

# DLMS/COSEM

## DLMS COSEM communication protocol

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### Supported device types and versions

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This protocol implements serial communication with the devices (energy & water metering) according to the DLMS/COSEM standard. It can use binary HDLC protocol, the TCP/UDP Wrapper (used for communication via TCP/IP), or the Gateway protocol. Gateway protocol is used if there is a so-called Gateway device between the SCADA system and the device. The Gateway is a device connected to a network with a SCADA system and to one/more networks with energy meters (it does not have to be an Ethernet network, but e.g. RS-485 or power lines).

Two modes of addressing I/O tags are supported:

- "Short Name (SN) referencing" using 16-bit object addresses
- "Logical Name (LN) referencing" using 6-byte OBIS codes

Communication was tested with the following devices:

- EMH LZQJ (SN referencing)
- Landis ZMD400 (SN referencing)
- Iskraemeco Iskra MT880-M (LN referencing)
- ADDAX NP73E.2-18-1 (LN referencing)
- Iskraemeco AC750-G3C2 gateway + Iskraemeco AM550-ED1.11, AM550-TD2.12 electrometers (LN referencing, Gateway mode)
- Iskraemeco AC750-G3C2 gateway + Iskraemeco AM550-ED1.11, AM550-TD2.12 electrometers (LN referencing, Wrapper mode, IPv6 communication)

The protocol supports time synchronization, the period is configured in the [station configuration dialog](#).

### Communication line configuration

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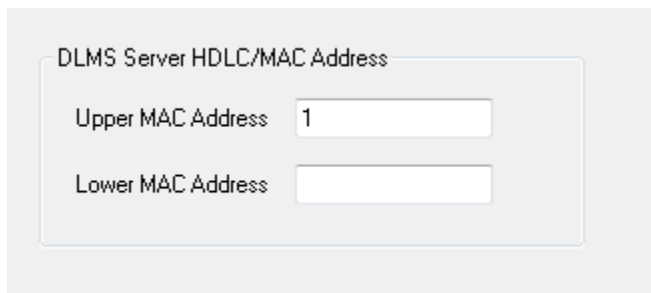
- Supported line categories: [Serial](#), [SerialOverUDP Device Redundant](#), [TCP/IP-TCP](#), [TCP/IP-TCP Redundant](#), [MOXA IP Serial Library](#), [RFC2217 Client](#), **MODEM**.
- For TCP/UDP communication using TCP/UDP Wrapper, TCP/UDP ports 4059 are reserved.

### Station configuration

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- Communication protocol "**DLMS/COSEM**".

The station address (DLMS Server HDLC/MAC Address) consists of two parts: Upper MAC Address and Lower MAC Address. Each of them is in the range from 0 to 16383 (3FFFFH).



DLMS Server HDLC/MAC Address

Upper MAC Address

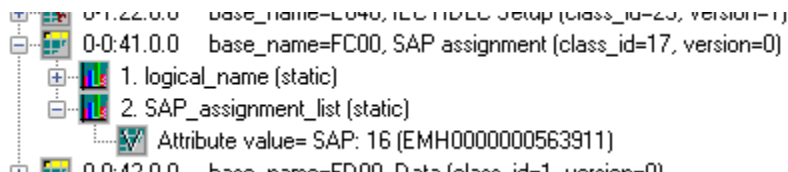
Lower MAC Address

As per a specification, DLMS UA 1000-2 Ed. 7.0 (Green Book) represents:

- **Upper MAC Address** is used for Logical Device addressing, i.e. separately addressable entity within the physical device.
- **Lower MAC Address** is used for Physical Device addressing, i.e. multi-drop address on the line.

Upper MAC Address is required. An implicit value, which is set when the station address is missing, is a reserved address Upper MAC Address = 1 (Management Logical Device).

In ordinary situations, when the physical device is identical with the logical one (one physical device = one logical device), this address does not need to be changed. If the physical device integrates more logical devices, you should monitor content or "0-0:41.0.0" register of "SAP assignment" class (class\_id=17, attribute 2 "SAP\_assignment\_list") in the "DLMS SN Object List" dialog box. This dialog box shows the list of logical devices that are integrated in a physical one.



This is the example of a value representation of the "SAP\_assignment\_list" attribute of the "SAP assignment" class in the device which contains one logical device with Upper MAC Address 16.

See also the protocol parameter "[Client MAC address](#)" and a document "DLMS UA 1000-2 Ed. 7.0", chapter 8.4.2.3 "Reserved special HDLC addresses".

**Note:** for Iskraemec Iskra MT880, Upper MAC Address = 1, Lower MAC Address = 16 + last two digits of the serial number (if, for example, the serial number is 72211943, then Lower MAC Address = 16 + 43 = 59).

