+5 VDC ± 10%" pin and GND.

It must be ensured galvanic isolation of this interface as an auxiliary circuit, according to section 7.3 (Dielectric Characteristics) of [5]. In any case, this physical interface must be in accordance with Annex F of [3].

3.2 HAN communication module

The HAN interface is available under the EDP Box terminal cover and its access is exclusive of EDP Distribuição. This interface supports the connection to customer's devices through an appropriate HAN communication module, with the purpose of encourage the use of energy management solutions. It will be up to the retailers and interested entities to develop this module and the associated services.

The EDP Box has a reserved space under the terminal cover to accommodate the HAN communication module, therefore the module dimensions must not exceed the following (according to Annex C of [5]):

- Height (H): 30 mm;
- Width (W): 80 mm;
- Depth (D): 20 mm.

Top view **Profile view**

The HAN communication module shall only connect wirelessly with external devices or, alternatively, by using PLC technology compliant with legal and regulatory requirements (in any case, it must never interfere with Cenelec-A band).

4. MODBUS PROTOCOL

Modbus is a request/reply protocol and offers services specified by function codes. It is an application layer messaging protocol, positioned at level 7 of the OSI model, which provides client/server communication between devices that can be connected on different types of buses or networks. In this case, an asynchronous serial line protocol over EIA-485 is used.

Layer	OSI Model	Description
7	Application	Modbus Application Protocol
6	Presentation	Empty
5	Session	Empty
4	Transport	Empty
3	Network	Empty
2	Data link	Modbus Serial Line Protocol
1	Physical	EIA/TIA 485 (or EIA/TIA 232)

There can be only one master connected to the bus, and a maximum of 247 slaves (EDP Boxes).

4.1 Addressing

The addressing is done in the first byte of the Modbus frame, and is assigned in the following way:

Broadcast Address	Slave Individual Addresses	Reserved
0	From 1 to 247	From 248 to 255

There are two addressing modes available in the protocol:

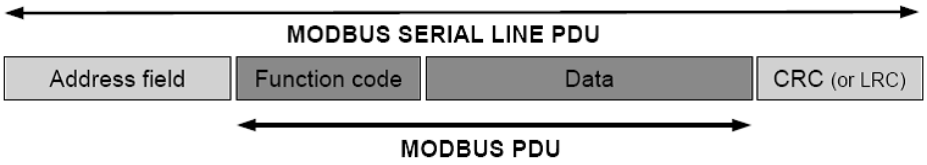
- ***Unicast mode:*** In this mode the network master addresses only one slave, and for each request there is a reply. Each slave should have a unique address in the bus, otherwise collisions are expected.
- ***Broadcast mode:*** In this mode the master addresses all slaves connected to the bus with a request and it's not expected a reply from any slave, since it would provoke bus congestion. The address field has the value 0x00 reserved for this feature.

By default, the EDP Box must have the address 0x01.

To change the address in Broadcast mode, make sure the bus has only one slave, otherwise all slaves will assume the same address and the control over the physical layer will be lost.

4.2 Modbus frame

The Modbus frame is based on the following structure:



- Address field: slave address (0x00 if broadcast);
- Function code: Type of request (e.g.: 0x04 for reading registers);
- Data: Data exchanged;
- CRC: Cyclic Redundancy Check for error checking.

Slave Address	Function Code	Data	CRC	
1 byte	1 byte	0 up to 252 bytes	CRC low	CRC high
			1 byte	1 byte

The maximum size of ModBus serial line PDU frame is 256 bytes.

4.3 Transmission mode

The transmission mode should be RTU in the following configuration (8N2):

- Start bit: 1;
- Data bits: 8;
- Parity: No;
- Stop bit: 2.

Start bit	Data bits (1 byte)								Stop bit	Stop bit
	Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7		

The first bit to be sent is the least significant of the byte. When there is more than one byte to be transmitted in the field of the message the most significant byte is sent first, followed by the lower order bytes.

By default, the communication baud rate should be 9600 bps. The communication speed should be configurable, from the minimum 9600 bps at least up to 19200 bps.

4.4 Error checking

The error checking must be done using a 16 bit CRC implemented as two 8 bit bytes.

The CRC is appended to the frame as the last field. The low order byte of the CRC is appended first, followed by the high order byte. Thus, the CRC high order byte is the last byte to be sent in the frame.

The polynomial value used to generate the CRC must be 0xA001.

5. DATA EXCHANGE

5.1 Types of data

5.1.1 General types of data

The general types of data are presented in the table below.

General types of data		
Type	**Values**	**Bytes**
Unsigned	0 to 255	1
Integer	-128 to 127	1
Long unsigned[1]	0 to 65 535	2
Long[1]	-32 768 to 32 767	2
Double long unsigned[1]	0 to 4 294 967 295	4
Double long[1]	-2 147 483 648 to 2 147 483 647	4
Octet string[1]	Sequence of octets	1 to n
Array[1]	Ordered sequence of unsigned values	1 to n
Bit string[2]	Ordered sequence of boolean values	1 to n

Note[1]: The first byte to be transmitted is the most significant one, followed by the low order bytes. In an octet string, the left-most byte is the first to be transmitted.

Note[2]: In a bit string, the first byte to be transmitted is the left-most byte (least significant byte).

5.1.2 Enumerated types of data

The enumerated types of data are presented in the following table. Those are all composed by one byte of unsigned type, whose valid values are indicated in the table.

Enumerated types of data	
Type	**Valid values**
Demand management status	(0): No active period (1): Non critical period (2): Critical period
Disconnect control state	(0): Disconnected (1): Connected (2): Ready for Re-connection (Manually)
Type of period	(1): Non critical period (2): Critical period
Measurement ID	The valid values for this enumerated type are presented in the subsection 5.6.7 - Load Profile.

5.1.3 Structured types of data

In the following tables of this subsection are presented the structured types of data used.

The first items present in the tables are the most significant bytes of the structure and the last items are the least significant bytes. The first byte to be transmitted is the most significant followed by the low order bytes, e.g., for the “Clock” (see 5.1.3.1) the first byte transmitted is the most significant byte of the “Year” and the last is the “Clock status”.