**Note:** since the station address is DLMS Server HDLC/MAC Address, it is only used when the protocol parameter "[Opening mode](#)" is set to "Direct HDLC" or "IEC Mode E".

## Station parameters

[Communication station configuration dialog box](#) - **Protocol parameters** tab.

They influence some optional protocol parameters. The following station protocol parameters can be set:

**Table 1**

Mode (Opening Mode)		Direct HDLC IEC mode E UDP Pure TCP /UDP Wrapper TCP /UDP Wrapper + Gateway protocol Gateway protocol	Direct HDLC
	<p>Opening mode of connection with the device and a used link protocol.</p> <p>If the device is configured so that it directly uses DLMS/COSEM protocol on the given interface, set this parameter to "Direct HDLC".</p> <p>Mostly (e.g. when reading through IR optical interface by an optical reading head) you must open the connection in IEC protocol in so-called "mode E" and then transfer to HDLC binary protocol (i.e. DLMS/COSEM).</p> <p>"IEC mode E", according to the specification of IEC protocol, uses the following settings of the transmission parameters:</p> <ul style="list-style-type: none"> <li>• baud rate 300 Baud,</li> <li>• 7 data bits,</li> <li>• even parity,</li> <li>• 1 stop bit.</li> </ul> <p>If "Opening Mode" is set to "IEC mode E", the above-mentioned transmission parameters must be set. As for the Serial communication line, the parameters must be set in the line parameters "<a href="#">Mode 1</a>". See the protocol parameter "<a href="#">Software 7E1</a>".</p> <p>The setting of the baud rate to 300 Baud is usually not required when using the line of the MODEM category. A so-called DTE speed is used between a PC and a modem. If this speed is higher than 300 Baud, you have to activate the "handshaking" parameter on RTS /CTS in proper line mode.</p> <p>If the parameter value is set to "Direct HDLC", a dynamic change of transmission parameters is not expected. You can use any Serial line mode and set it by the "<a href="#">Line mode</a>" parameter on the station.</p> <p>More information is mentioned in <i>IEC 62056-21, Electricity metering - Data exchange for meter reading, tariff and load control - Part 21: Direct local data exchange</i>, Annex E: "METERING HDLC protocol using protocol mode E for direct local data exchange".</p> <p>See also chapter "<a href="#">Setting of transmission parameters</a>".</p> <p>The "UDP Pure" mode is used by some devices when communicating over UDP. Each DLMS/COSEM data packet (challenge /response) is in a separate UDP packet. In the case of TCP, this is problematic (without parsing it is not possible to determine what the size of the DLMS/COSEM data packet is) so the DLMS/COSEM standard defines the use of an envelope - called a Wrapper - for TCP /UDP mode (see next paragraph).</p> <p>The "TCP/UDP Wrapper" mode is used when communicating over TCP or UDP. An 8-byte header (Version, <a href="#">Wrapper Source Port</a>, <a href="#">Wrapper Destination Port</a>, and Length fields) is added to the DLMS/COSEM data.</p> <p>The "TCP/UDP Wrapper + Gateway protocol" and "Gateway protocol" modes are used when communicating over TCP or UDP through a so-called Gateway device. A prefix is added to the DLMS/COSEM data (single-byte fields <a href="#">Header</a>, <a href="#">Device Network ID</a>, <a href="#">Address Length</a>, and variable-length field <a href="#">Device Address</a>). Based on the <a href="#">Device Network ID</a> and <a href="#">Device Address</a>, the Gateway can distinguish which target device to route the request to. The device response is routed to the D2000 KOM process, and the prefix this time contains its identification (<a href="#">My Network ID</a>, <a href="#">My Address</a>).</p> <p>In addition, in the "TCP/UDP Wrapper + Gateway protocol" mode, the same header as in the "TCP/UDP Wrapper" mode is added. When using UDP, some devices may omit the header, similar to the "UDP Pure" mode.</p>		
--- DLMS/HDLC parameters ---			

Application Context	The setting of the "Application Context" parameter of the DLMS/COSEM protocol. Short_Name_Referencing_No_Ciphering context is supported for "Short Name (SN) referencing". Logical_Name_Referencing_No_Ciphering context is supported for "Logical Name (LN) referencing". The next two contexts with encryption are not supported.	Logical_Name_Referencing_No_Ciphering Short_Name_Referencing_No_Ciphering Logical_Name_Referencing_With_Ciphering Short_Name_Referencing_With_Ciphering	Short_Name_Referencing_No_Ciphering
Client MAC Address	HDLC MAC address of a client (i.e. D2000 KOM process). The default value is 10H which is the reserved value "Public client". See " <i>DLMS UA 1000-2 Ed. 7.0</i> " document, chapter 8.4.2.3 " <i>Reserved special HDLC addresses</i> ". For ADDAX NP73E.2-18-1 a different value than 10H had to be configured (1 or 2).	0 .. 7FH	10H
HDLC Max_info_field_length-receive parameter	The maximum length of one HDLC frame packet on the receiver's side. When communication problems occur (e.g. checksum error etc.), we recommend decreasing the value of this parameter.		250
HDLC Max_info_field_length-transmit parameter	The maximum length of one HDLC frame packet on the transmitter's side. When communication problems occur (e.g. checksum error etc.), we recommend decreasing the value of this parameter.		250
Client Max Receive PDU Size	The maximum length of PDU (data packet). One PDU can be divided into more HDLC frame packets according to settings of protocol parameters <a href="#">HDLC Max_info_field_length-receive</a> and <a href="#">HDLC Max_info_field_length-transmit</a> . Note: A specific electricity meter (Landis + Gyr ZMD 400) only accepted a value of 0, otherwise it returned a <i>rejected-permanent</i> error during connection establishment. Another electricity meter (Landis + Gyr ZFD 405) only accepted the value 65535, otherwise it returned a <i>rejected-permanent</i> error during connection establishment.	0 .. 65535	1200
No Disconnect	A Disconnect request will not be used after the readout of values from a device is finished. During the next readout, a connection establishment phase is omitted (HDLC mode-setting request and AARQ negotiation request). This allows for greater data throughput and an increase in the frequency of reading values from the device.	YES/NO	NO
Password	Device password. If entered, the "Low Level Security" authentication with the entered password is used within the AARQ Association Request.		
No Browsing	Online address selection from the list of objects, directly on the device, through the <a href="#">DLMS Object List</a> dialog box in the configuration of the I/O tag address will be disabled. Disabling of browsing makes sense in a production environment if values are to be read on a several-seconds basis and reading a list of objects, which can take up to several minutes, is not acceptable. Some devices (e.g. ADDAX NP73E.2-18-1) do not support reading of the object list.	YES/NO	NO
Profile Data Optimization	Several electrometers implement optimization of time data when reading from profiles (class_id=7). The optimization means that only the first row of data contains a timestamp, others contain null. The timestamp of each row is equal to the previous row's timestamp plus the value of the <i>capture_period</i> (4) attribute.  If the value of this parameter is YES, the value of the <i>capture_period</i> attribute is read prior to reading the profile data. If the value of this parameter is NO, the content of the <i>capture_period</i> attribute is not read, but the KOM process relies on all profile rows to contain timestamps. If this is not the case, the profile data is not read, and the line logs contain error messages " <i>turn on station parameter 'Profile Data Optimization'</i> ".	YES/NO	YES
xDLMS Conformance	Bit settings in the "xDLMS Conformance" field in the AARQ initial message. The default settings are: <ul style="list-style-type: none"><li>• for <a href="#">Application Context</a> "Short Name (SN) referencing" read/write bits</li><li>• for <a href="#">Application Context</a> "Logical Name (LN) referencing" get/set/parameterized-access bits</li></ul>	0	0
--- IEC Parameters ---			