5.1.3.1 Clock

The structure “Clock” should be interpreted as follows:

Structured types of data - Clock			
Description	**Bytes**	**Types**	**Expected values**
Year	2	Long unsigned	2000 to 2099
Month	1	Unsigned	1 - January to 12 - December
Day of month	1	Unsigned	1 to 31
Weekday	1	Unsigned	1 - Monday to 7 - Sunday
Hour	1	Unsigned	0 to 23
Minute	1	Unsigned	0 to 59
Second	1	Unsigned	0 to 59
Hundredths of second	1	Unsigned	0 to 99
Deviation (from local to GMT)	2	Long	-720 to 720 minutes
Clock status	1	Unsigned	0x00 - Winter; 0x80 - Summer

5.1.3.2 Demand Management period

The structure “Demand management period” should be interpreted as follows:

Structured types of data - Demand Management period		
Description	**Bytes**	**Types**
Type of period	1	Type of period
Start period	12	Clock
End period	12	Clock
Decrease percentage	1	Unsigned
Absolute power value	4	Double long unsigned

5.2 Access profile

The configuration of the access profile, for the information/registers available through the HAN interface, is done through the EDP Box’s DLMS interface, where authentication is required.

All Modbus registers presented in section 5.6 - Registers Address - have an associated index that should be used as the reference index in the access control bit string filter.

For instance, if bit 4 of the string filter (bit string[4]) has the value “1” this means that register with index 4 (address 0x0004) is accessible to the Modbus master. The bit 0 of the array has no meaning, once there is no index 0 or address 0x0000 defined.

In the bit string filter “HAN interface - Access profile”, the left-most byte contains the low order indexes and the right-most byte the high order indexes. The size of this bit string filter is fixed and equal to 256 positions, so the non-meaningful bits should be padded with zeros in the transmission. As defined to the bit strings, the “HAN interface - Access profile” register is transmitted from the left-most byte to the right-most byte.

HAN interface - Access profile															
Byte 0								Byte 1 to 30	Byte 31						
Bit 0	**Bit 1**	**Bit 2**	**Bit 3**	**Bit 4**	**Bit 5**	**Bit 6**	**Bit 7**	…	**Bit 248**	**Bit 249**	**Bit 250**	**Bit 251**	**Bit 252**	**Bit 253**	**Bit 254**	**Bit 255**
0	0 or 1	0 or 1	0 or 1	0 or 1	0 or 1	0 or 1	0 or 1	…	0	0	0	0	0	0	0	0
Not used	Index 1	Index 2	Index 3	Index 4	Index 5	Index 6	Index 7	…	Padding							

If the Modbus master requests access to a register that is not enabled, an error message with the exception code 0x81 “ACCESS DENIED” must be returned (see subsection 5.5 - **Exception codes**).

5.3 Status control

To allow the Modbus master to perform the management of some functionalities of the EDP Box, there is a specific register which typically will be read frequently to present its current status.

This register is named “Status Control” (address 0x0009) and it is composed by a two positions array (2 bytes) with the structure presented in the following table.

Status Control															
Array[1]								Array[0]							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Reserved for future use				Demand management status		Load profile’s reset counter		Load profile’s entries counter							

The right-most position (array[0]) of “Status Control” is assigned to the “Load profile’s entries counter”. This counter should be incremented for each new entry of load profile buffer, so the Modbus master can recognize at any time if there is a newer entry in the buffer. If this counter reaches its limit (value 255) it will overflow and reinitialize (value 0) when incremented again.

The two least significant bits of left-most position (array[1]) of “Status Control” are assigned to the “Load profile’s reset counter”. This 2-bit counter should be incremented for each reset of load profile, which occurs when there is a configuration of the measurements to be captured in the load profile. When the Modbus master detects a change in this counter, it should read the “Load profile - Configured measurements” to recognize the new configuration (see 5.4.2 - Load Profile). If this counter reaches its limit (value 3) it will overflow and reinitialize (value 0) when incremented again.

The bits 2 and 3 of left-most position (array[1]) are assigned to the “Demand management status”, holding information about the currently active demand management period (the admissible values for this status are defined in 5.1.2 - Enumerated types of data).

The Modbus master should read this register with an appropriate frequency to conveniently manage the:

- Load profile access - avoiding the need to read the last entry of load profile to recognize a new entry or a new configuration;
- Demand management status - to eventually take actions according to the active demand management period.

5.4 Function codes description

The functions to be used in the Modbus protocol of EDP Box's HAN interface and the content of the Modbus PDU frame (see 4.2 Modbus frame) are defined in the following subsections.

When addresses and data items larger than a single byte are transmitted, the most significant byte is sent first.

5.4.1 General purpose

The general purpose functions (current subsection) have public function codes, so their definition is according to document [2].

All addresses used in the frames are defined in the subsection 5.6 - Registers Address.

5.4.1.1 Read input registers

This function is used to read registers of the EDP Box.

Request:

READ INPUT REGISTERS - REQUEST	Bytes	Value
Function code	1	0x04
Starting Address	2	0x0001 to 0xFFFF
Quantity of Input Registers	2	0x0001 to 0x007D[1]

Note [1]: The quantity of registers to be read combined with all other fields in the expected reply must not exceed the 256 bytes of allowable Modbus messages length.

Response:

READ INPUT REGISTERS - RESPONSE	Bytes	Value
Function code	1	0x04
Byte count	1	n
Input Registers	n	

n = even number of bytes returned, containing the values of the requested Input Registers.

Note: If the content of returned Input Registers is not a multiple of two bytes, then the PDU frame must be padded in the right-most position with a zero byte (last transmitted byte). The type and size of each register are indicated in subsection 5.6 - Registers Address.

Error:

READ INPUT REGISTERS - ERROR	Bytes	Value
Function code	1	0x84
Exception code	1	0x01, 0x02, 0x03, 0x04 or 0x81

Example:

Read the "Active core firmware Id" (register address 0x0004).

READ INPUT REGISTERS - EXAMPLE			
REQUEST		**RESPONSE**	
Field name	**Value (Hex)**	**Field name**	**Value (Hex)**
Function code	04	**Function code**	04
Starting Address (MSB)	00	**Byte count**	06
Starting Address (LSB)	04	**Register 0x0004 (MSB - 5th byte)**	XX
Quantity of Input Registers (MSB)	00	**Register 0x0004 (4th byte)**	XX
Quantity of Input Registers (LSB)	01	**Register 0x0004 (3th byte)**	XX
		Register 0x0004 (2nd byte)	XX
		Register 0x0004 (LSB - 1st byte)	XX
		Padding	00

5.4.1.2 Write single register

This function is used exclusively to write the EDP Box Modbus address. Therefore, the only admissible address in the "Register Address" field of this function is the 0x0007 (HAN interface - Modbus address).

Request:

WRITE SINGLE REGISTER – REQUEST	Bytes	Value
Function code	1	0x06
Register Address	2	0x0007
Register Value	2	0x0001 to 0x00F7[1]

Note [1]: Limitation according to 4.1 - Addressing.

Response:

WRITE SINGLE REGISTER – RESPONSE	Bytes	Value
Function code	1	0x06
Register Address	2	0x0007
Register Value	2	0x0001 to 0x00F7

Error:

WRITE SINGLE REGISTER - ERROR	Bytes	Value
Function code	1	0x86
Exception code	1	0x01, 0x02, 0x03, 0x04 or 0x81

Example:

Write the “HAN interface - Modbus address” (register address 0x0007 with value 0x0001).

WRITE SINGLE REGISTER - EXAMPLE			
REQUEST		**RESPONSE**	
Field name	**Value (Hex)**	**Field name**	**Value (Hex)**
Function code	06	**Function code**	06
Register Address (MSB)	00	**Register Address (MSB)**	00
Register Address (LSB)	07	**Register Address (LSB)**	07
Register Value (MSB)	00	**Register Value (MSB)**	00
Register Value (LSB)	01	**Register Value (LSB)**	01

5.4.2 Load Profile

There are two different user-defined functions to access the load profile buffer (object with the OBIS code {7,{1.0.99.1.0.255},2}), although no particular register address is explicitly referred in their request frames.

The load profile dimension may depend on the number and type of measurements configured to be captured in the buffer. The maximum load profile entries with current structure are accessible through register 0x0083 “Load profile - Profile entries”. The Modbus master should use the register 0x0082 “Load profile - Entries in use” to know the current number of occupied entries in the load profile buffer. When the load profile buffer is full the register “Load profile - Entries in use” has the same value of “Load profile - Profile entries”.

The load profile buffer is organized in a FIFO structure, so the first entry of the buffer is always the oldest one and the last entry is the newest. Accordingly, the oldest entry of the buffer is always the position 0x0001 and the newest is the correspondent position expressed in the register “Load profile - Entries in use”.

The Modbus register 0x0080 “Load profile - Configured measurements” contains relevant information about the measurements that are being recorded in the EDP Box’s load profile. It displays an array of up to 8 Measurement IDs, enabling the Modbus master to recognize the type of data that is being captured in the load profile.

The size of “Load profile - Configured measurements” array is fixed and equal to 8 positions, where each position has an unique assigned index. The “Clock” and the “AMR profile status” are always the first two objects to be captured in the load profile and consequently assigned with indexes 1 and 2, respectively, within the array. Thus, if less than 6 measurements (excluding “Clock” and “AMR profile status”) are configured to be captured in the EDP Box’s load profile, then the positions of the array with no measurements assigned should have the value 0xFF. The array should be filled considering that the left-most position is the first to be assigned and so on, since empty positions between two configured measurements are not acceptable. The first byte to be transmitted is the left-most position, followed by the next right positions until the last right-most position.

Load profile - Configured measurements							
Array[7]	**Array[6]**	**Array[5]**	**Array[4]**	**Array[3]**	**Array[2]**	**Array[1]**	**Array[0]**
Index 1	Index 2	Index 3	Index 4	Index 5	Index 6	Index 7	Index 8

The "Load profile - Configured measurements" register address (0x0080) is also used for access profile purposes, either to enable or disable the access to the EDP Box's load profile buffer through the user-defined functions.

The description of all Measurement IDs and their correspondence with the OBIS code of the captured object (defined in [4]) are presented in the table below. The "Scaler" column is related to the resolution of the received data, i.e., to determine how many decimal digits should be considered. For example, the "Last average power factor" has a scaler of "-2", so the received data of 0x00000062 (98 in decimal) corresponds to the value 0,98.

Measurement ID's of Load Profile					
Measurement ID	**Description**	**OBIS**	**Type**	**Unit**	**Scaler**
(1)	Clock	{8,{0.0.1.0.0.255},2}	Clock	-	-
(2)	AMR profile status	{1,{0.0.96.10.7.255},2}	Unsigned	-	-
(3)	Active energy (+A)	{3,{1.0.1.8.0.255},2}	Double long unsigned	Wh	0
(4)	Active energy (-A)	{3,{1.0.2.8.0.255},2}	Double long unsigned	Wh	0
(5)	Reactive energy (+Ri)	{3,{1.0.5.8.0.255},2}	Double long unsigned	VArh	0
(6)	Reactive energy (+Rc)	{3,{1.0.6.8.0.255},2}	Double long unsigned	VArh	0
(7)	Reactive energy (-Ri)	{3,{1.0.7.8.0.255},2}	Double long unsigned	VArh	0
(8)	Reactive energy (-Rc)	{3,{1.0.8.8.0.255},2}	Double long unsigned	VArh	0
(9)	Active energy (+A) inc.	{3,{1.0.1.29.0.255},2}	Double long unsigned	Wh	0
(10)	Active energy (-A) inc.	{3,{1.0.2.29.0.255},2}	Double long unsigned	Wh	0
(11)	Reactive energy (+Ri) inc.	{3,{1.0.5.29.0.255},2}	Double long unsigned	VArh	0
(12)	Reactive energy (+Rc) inc.	{3,{1.0.6.29.0.255},2}	Double long unsigned	VArh	0
(13)	Reactive energy (-Ri) inc.	{3,{1.0.7.29.0.255},2}	Double long unsigned	VArh	0
(14)	Reactive energy (-Rc) inc.	{3,{1.0.8.29.0.255},2}	Double long unsigned	VArh	0
(15)	Last average power factor	{5,{1.0.13.5.0.255},3}	Double long unsigned	-	-2
(16)	Last average voltage L1[1]	{5,{1.0.32.5.0.255},3}	Double long unsigned	V	-1
(17)	Last average voltage L2[1]	{5,{1.0.52.5.0.255},3}	Double long unsigned	V	-1
(18)	Last average voltage L3[1]	{5,{1.0.72.5.0.255},3}	Double long unsigned	V	-1
(19)	Last average any phase voltage	{5,{1.0.12.5.0.255},3}	Double long unsigned	V	-1

Note [1]: Measurement ID does only apply to three-phase EDP Boxes.

Measurement ID = 0 can be used by Modbus master to read all the configured measurements in the load profile.

Example:

Read the “Load profile - Configured measurements” (register address 0x0080).