IEC Device Address	<p>It is an address of a station (device) and is used only if the <a href="#">Opening mode</a> is set to "IEC Mode E".</p> <p>This parameter is optional. It identifies the address of the device at the beginning of communication via the IEC protocol. If this parameter is not defined, the address will not be set at the communication via the IEC protocol and the device must always respond. If several devices are connected to one line (e.g. RS485 bus), the IEC address of a device must be set so that the devices could be identified and avoid a collision. A device address is max. 32 characters consisting of figures (0...9), capital letters (A...Z), small letters (a...z), or a blank space ( ). Zeros in front of valid figure are ignored (i.e. address 10203 = 010203 = 000010203).</p> <p>"IEC Device Address" is a serial number of the device. In OBIS addressing, this register has an address "0-0:C.1.0" - Device ID 1, manufacturing number.</p> <p>The picture below shows the front panel of the EMH LZQJ device. There is a serial number, i.e. IEC address (563911). If the device contains a display, this value may be usually displayed as you can see in the picture.</p> 		-
Baudrate Changeover (Z)	<p>This parameter is used only if the <a href="#">Opening mode</a> is set to "IEC Mode E".</p> <p>It defines baud rate for the communication through HDLC protocol DLMS/COSEM after the changeover from IEC mode E to the HDLC binary communication.</p> <p>As for the Serial line, this parameter must set the baud rate to "<a href="#">Mode 2</a>" of the line.</p> <p>AUTO option sets the baud rate according to the value offered by a device. If this baud rate can not be identified, you should check <a href="#">the diagnostic communication logs</a>. The following message can be found there:</p> <pre>10:46:05.809 30-05-2011  D DLMS&gt; Z Detected: '4' = 4800 Bd</pre> <p>and set the baud rate according to it.</p> <p>HDLC binary communication through DLMS/COSEM protocol, unlike the opening IEC step, is realized by different parameters which have to be set in "<a href="#">Mode 2</a>" of the Serial line category:</p> <ul style="list-style-type: none"> <li>• 8 data bits,</li> <li>• none parity,</li> <li>• 1 stop bit.</li> </ul> <p>See also the "<a href="#">Software 7E1</a>" parameter and the chapter <a href="#">Settings of transmission parameters</a>.</p>	300 600 1200 2400 4800 9600 19200 AUTO	AUTO
Software 7E1	<p>This parameter is used if "<a href="#">Opening mode</a>" is set to "IEC Mode E".</p> <p>Setting it to YES activates an SW emulation of transmission parameters of 7 data bits and even parity when the transmission parameters of 8 data bits and none parity are set (i.e. emulation of 7E1 when 8N1 is set). It enables the use of the "IEC mode E" option for SerialOverUDP lines that do not support dynamic changes of transmission parameters.</p> <p>See the chapter <a href="#">Settings of transmission parameters</a>.</p>	YES/NO	NO
Wake-up Message Length	<p>This parameter is used if "<a href="#">Opening mode</a>" is set to "IEC Mode E".</p> <p>Nonzero value activates the sending of a so-called "wake-up message" which activates the communication interface of battery-powered devices. The null characters (0x00) are sent according to the quantity that is defined by the parameter value. The baud rate must be 300 Baud (configured in "Mode 1" for Serial lines).</p> <p>More information is available in <i>IEC 62056-21, Electricity metering - Data exchange for meter reading, tariff and load control - Part 21: Direct local data exchange</i>, Annex B: "Wake-up methods for battery-operated tariff devices".</p>	0 .. 120	0
Delay After Wake-up Message	<p>This parameter is used if "<a href="#">Opening mode</a>" is set to "IEC Mode E".</p> <p>If a so-called "wake-up" message is activated, this parameter defines a delay after sending a "wake-up" message, before the beginning of communication. In the case of a Serial line, we recommend setting the "WaitTxEMPTY" parameter in a specific line mode.</p> <p>According to document <i>IEC 62056-21</i>, you should set this parameter between 1,5 and 1,7 seconds.</p>	ms	0
--- TCP/UDP Wrapper parameters ---			

Wrapper Source Port	<p>This parameter is used if the "Opening mode" protocol parameter is set to "TCP/UDP Wrapper" or "TCP/UDP Wrapper + Gateway protocol". It specifies the value of the <i>Source Port</i> field (2-byte number) in the wrapper header.</p> <p>Reserved ports are according to the standard:</p> <ul style="list-style-type: none"> <li>• No-station: 0x0000</li> <li>• Client Management Process: 0x0001</li> <li>• Public client: 0x0010</li> <li>• Open for client SAP assignment: 0x02 .. 0x0F, 0x11 .. 0xFF</li> </ul>	-	0
Wrapper Destination Port	<p>This parameter is used if the "Opening mode" protocol parameter is set to "TCP/UDP Wrapper" or "TCP/UDP Wrapper + Gateway protocol". It specifies the value of the <i>Destination Port</i> field (2-byte number) in the wrapper header.</p> <p>Reserved ports are according to the standard:</p> <ul style="list-style-type: none"> <li>• No-station: 0x0000</li> <li>• Management Logical Device: 0x0001</li> <li>• Reserved: 0x0002 .. 0x000F</li> <li>• Open for client SAP assignment: 0x0010 .. 0x007E</li> <li>• All-station (Broadcast): 0x007F</li> </ul>	-	0
--- Gateway parameters ---			
Device Network ID	<p>This parameter is used if the "Opening mode" protocol parameter is set to "Gateway protocol" or "TCP/UDP Wrapper + Gateway protocol". It specifies the value of the <i>Device Network ID</i> field in the prefix in the sent request.</p> <p>If only one network exists, value 0 shall be used.</p>	-	0
Device Address (hex)	<p>This parameter is used if the "Opening mode" protocol parameter is set to "Gateway protocol" or "TCP/UDP Wrapper + Gateway protocol". It specifies the value of the <i>Device Address</i> field in the prefix in the sent request.</p> <p><b>Note:</b> in the case of the Iskraemeco AC750 gateway, the 8-byte MAC address of the meters on the Power Line Communication bus is used as the <i>Device Address</i>.</p>	-	-
--- Send/receive parameters ---			
Wait First Timeout	The delay after sending the request but before reading the response.	ms	100 ms
Wait Timeout	The delay between readings of the response until its completion.	ms	200 ms
Max. Wait Retry	A retry count of reading response until its completion.	1 .. 100	20
Retry Timeout	The delay between the request retries if a communication error occurs.	ms	500 ms
Retry Count	A retry count of a request if a communication error occurs.	1 .. 20	3
--- Modem parameters ---			
Modem Telephone Number	The phone number for modem connection with a device (only for MODEM lines).		
Dial Timeout	Maximum waiting time for dial-up modem connection (only for MODEM lines).	1 .. 600 s	60 s
Dial Retry Count	A maximum retry count of dial-up modem connection (only for MODEM lines).	1 .. 20	1
Dial Retry Timeout	Delay before attempting to dial after an unsuccessful connection attempt (only for MODEM lines).	1 .. 600 s	30 s
After Connect Delay	Time delay after the dial-up connection has been established (only for MODEM lines) but before the beginning of communication. It is used to stabilize the modem connection for old types of modems. After this timeout elapses, all the redundant received data (the residues of AT modem communication) will be read and ignored.	0 .. 30 s	5 s
AT Command 1	A special initial string of modem 1 (only for MODEM lines).		AT&FE 0V1Q0 B0X3L 0M0