READ “LOAD PROFILE - CONFIGURED MEASUREMENTS” – EXAMPLE			
REQUEST		**RESPONSE**	
Field name	**Value (Hex)**	**Field name**	**Value (Hex)**
Function code	04	**Function code**	04
Starting Address (MSB)	00	**Byte count**	08
Starting Address (LSB)	80	**1st Measurement ID (“Clock”)**	01
Quantity of Input Registers (MSB)	00	**2nd Measurement ID (“AMR profile status”)**	02
Quantity of Input Registers (LSB)	01	**3rd Measurement ID (“Active energy (+A) inc.”)**	09
		4th Measurement ID (“Last average any phase voltage”)	13
		5th Measurement ID (not used)	FF
		6th Measurement ID (not used)	FF
		7th Measurement ID (not used)	FF
		8th Measurement ID (not used)	FF

5.4.2.1 Read last Load Profile entries

This function is used to read the latest entries of the load profile buffer.

Request:

READ LAST LOAD PROFILE ENTRIES - REQUEST	Bytes	Value
Function code	1	0x44
Measurement ID indexes to retrieve	1	0 to 8
Quantity of Entries	1	1 to 6

The Modbus master shall use the “Measurement ID indexes to retrieve” in the request to define the information to be read in each load profile entry, where “Measurement ID indexes to retrieve” = 0 is used to read all the configured measurements in the load profile (up to 6 plus “Clock” and “AMR profile status”).

In order to properly recognize the response when using this function, the Modbus master should read register 0x0080 “Load profile - Configured measurements” in the first place.

The quantity of entries to be read in the load profile is limited to 6.

When the Modbus master requires a “Measurement ID indexes to retrieve” that doesn’t exist (out of scope) or is higher than the number of configured measurements in the EDP Box, an error message must be generated with the exception code 0x82. If the quantity of entries required is greater than the number of load profile’s entries in

use, then an error message must be generated with the exception code 0x83. For more details see subsection 5.5 - Exception codes.

Response:

READ LAST LOAD PROFILE ENTRIES - RESPONSE	Bytes	Value
Function code	1	0x44
Byte count	1	n
Entries data	n	

n = number of bytes returned, containing the data of the requested Entries

The order of the retrieved "Entries data" should be the following: the first entry to be transmitted is the most recent entry of the load profile (the last one to be stored), the second entry to be transmitted is the second most recent entry of the load profile (the penultimate one to be stored) and so on up to the last of entry to be transmitted.

Within the same entry, the first byte to be transmitted is always the most significant byte of the "Clock", followed by the lower order bytes of the "Clock" and then by the "AMR profile status" byte. Afterwards, the last bytes to be transmitted within the same entry are the ones related to the data from the Measurement IDs configured in the EDP Box up to the selected index, considering the order defined in the "Load profile - Configured measurements".

When there are multiple bytes to be transmitted on the same field of the message, the most significant byte is sent first followed by the low order bytes.

Error:

READ LAST LOAD PROFILE ENTRIES - ERROR	Bytes	Value
Function code	1	0xC4
Exception code	1	0x01, 0x02, 0x03, 0x04, 0x81, 0x82 or 0x83

Example:

Read the last load profile entry for the first three Measurements IDs configured in the load profile. The load profile configuration is according to the "Load profile - configured measurements" presented in the example of page 15.

READ LAST LOAD PROFILE ENTRIES – EXAMPLE			
REQUEST		**RESPONSE**	
Field name	**Value (Hex)**	**Field name**	**Value (Hex)**
Function code	44	**Function code**	44
Measurement ID indexes to retrieve	03	**Byte count**	11
Quantity of Entries	01	**Data of last entry 1st Measurement ID ("Clock" - MSB of "Year")**	XX
		Data of last entry 1st Measurement ID ("Clock" - LSB of "Year")	XX

READ LAST LOAD PROFILE ENTRIES – EXAMPLE			
REQUEST		RESPONSE	
Field name	Value (Hex)	Field name	Value (Hex)
		… (Total of 9 bytes - 8 fields of "Clock" - month, day of month, weekday, hour, minute, second, hundredths of second and deviation)	9x XX
		Data of last entry 1st Measurement ID ("Clock" - "Clock status")	XX
		Data of last entry 2nd Measurement ID ("AMR profile status")	XX
		Data of last entry 3rd Measurement ID ("Active energy (+A) inc." - MSB - 4th byte)	XX
		Data of last entry 3rd Measurement ID ("Active energy (+A) inc." - 3rd byte)	XX
		Data of last entry 3rd Measurement ID ("Active energy (+A) inc." - 2nd byte)	XX
		Data of last entry 3rd Measurement ID ("Active energy (+A) inc." - LSB - 1st byte)	XX

5.4.2.2 Read Load Profile entries

This function is used to read up to 6 entries of the load profile buffer.

Request:

READ LOAD PROFILE ENTRIES - REQUEST	Bytes	Value
Function code	1	0x45
Measurement ID indexes to retrieve	1	0 to 8
Start entry	4	1 to profile entries[1]
Quantity of Entries	1	1 to 6

Note [1]: The Modbus master should read the register 0x0083 "Load profile - Profile entries" in the first place, to be able to recognize the upper limit of this value.

The Modbus master shall use the "Measurement ID indexes to retrieve" in the request to define the information to be read in each load profile entry, where "Measurement ID indexes to retrieve" = 0 is used to read all the configured measurements in the load profile (up to 6 plus "Clock" and "AMR profile status").

The Modbus master should read the register 0x0082 “Load profile - Entries in use” to know the current number of occupied entries in the load profile buffer and consequently its last entry.

In order to properly recognize the response when using this function, the Modbus master should read register 0x0080 “Load profile - Configured measurements” in the first place.

The quantity of entries to be read in the load profile is limited to 6.

When the Modbus master requires a “Measurement ID indexes to retrieve” that doesn’t exist (out of scope) or is higher than the number of configured measurements in the EDP Box, an error message must be generated with the exception code 0x82. If the start entry of load profile buffer doesn’t exist in the EDP Box (out of scope) or the index of the start entry plus the quantity of entries required is greater than profile entries, then an error message must be generated with the exception code 0x83. For more details see subsection 5.5 - Exception codes.

Response:

READ LOAD PROFILE ENTRIES - RESPONSE	Bytes	Value
Function code	1	0x45
Byte count	1	n
Entries data	n	

n = number of bytes returned, containing the data of the requested Entries

The order of the retrieved “Entries data” should be the following: the first entry to be transmitted is the data from the entry defined in the “Start entry”, the second entry to be transmitted is the data from the very next position of the load profile (previous position plus 1) and so on up to the last of entry to be transmitted.

Within the same entry, the first byte to be transmitted is always the most significant byte of the “Clock”, followed by the lower order bytes of the “Clock” and then by the “AMR profile status” byte. Afterwards, the last bytes to be transmitted within the same entry are the ones related to the data from the Measurement IDs configured in the EDP Box up to the selected index, considering the order defined in the “Load profile - Configured measurements”.