AT Command 2	<p>A special initial string of modem 2 (only for MODEM lines). Explanation of recommended settings:</p> <p><b>S37=5</b> 1200bps DTE-DTE speed - limits the speed for modems. Many devices use modems with limited transmission speeds and this setting can speed-up the connection establishment process. Higher transmission speeds must be negotiated individually.</p> <p><b>&amp;D2</b> DTR drop to hangup - for matching with the parameter of modem line (line configuration, tab "Modem - parameters", check the "Use DTR for Hangup" option).</p> <p><b>S0=0</b> Disable auto-answer. Auto-answer will not be used.</p> <p><b>S30=2</b> 20 sec inactivity timeout - automatic hangup after idle timeout expired. Necessary for assuring connection termination after the communication with the last device is over.</p>		ATS37=5&D2 S0=0S 7=60S3 0=2
--- Debug parameters ---			
HDLC /Wrapper /Gateway Debug	This parameter activates debug information from the HDLC protocol level.	YES/NO	NO
Full Debug	This parameter activates full communication monitoring. It enables displaying of the I/O tag values and other debug information.	YES/NO	NO

## Settings of transmission parameters

Example 1 - line category Serial, the communication through IR optical head.

Line mode 1	300 Baud, 7 data bits, 1 stop bit, even parity
Line mode 2	300 Baud, 8 data bits, 1 stop bit, none parity
Opening Mode	IEC mode E
Baudrate Changeover (Z)	300
Software 7E1	NO

Example 2 - line category Serial, communication through IR optical head.

Line mode 1	300 Baud, 8 data bits, 1 stop bit, none parity
Line mode 2	300 Baud, 8 data bits, 1 stop bit, none parity
Opening Mode	IEC mode E
Baudrate Changeover (Z)	300
Software 7E1	YES

Example 3 - line category Serial, communication through RS232/RS485 interface.

Line mode 1	4800 Baud, 8 data bits, 1 stop bit, none parity
Opening Mode	Direct HDLC

## I/O tag configuration

Possible I/O tag types: **Ai**, **Ci**, **Di**, **TxtI**, **TiA**, **TiR**.

## I/O tag address

To understand the object addressing in DLMS/COSEM protocol, you should know a so-called OBIS standard according to the IEC standard 62056-61 *Object Identification system (OBIS)*, chapter "Annex A - Code presentation".

The "Logical Name (LN) referencing" mode directly uses the OBIS address of objects.

The "Short Name (SN) referencing" mode does not use the OBIS address but a 16-bit numerical address.

The individual data entities are presented in so-called COSEM objects (Companion Specification for Energy Metering), which are the instances of COSEM classes (COSEM interface classes, COSEM IC). Individual types of COSEM classes are specified in the document "*COSEM Identification System and Interface Classes, Ed. 10.0*", i.e. so-called *DLMS Blue Book*. Each type of COSEM class has its own identification number ("class\_id"). Each class has a set of attributes that have sequence numbers. The attribute facilitates the reading of a specific parameter of a data entity. Each instance has its beginning SN address (base\_name), which is also the address of the first attribute of a class. The "logical\_name" is the first attribute of all COSEM classes. By reading this attribute, an OBIS address of a data entity that is presented by a specific class can be obtained. The addresses of further attributes are calculated according to this formula in the "Short Name referencing" mode:

$$\text{short\_name} = \text{base\_name} + ((\text{attribute\_index} - 1) * 0x08)$$

The attributes can be static or dynamic depending on whether their value is static (i.e. unchanging, set by a producer or in the configuration of the device) or dynamic (changing). In the D2000 System, we recommend configuring only the dynamic attributes, as the value of the measured data entity is in dynamic attributes. If it is necessary for the interpretation of a value in a dynamic attribute (mostly the "value" attribute), other static or dynamic attributes are read automatically. See more information in the section [Supported COSEM classes](#).

In the following tables, you can find the supported COSEM classes. The attributes that represent the value of the data entity (i.e. value that is important for a user) are marked as "Yes, the value of an entity" in the column "Support in D2000". The static attributes are read automatically and characterized as "Automatically read".

## Supported COSEM classes

Data class_id = 1, version = 0		The basic class that contains data entity accessible via attribute "value".		
Attribute	Attribute value type	Attribute description	Support in D2000	
1. logical_name (static)	octet-string (text)	OBIS address of the data entity which is represented by an instance of this class.	Yes, separate I/O tag	
2. value (dynamic)	CHOICE (see <a href="#">supported types of attribute values</a> )	The value of the data entity.	Yes, the value of an entity	

Register class_id = 3, version = 0		A class with data entity value that is accessible via attribute "value". The multiplication coefficient, which is gained by a static attribute "scaler_unit", is used automatically.		
Attribute	Attribute value type	Attribute description	Support in D2000	
1. logical_name (static)	octet-string (text)	OBIS address of the data entity which is represented by an instance of this class.	Yes, separate I/O tag	
2. value (dynamic)	CHOICE (see <a href="#">supported types of attribute values</a> )	The value of the data entity.	Yes, the value of an entity	
3. scaler_unit (static)	-	Technical units and multiply coefficient.	Automatically read	

Extended register class_id = 4, version = 0		class with data entity value that is accessible via attribute "value". The multiplication coefficient, which is gained by a static attribute "scaler_unit", is used automatically. A timestamp, which has been gained by the reading of dynamic attribute "capture_time", is added to the entity value.		
Attribute	Attribute value type	Attribute description	Support in D2000	
1. logical_name (static)	octet-string (text)	OBIS address of the data entity which is represented by an instance of this class.	Yes, separate I/O tag	
2. value (dynamic)	CHOICE (see <a href="#">supported types of attribute values</a> )	The value of the data entity.	Yes, the value of an entity	
3. scaler_unit (static)	-	Technical units and multiply coefficient.	Automatically read	
4. status (dynamic)	CHOICE (see <a href="#">supported types of attribute values</a> )	Status of the value. The standard does not specify the interpretation of this value. Mostly, it is a numerical value and you can find necessary information about its interpretation in a device manual.	Yes, separate I/O tag	
5. capture_time (dynamic)	date_time	The timestamp of data entity value.	Automatically read	

Demand register class_id = 5, version = 0		A register for measurement of accumulation energy supply in a given period. See more info in DLMS Blue Book.		
Attribute		Attribute value type	Attribute description	Support in D2000
1.	logical_name (static)	octet-string (text)	OBIS address of the data entity which is represented by an instance of this class.	Yes, separate I/O tag
2.	current_average_value (dynamic)	CHOICE (see <a href="#">supported types of attribute values</a> )	Current situation of energy supply that is accumulated since the beginning of the period.	Yes, the value of an entity
3.	last_average_value (dynamic)	CHOICE (see <a href="#">supported types of attribute values</a> )	Value of energy accumulated in the last period.	Yes, the value of an entity
4.	scaler_unit (static)	-	Technical units and multiply coefficient.	Automatically read
5.	status (dynamic)	CHOICE (see <a href="#">supported types of attribute values</a> )	Status of the value. The standard does not specify the interpretation of this value. Mostly, it is a numerical value and you can find necessary information about its interpretation in a device manual.	Yes, separate I/O tag
6.	capture_time (dynamic)	date_time	The timestamp of data entity value in the attribute "last_average_value".	Automatically read
7.	start_time_current (dynamic)	date_time	The timestamp of the beginning of accumulated energy measurement with current status in the attribute "current_average_value".	Automatically read
8.	period (static)	double-long-unsigned	The period of an interval between two changes in data entity value in the attribute "last_average_value". The value is in seconds.	Yes, separate I/O tag
9.	number_of_periods (static)	long-unsigned	The number of periods that are used for calculation of data entity value in the "last_average_value" attribute. If "number_of_periods" > 1, the "last_average_value" represents "sliding demand". If "number_of_periods" = 1, the "last_average_value" represents "block demand".	Yes, separate I/O tag