When there are multiple bytes to be transmitted on the same field of the message, the most significant byte is sent first followed by the low order bytes.

Error:

READ LOAD PROFILE ENTRIES - ERROR	Bytes	Value
Function code	1	0xC5
Exception code	1	0x01, 0x02, 0x03, 0x04, 0x81, 0x82 or 0x83

Example:

Read the 6000th entry (0x00001770) of the load profile for all configured Measurement IDs in the load profile. The load profile configuration is according to the “Load profile - configured measurements” presented in the example of page 15.

READ LOAD PROFILE ENTRIES - EXAMPLE			
REQUEST		**RESPONSE**	
Field name	**Value (Hex)**	**Field name**	**Value (Hex)**
Function code	45	**Function code**	45
Measurement ID indexes to retrieve	00	**Byte count**	15
Start entry (MSB - 4th byte)	00	**Data of entry 6000 1st Measurement ID ("Clock" - MSB of "Year")**	XX
Start entry (3rd byte)	00	**Data of entry 6000 1st Measurement ID ("Clock" - LSB of "Year")**	XX
Start entry (2nd byte)	17	**… (8 fields of "Clock" - month, day of month, weekday, hour, minute, second, hundredths of second and deviation - total of 9 bytes)**	…
Start entry (LSB - 1st byte)	70	**Data of entry 6000 1st Measurement ID ("Clock" - "Clock status")**	XX
Quantity of Entries	01	**Data of entry 6000 2nd Measurement ID ("AMR profile status")**	XX
		Data of entry 6000 3rd Measurement ID ("Active energy (+A) inc." - MSB - 4th byte)	XX
		Data of entry 6000 3rd Measurement ID ("Active energy (+A) inc." - 3rd byte)	XX
		Data of entry 6000 3rd Measurement ID ("Active energy (+A) inc." - 2nd byte)	XX
		Data of entry 6000 3rd Measurement ID ("Active energy (+A) inc." - LSB - 1st byte)	XX
		Data of entry 6000 4th Measurement ID ("Last average any phase voltage" - MSB - 4th byte)	XX
		Data of entry 6000 4th Measurement ID ("Last average any phase voltage" - 3rd byte)	XX
		Data of entry 6000 4th Measurement ID ("Last average any phase voltage" - 2nd byte)	XX
		Data of entry 6000 4th Measurement ID ("Last average any phase voltage" - LSB - 1st byte)	XX

5.5 Exception codes

The available exception codes to be used in all functions are listed and described in the following table.

The exception codes from 0x01 up to 0x04 are according to the standard Modbus protocol (see document [2]) and all other are user defined.

Exception Codes			
Exception Code	**Designation**	**Description**	**Admissible functions**
0x01	ILLEGAL FUNCTION	The function code received in the query is not an allowable action for the server (or slave). This may be because the function code is only applicable to newer devices, and was not implemented in the unit selected. It could also indicate that the server (or slave) is in the wrong state to process a request of this type, for example because it is unconfigured and is being asked to return register values.	All
0x02	ILLEGAL DATA ADDRESS	The data address received in the query is not an allowable address for the server (or slave). More specifically, the combination of reference number and transfer length is invalid. For a controller with 100 registers, a request with offset 96 and length 4 would succeed a request with offset 96 and length 5 will generate exception 02.	All
0x03	ILLEGAL DATA VALUE	A value contained in the query data field is not an allowable value for the slave. This indicates a fault in the structure of the remainder of a complex request, such as that the implied length is incorrect. It specifically does NOT mean that a data item submitted for storage in a register has a value outside the expectation of the application program, since the MODBUS protocol is unaware of the significance of any particular value of any particular register.	All
0x04	SLAVE DEVICE FAILURE	An unrecoverable error occurred while the slave was attempting to perform the requested action.	All
0x81	ACCESS DENIED	The master is attempting to access a register that is not enabled in the access profile.	All
0x82	MEASUREMENT DOES NOT EXIST	Used in the following circumstances: - Measurement ID index doesn't exist (out of scope); - Measurement ID index higher than the number of configured measurements in the slave (EDP Box).	0xC4 0xC5
0x83	ENTRY DOES NOT EXIST	Used in the following circumstances: - The quantity of entries required is greater than load profile's entries in use; - The start entry doesn't exist (out of scope) - only applies to function 0x45; - The start entry plus the quantity of entries required is greater than profile entries - only applies to function 0x45.	0xC4 0xC5

5.6 Registers Address

The information available through the EDP Box's HAN interface is described in the following tables of this subsection.

All registers have a specific address and an associated index that should be used as reference to the access profile (see 5.2 - Access profile).

Each register address is related to a DLMS object of EDP Box by its OBIS code {Class ID,{Logical name}, Attribute index}. The correspondent type of data, unit and scaler are also defined. The scaler is related to the resolution of the received data, i.e., to determine how many decimal digits should be considered.

5.6.1 General Information

Registers Address - General Information						
Index	**Address**	**Description**	**OBIS**	**Type**	**Unit**	**Scaler**
1	0x0001	Clock	{8,{0.0.1.0.0.255},2}	Clock	-	-
2	0x0002	Device ID 1 - Device Serial Number	{1,{0.0.96.1.0.255},2}	Octet string[10]	-	-
3	0x0003	Device ID 2 - Manufacturer Model Codes and Year	{1,{0.0.96.1.1.255},2}	Octet string[6]	-	-
4	0x0004	Active core firmware Id.	{1,{1.0.0.2.0.255},2}	Octet string[5]	-	-
5	0x0005	Active app firmware Id.	{1,{1.1.0.2.0.255},2}	Octet string[5]	-	-
6	0x0006	Active com firmware Id.	{1,{1.2.0.2.0.255},2}	Octet string[5]	-	-
7	0x0007	HAN interface - Modbus address	{1,{0.65.0.30.5.255},2}	Unsigned	-	-
8	0x0008	HAN interface - Access profile	{1,{0.65.0.30.7.256},2}	Bit string[256]	-	-
9	0x0009	Status control[1]	-	Octet string[2]	-	-

Note [1]: This register is not related to a DLMS object of EDP Box.