Clock class_id = 8, version = 0		Current time and other time parameters.		
Attribute		Attribute value type	Attribute description	Support in D2000
1.	logical_name (static)	octet-string (text)	OBIS address of the data entity which is represented by an instance of this class.	Yes, separate I/O tag
2.	time (dynamic)	date_time	Current local time.	Yes, the value of an entity
3.	time_zone (static)	long	Deviation of local time from UTC in minutes.	Yes, separate I/O tag
4.	status (dynamic)	unsigned	Time status: bit 0 (LSB): invalid value, bit 1: doubtful value, bit 2: different clock base, bit 3: invalid clock status, bit 4: reserved, bit 5: reserved, bit 6: reserved, bit 7 (MSB): daylight saving active	Yes, separate I/O tag
5.	daylight_savings_begin (static)	date_time	Time of transition from local time to daylight saving time (DST).	Yes, separate I/O tag
6.	daylight_savings_end (static)	date_time	Time of transition from daylight saving time (DST) to local time.	Yes, separate I/O tag
7.	daylight_savings_deviation (static)	integer	Deviation of DS time from standard time in minutes within the range +/- 120 minutes.	Yes, separate I/O tag
8.	daylight_savings_enabled (static)	boolean	TRUE = DST enabled, FALSE = DST disabled	Yes, separate I/O tag
9.	clock_base (static)	enum	Type of source type of exact time: (0) not defined, (1) internal crystal, (2) mains frequency 50 Hz, (3) mains frequency 60 Hz, (4) GPS (global positioning system), (5) radio-controlled	Yes, separate I/O tag



SAP assignment class_id = 17, version = 0		Information about assignment of logical devices.		
Attribute		Attribute value type	Attribute description	Support in D2000
1.	logical_name (static)	octet-string (text)	OBIS address of data entity which is represented by an instance of this class. For this case, it is always "0-0:41.0.0".	Yes, separate I/O tag
2.	SAP_assignment_list (static)	asslist_type	asslist_type is an array of structures with addresses and a text description "logical device name". It can be only in text format, i.e. I/O tag must be of Txtl type. See information about the <a href="#">station configuration</a> .	Yes, separate I/O tag

IEC local port setup class_id = 19, version = 1		Information about the configuration of communication interface for the communication according to IEC 62056-21.		
Attribute		Attribute value type	Attribute description	Support in D2000
1.	logical_name (static)	octet-string (text)	OBIS address of data entity which is represented by an instance of this class.	Yes, separate I/O tag
2.	default_mode (static)	enum	It defines the protocol that is used by a device on a specific port: (0) protocol according to IEC 62056-21 (modes A...E), (1) protocol according to Clause 8 of DLMS UA 1000-2 Ed. 7.0. Using this enumeration value all other attributes of this IC are not applicable, (2) protocol not specified. Using this enumeration value, attribute 4, prop_baud is used for setting the communication speed on the port. All other attributes are not applicable.	Yes, separate I/O tag
3.	default_baud (static)	enum	Baud rate in so-called "opening sequence": (0) 300 baud, (1) 600 baud, (2) 1 200 baud, (3) 2 400 baud, (4) 4 800 baud, (5) 9 600 baud, (6) 19 200 baud, (7) 38 400 baud, (8) 57 600 baud, (9) 115 200 baud	Yes, separate I/O tag
4.	prop_baud (static)	enum	Baud rate which is suggested by a device. The values are the same as for "default_baud" attribute above.	Yes, separate I/O tag
5.	response_time (static)	enum	It defines the minimal time between the receiving of a request (the end of request telegram) and the sending of response (the beginning of response telegram): (0) 20 ms, (1) 200 ms	Yes, separate I/O tag
6.	device_addr (static)	octet-string	Device address for the IEC 62056-21 protocol.	Yes, separate I/O tag
7.	pass_p1 (static)	octet-string	Password 1 according to IEC 62056-21.	Yes, separate I/O tag
8.	pass_p2 (static)	octet-string	Password 2 according to IEC 62056-21.	Yes, separate I/O tag
9.	pass_w5 (static)	octet-string	Password W5 reserved for national applications.	Yes, separate I/O tag

IEC HDLC setup class_id = 23, version = 1				
Attribute		Attribute value type	Attribute description	Support in D2000
1.	logical_name (static)	octet-string (text)	OBIS address of the data entity which is represented by an instance of this class.	Yes, separate I/O tag
2.	comm_speed (static)	enum	Communication speed on a specific port: (0) 300 baud, (1) 600 baud, (2) 1 200 baud, (3) 2 400 baud, (4) 4 800 baud, (5) 9 600 baud, (6) 19 200 baud, (7) 38 400 baud, (8) 57 600 baud, (9) 115 200 baud	Yes, separate I/O tag
3.	window_size_transmit (static)	unsigned	The maximum number of frames that a device or system can transmit before it needs to receive an acknowledgement from a corresponding station. During logon, other values can be negotiated.	Yes, separate I/O tag
4.	window_size_receive (static)	unsigned	The maximum number of frames that a device or system can receive before it needs to transmit an acknowledgment to the corresponding station. During logon, other values can be negotiated.	Yes, separate I/O tag