5.6.2 Tariff Configuration

Registers Address - Tariff Configuration						
Index	**Address**	**Description**	**OBIS**	**Type**	**Unit**	**Scaler**
10	0x000A	Activity Calendar - Active Name	{20,{0.0.13.0.1.255},2}	Octet string[6]	-	-
11	0x000B	Currently active tariff	{1,{0.0.96.14.1.255},2}	Unsigned	-	-
12	0x000C	Active demand control threshold T1	{3,{0.1.94.35.1.255},2}	Double long unsigned	VA	0
13	0x000D	Active demand control threshold T2	{3,{0.1.94.35.2.255},2}	Double long unsigned	VA	0

Registers Address - Tariff Configuration						
Index	**Address**	**Description**	**OBIS**	**Type**	**Unit**	**Scaler**
14	0x000E	Active demand control threshold T3	{3,{0.1.94.35.3.255},2}	Double long unsigned	VA	0
15	0x000F	Active demand control threshold T4	{3,{0.1.94.35.4.255},2}	Double long unsigned	VA	0
16	0x0010	Active demand control threshold T5	{3,{0.1.94.35.5.255},2}	Double long unsigned	VA	0
17	0x0011	Active demand control threshold T6	{3,{0.1.94.35.6.255},2}	Double long unsigned	VA	0
18	0x0012	Currently apparent power threshold	{3,{0.1.94.35.31.255},2}	Double long unsigned	VA	0

5.6.3 Demand Management

Registers Address - Demand Management						
Index	**Address**	**Description**	**OBIS**	**Type**	**Unit**	**Scaler**
19	0x0013	Demand management status	{1,{0.1.94.35.64.255},2}	Demand management status	-	-
20	0x0014	Demand management period definition	{1,{0.1.94.35.60.255},2}	Demand management period	-	-
21	0x0015	Residual power threshold	{3,{0.1.94.35.61.255},2}	Double long unsigned	VA	0

5.6.4 Total Registers

Registers Address - Total Registers						
Index	**Address**	**Description**	**OBIS**	**Type**	**Unit**	**Scaler**
22	0x0016	Active energy import (+A)	{3,{1.0.1.8.0.255},2}	Double long unsigned	Wh	0
23	0x0017	Active energy export (-A)	{3,{1.0.2.8.0.255},2}	Double long unsigned	Wh	0
24	0x0018	Reactive energy QI (+Ri)	{3,{1.0.5.8.0.255},2}	Double long unsigned	VArh	0
25	0x0019	Reactive energy QII (+Rc)	{3,{1.0.6.8.0.255},2}	Double long unsigned	VArh	0
26	0x001A	Reactive energy QIII (-Ri)	{3,{1.0.7.8.0.255},2}	Double long unsigned	VArh	0
27	0x001B	Reactive energy QIV (-Rc)	{3,{1.0.8.8.0.255},2}	Double long unsigned	VArh	0
28	0x001C	Active energy import (+A) L1[1]	{3,{1.0.21.8.0.255},2}	Double long unsigned	Wh	0
29	0x001D	Active energy import (+A) L2[1]	{3,{1.0.41.8.0.255},2}	Double long unsigned	Wh	0
30	0x001E	Active energy import (+A) L3[1]	{3,{1.0.61.8.0.255},2}	Double long unsigned	Wh	0
31	0x001F	Active energy export (-A) L1[1]	{3,{1.0.22.8.0.255},2}	Double long unsigned	Wh	0

Registers Address - Total Registers						
Index	**Address**	**Description**	**OBIS**	**Type**	**Unit**	**Scaler**
32	0x0020	Active energy export (-A) L2[1]	{3,{1.0.42.8.0.255},2}	Double long unsigned	Wh	0
33	0x0021	Active energy export (-A) L3[1]	{3,{1.0.62.8.0.255},2}	Double long unsigned	Wh	0
34	0x0022	Max demand active power + (QI+QIV)	{4,{1.0.1.6.0.255},2}	Double long unsigned	W	0
35	0x0023	Max demand active power + (QI+QIV) (capture time)	{4,{1.0.1.6.0.255},5}	Clock	-	-
36	0x0024	Max demand active power - (QII+QIII)	{4,{1.0.2.6.0.255},2}	Double long unsigned	W	0
37	0x0025	Max demand active power - (QII+QIII) (capture time)	{4,{1.0.2.6.0.255},5}	Clock	-	-

Note [1]: These registers only apply to three-phase EDP Boxes.

5.6.5 Tariff Registers

Registers Address - Tariff Registers						
Index	**Address**	**Description**	**OBIS**	**Type**	**Unit**	**Scaler**
38	0x0026	Rate 1 contract 1 active energy (+A)	{3,{1.0.1.8.1.255},2}	Double long unsigned	Wh	0
39	0x0027	Rate 2 contract 1 active energy (+A)	{3,{1.0.1.8.2.255},2}	Double long unsigned	Wh	0
40	0x0028	Rate 3 contract 1 active energy (+A)	{3,{1.0.1.8.3.255},2}	Double long unsigned	Wh	0
41	0x0029	Rate 4 contract 1 active energy (+A)	{3,{1.0.1.8.4.255},2}	Double long unsigned	Wh	0
42	0x002A	Rate 5 contract 1 active energy (+A)	{3,{1.0.1.8.5.255},2}	Double long unsigned	Wh	0
43	0x002B	Rate 6 contract 1 active energy (+A)	{3,{1.0.1.8.6.255},2}	Double long unsigned	Wh	0
44	0x002C	Total Rate contract 1 active energy (+A)	{3,{1.0.1.8.10.255},2}	Double long unsigned	Wh	0
45	0x002D	Rate 1 contract 1 active energy (-A)	{3,{1.0.2.8.1.255},2}	Double long unsigned	Wh	0
46	0x002E	Rate 2 contract 1 active energy (-A)	{3,{1.0.2.8.2.255},2}	Double long unsigned	Wh	0
47	0x002F	Rate 3 contract 1 active energy (-A)	{3,{1.0.2.8.3.255},2}	Double long unsigned	Wh	0
48	0x0030	Rate 4 contract 1 active energy (-A)	{3,{1.0.2.8.4.255},2}	Double long unsigned	Wh	0
49	0x0031	Rate 5 contract 1 active energy (-A)	{3,{1.0.2.8.5.255},2}	Double long unsigned	Wh	0
50	0x0032	Rate 6 contract 1 active energy (-A)	{3,{1.0.2.8.6.255},2}	Double long unsigned	Wh	0
51	0x0033	Total Rate contract 1 active energy (-A)	{3,{1.0.2.8.10.255},2}	Double long unsigned	Wh	0
52	0x0034	Rate 1 contract 1 reactive energy QI (+Ri)	{3,{1.0.5.8.1.255},2}	Double long unsigned	VArh	0
53	0x0035	Rate 2 contract 1 reactive energy QI (+Ri)	{3,{1.0.5.8.2.255},2}	Double long unsigned	VArh	0
54	0x0036	Rate 3 contract 1 reactive energy QI (+Ri)	{3,{1.0.5.8.3.255},2}	Double long unsigned	VArh	0
55	0x0037	Rate 4 contract 1 reactive energy QI (+Ri)	{3,{1.0.5.8.4.255},2}	Double long unsigned	VArh	0
56	0x0038	Rate 5 contract 1 reactive energy QI (+Ri)	{3,{1.0.5.8.5.255},2}	Double long unsigned	VArh	0

Registers Address - Tariff Registers						
Index	**Address**	**Description**	**OBIS**	**Type**	**Unit**	**Scaler**
57	0x0039	Rate 6 contract 1 reactive energy QI (+Ri)	{3,{1.0.5.8.6.255},2}	Double long unsigned	VArh	0
58	0x003A	Total Rate contract 1 reactive energy QI (+Ri)	{3,{1.0.5.8.10.255},2}	Double long unsigned	VArh	0
59	0x003B	Rate 1 contract 1 reactive energy QII (+Rc)	{3,{1.0.6.8.1.255},2}	Double long unsigned	VArh	0
60	0x003C	Rate 2 contract 1 reactive energy QII (+Rc)	{3,{1.0.6.8.2.255},2}	Double long unsigned	VArh	0
61	0x003D	Rate 3 contract 1 reactive energy QII (+Rc)	{3,{1.0.6.8.3.255},2}	Double long unsigned	VArh	0
62	0x003E	Rate 4 contract 1 reactive energy QII (+Rc)	{3,{1.0.6.8.4.255},2}	Double long unsigned	VArh	0
63	0x003F	Rate 5 contract 1 reactive energy QII (+Rc)	{3,{1.0.6.8.5.255},2}	Double long unsigned	VArh	0
64	0x0040	Rate 6 contract 1 reactive energy QII (+Rc)	{3,{1.0.6.8.6.255},2}	Double long unsigned	VArh	0
65	0x0041	Total Rate contract 1 reactive energy QII (+Rc)	{3,{1.0.6.8.10.255},2}	Double long unsigned	VArh	0
66	0x0042	Rate 1 contract 1 reactive energy QIII (-Ri)	{3,{1.0.7.8.1.255},2}	Double long unsigned	VArh	0
67	0x0043	Rate 2 contract 1 reactive energy QIII (-Ri)	{3,{1.0.7.8.2.255},2}	Double long unsigned	VArh	0
68	0x0044	Rate 3 contract 1 reactive energy QIII (-Ri)	{3,{1.0.7.8.3.255},2}	Double long unsigned	VArh	0
69	0x0045	Rate 4 contract 1 reactive energy QIII (-Ri)	{3,{1.0.7.8.4.255},2}	Double long unsigned	VArh	0
70	0x0046	Rate 5 contract 1 reactive energy QIII (-Ri)	{3,{1.0.7.8.5.255},2}	Double long unsigned	VArh	0
71	0x0047	Rate 6 contract 1 reactive energy QIII (-Ri)	{3,{1.0.7.8.6.255},2}	Double long unsigned	VArh	0
72	0x0048	Total Rate contract 1 reactive energy QIII (-Ri)	{3,{1.0.7.8.10.255},2}	Double long unsigned	VArh	0
73	0x0049	Rate 1 contract 1 reactive energy QIV (-Rc)	{3,{1.0.8.8.1.255},2}	Double long unsigned	VArh	0
74	0x004A	Rate 2 contract 1 reactive energy QIV (-Rc)	{3,{1.0.8.8.2.255},2}	Double long unsigned	VArh	0
75	0x004B	Rate 3 contract 1 reactive energy QIV (-Rc)	{3,{1.0.8.8.3.255},2}	Double long unsigned	VArh	0
76	0x004C	Rate 4 contract 1 reactive energy QIV (-Rc)	{3,{1.0.8.8.4.255},2}	Double long unsigned	VArh	0
77	0x004D	Rate 5 contract 1 reactive energy QIV (-Rc)	{3,{1.0.8.8.5.255},2}	Double long unsigned	VArh	0
78	0x004E	Rate 6 contract 1 reactive energy QIV (-Rc)	{3,{1.0.8.8.6.255},2}	Double long unsigned	VArh	0
79	0x004F	Total Rate contract 1 reactive energy QIV (-Rc)	{3,{1.0.8.8.10.255},2}	Double long unsigned	VArh	0
80	0x0050	Rate 1 contract 1 Maximum demand active power + (last average)	{4,{1.0.1.6.1.255},2}	Double long unsigned	W	0
81	0x0051	Rate 1 contract 1 Maximum demand active power + (capture time)	{4,{1.0.1.6.1.255},5}	Clock	-	-
82	0x0052	Rate 2 contract 1 Maximum demand active power + (last average)	{4,{1.0.1.6.2.255},2}	Double long unsigned	W	0
83	0x0053	Rate 2 contract 1 Maximum demand active power + (capture time)	{4,{1.0.1.6.2.255},5}	Clock	-	-
84	0x0054	Rate 3 contract 1 Maximum demand active power + (last average)	{4,{1.0.1.6.3.255},2}	Double long unsigned	W	0
85	0x0055	Rate 3 contract 1 Maximum demand active power + (capture time)	{4,{1.0.1.6.3.255},5}	Clock	-	-
86	0x0056	Rate 4 contract 1 Maximum demand active power + (last average)	{4,{1.0.1.6.4.255},2}	Double long unsigned	W	0
87	0x0057	Rate 4 contract 1 Maximum demand active power + (capture time)	{4,{1.0.1.6.4.255},5}	Clock	-	-
88	0x0058	Rate 5 contract 1 Maximum demand active power + (last average)	{4,{1.0.1.6.5.255},2}	Double long unsigned	W	0

Registers Address - Tariff Registers						
Index	**Address**	**Description**	**OBIS**	**Type**	**Unit**	**Scaler**
89	0x0059	Rate 5 contract 1 Maximum demand active power + (capture time)	{4,{1.0.1.6.5.255},5}	Clock	-	-
90	0x005A	Rate 6 contract 1 Maximum demand active power + (last average)	{4,{1.0.1.6.6.255},2}	Double long unsigned	W	0
91	0x005B	Rate 6 contract 1 Maximum demand active power + (capture time)	{4,{1.0.1.6.6.255},5}	Clock	-	-
92	0x005C	Total Rate contract 1 Maximum demand active power + (last average)	{4,{1.0.1.6.10.255},2}	Double long unsigned	W	0
93	0x005D	Total Rate contract 1 Maximum demand active power + (capture time)	{4,{1.0.1.6.10.255},5}	Clock	-	-
94	0x005E	Rate 1 contract 1 Maximum demand active power - (last average)	{4,{1.0.2.6.1.255},2}	Double long unsigned	W	0
95	0x005F	Rate 1 contract 1 Maximum demand active power - (capture time)	{4,{1.0.2.6.1.255},5}	Clock	-	-
96	0x0060	Rate 2 contract 1 Maximum demand active power - (last average)	{4,{1.0.2.6.2.255},2}	Double long unsigned	W	0
97	0x0061	Rate 2 contract 1 Maximum demand active power - (capture time)	{4,{1.0.2.6.2.255},5}	Clock	-	-
98	0x0062	Rate 3 contract 1 Maximum demand active power - (last average)	{4,{1.0.2.6.3.255},2}	Double long unsigned	W	0
99	0x0063	Rate 3 contract 1 Maximum demand active power - (capture time)	{4,{1.0.2.6.3.255},5}	Clock	-	-
100	0x0064	Rate 4 contract 1 Maximum demand active power - (last average)	{4,{1.0.2.6.4.255},2}	Double long unsigned	W	0
101	0x0065	Rate 4 contract 1 Maximum demand active power - (capture time)	{4,{1.0.2.6.4.255},5}	Clock	-	-
102	0x0066	Rate 5 contract 1 Maximum demand active power - (last average)	{4,{1.0.2.6.5.255},2}	Double long unsigned	W	0
103	0x0067	Rate 5 contract 1 Maximum demand active power - (capture time)	{4,{1.0.2.6.5.255},5}	Clock	-	-
104	0x0068	Rate 6 contract 1 Maximum demand active power - (last average)	{4,{1.0.2.6.6.255},2}	Double long unsigned	W	0
105	0x0069	Rate 6 contract 1 Maximum demand active power - (capture time)	{4,{1.0.2.6.6.255},5}	Clock	-	-
106	0x006A	Total Rate contract 1 Maximum demand active power - (last average)	{4,{1.0.2.6.10.255},2}	Double long unsigned	W	0
107	0x006B	Total Rate contract 1 Maximum demand active power - (capture time)	{4,{1.0.2.6.10.255},5}	Clock	-	-

5.6.6 Instantaneous Values

Registers Address - Instantaneous Values						
Index	**Address**	**Description**	**OBIS**	**Type**	**Unit**	**Scaler**
108	0x006C	Instantaneous Voltage L1	{3,{1.0.32.7.0.255},2}	Long unsigned	V	-1
109	0x006D	Instantaneous Current L1	{3,{1.0.31.7.0.255},2}	Long unsigned	A	-1
110	0x006E	Instantaneous Voltage L2[1]	{3,{1.0.52.7.0.255},2}	Long unsigned	V	-1
111	0x006F	Instantaneous Current L2[1]	{3,{1.0.51.7.0.255},2}	Long unsigned	A	-1
112	0x0070	Instantaneous Voltage L3[1]	{3,{1.0.72.7.0.255},2}	Long unsigned	V	-1
113	0x0071	Instantaneous Current L3[1]	{3,{1.0.71.7.0.255},2}	Long unsigned	A	-1
114	0x0072	Instantaneous Current (Sum of all phases) [1]	{3,{1.0.90.7.0.255},2}	Long unsigned	A	-1

Registers Address - Instantaneous Values						
Index	**Address**	**Description**	**OBIS**	**Type**	**Unit**	**Scaler**
115	0x0073	Instantaneous Active power + L1[1]	{3,{1.0.21.7.0.255},2}	Double long unsigned	W	0
116	0x0074	Instantaneous Active power - L1[1]	{3,{1.0.22.7.0.255},2}	Double long unsigned	W	0
117	0x0075	Instantaneous Active power + L2[1]	{3,{1.0.41.7.0.255},2}	Double long unsigned	W	0
118	0x0076	Instantaneous Active power - L2[1]	{3,{1.0.42.7.0.255},2}	Double long unsigned	W	0
119	0x0077	Instantaneous Active power + L3[1]	{3,{1.0.61.7.0.255},2}	Double long unsigned	W	0
120	0x0078	Instantaneous Active power - L3[1]	{3,{1.0.62.7.0.255},2}	Double long unsigned	W	0
121	0x0079	Instantaneous Active power + (Sum of all phases)	{3,{1.0.1.7.0.255},2}	Double long unsigned	W	0
122	0x007A	Instantaneous Active power - (Sum of all phases)	{3,{1.0.2.7.0.255},2}	Double long unsigned	W	0
123	0x007B	Instantaneous Power factor	{3,{1.0.13.7.0.255},2}	Long unsigned	-	-3
124	0x007C	Instantaneous Power factor L1[1]	{3,{1.0.33.7.0.255},2}	Long unsigned	-	-3
125	0x007D	Instantaneous Power factor L2[1]	{3,{1.0.53.7.0.255},2}	Long unsigned	-	-3
126	0x007E	Instantaneous Power factor L3[1]	{3,{1.0.73.7.0.255},2}	Long unsigned	-	-3
127	0x007F	Instantaneous Frequency	{3,{1.0.14.7.0.255},2}	Long unsigned	Hz	-1

Note [1]: These registers only apply to three-phase EDP Boxes.

5.6.7 Load Profile

Registers Address - Load Profile						
Index	**Address**	**Description**	**OBIS**	**Type**	**Unit**	**Scaler**
128	0x0080	Load profile - Configured measurements	{7,{1.0.99.1.0.255},3}	Array[8][1]	-	-
129	0x0081	Load profile - Capture period	{7,{1.0.99.1.0.255},4}	Double long unsigned	s	0
130	0x0082	Load profile - Entries in use	{7,{1.0.99.1.0.255},7}	Double long unsigned	-	-
131	0x0083	Load profile - Profile entries	{7,{1.0.99.1.0.255},8}	Double long unsigned	-	-

Note [1]: Array of Measurement IDs whose size is fixed and equal to 8. If less than 6 measurements (plus “Clock” and “AMR profile status”) are configured to be captured in the EDP Box’s load profile, then the positions of the array with no measurements assigned should return the value 0xFF (see 5.4.2 - Load Profile).

5.6.8 Disconnector

Registers Address - Disconnector						
Index	**Address**	**Description**	**OBIS**	**Type**	**Unit**	**Scaler**
132	0x0084	Disconnect control state	{70,{0.0.96.3.10.255},3}	Disconnect control state	-	-
133	0x0085	Disconnector Q parameter	{1,{0.0.128.30.1.255},2}	Double long unsigned	-	-
134	0x0086	Disconnector K parameter	{3,{0.0.128.30.2.255},2}	Double long unsigned	%	0