5.	max_info_field_length_transmit (static)	long-unsigned	The maximum information field length that a device can transmit. During logon, a smaller value can be negotiated.	Yes, separate I/O tag
6.	max_info_field_length_receive (static)	long-unsigned	The maximum information field length that a device can receive. During logon, a smaller value can be negotiated.	Yes, separate I/O tag
7.	inter_octet_time_out (static)	long-unsigned	Defines the time, expressed in milliseconds, over which, when any character is received from the primary station, the device will treat the already received data as a complete frame.	Yes, separate I/O tag
8.	inactivity_time_out (static)	long-unsigned	From the primary station, the device will process a disconnection. When this value is set to 0, this means that the inactivity_time_out is not operational.	Yes, separate I/O tag
9.	device_address (static)	long-unsigned	Contains the physical device address of a device. In the case of one byte addressing: 0x00 NO_STATION Address, 0x01...0x0F Reserved for future use, 0x10...0x7D Usable address space, 0x7E 'CALLING' device address, 0x7F Broadcast address  In the case of two byte addressing: 0x0000 NO_STATION address, 0x0001..0x000F Reserved for future use, 0x0010..0x3FFD Usable address space, 0x3FFE 'CALLING' physical device address, 0x3FFF Broadcast address	Yes, separate I/O tag

## Historical data reading from load profiles

The reading of historical data from load profiles is performed using the instances of COSEM classes "Profile generic" (class\_id = 7), i.e. by configuring an I/O tag with an attribute 2 ("*buffer*"). This I/O tag always contains an invalid value in D2000 System, however, it enables reading a buffer of a specific instance of COSEM class "Profile generic".

Profile generic class_id = 7, version = 1				
Attribute		Attribute value type	Attribute description	Support in D2000
1.	logical_name (static)	octet-string (text)	OBIS address of the data entity which is represented by an instance of this class.	Yes, separate I/O tag
2.	buffer (dynamic)	array	Data of stored objects.	Yes, see the description above
3.	capture_objects (static)	array	List of object, values of which are stored.	Automatic or separate I/O tag of Txl type
4.	capture_period (static)	double-long-unsigned	Period of data storage in seconds. if the value = 0, data are stored by a trigger, not automatically.	Yes, separate I/O tag
5.	sort_method (static)	enum	Method to sort data in profile: (1) fifo (first in first out), (2) lifo (last in first out), (3) largest, (4) smallest, (5) nearest_to_zero, (6) farrest_from_zero	Yes, separate I/O tag
6.	sort_object (static)		It specifies the object or time according to which the data are sorted in a profile.	Yes, separate I/O tag
7.	entries_in_use (dynamic)	double-long-unsigned	Number of records that have been saved into a buffer of profile.	Yes, separate I/O tag
8.	profile_entries (static)	double-long-unsigned	The maximum number of records that can be stored into the buffer.	Yes, separate I/O tag

Data about objects that are accessible by the reading of attribute "*capture\_objects*" are stored in the buffer. D2000 System automatically searches for I/O tags that match the objects from attribute "*capture\_objects*" (by their address parameters). The objects are searched by parameters "*logical\_name*", "*class\_id*", and "*attribute\_index*".

The TELL command [GETOLDVAL](#) or ESL action [GETOLDVAL](#) start the reading of all the configured load profiles on the station. The time interval with data is always read from the load profile according to the parameters of the TELL command or ESL action.

Example: I/O tag with address::

- class\_id = 7
- attribute\_index = 2
- logical\_name = 1-0:P.1.0

After a tell command GETOLDVAL B.ELMER\_125 "06-07-2020 00:00:00" "06-07-2020 01:00:00", the KOM process queries a list of objects in a profile (by reading attribute 3):

```
09:44:39.558 06-07-2020|D|DLMS> Composing getRequest for LN ClassID=0007 InstanceID=1-0:P.1.0 AttributeId 3,
InvokeID 65
```

and displays a list of received objects:

```

09:44:40.710 06-07-2020|D|DLMS> Received capture_objects attribute for I/O tag 'M.ELMERY_T125_1_25_PROFILE'
(class_id=7, logical_name=1-0:P.1.0, attribute_index=3) are:
09:44:40.710 06-07-2020|D|DLMS> 1. logical_name=1-0:1.5.0, class_id=4, attribute_index=2
09:44:40.710 06-07-2020|D|DLMS> 2. logical_name=1-0:2.5.0, class_id=4, attribute_index=2
09:44:40.710 06-07-2020|D|DLMS> 3. logical_name=1-0:32.7.0, class_id=3, attribute_index=2
09:44:40.711 06-07-2020|D|DLMS> 4. logical_name=1-0:3.5.0, class_id=4, attribute_index=2

```

this reading is performed only once and the result is cached. Subsequently, data blocks containing historical values are read:

```

09:44:42.924 06-07-2020|D|DLMS> Block 1 complete, reading next
09:44:42.925 06-07-2020|D|DLMS> Composing Get-Request-Next for block-number 2
..
09:44:51.203 06-07-2020|D|DLMS> Get-Data-Block-Result: raw-data [0], length 88:
09:44:51.203 06-07-2020|D|DLMS> Last Block complete, going to parse 1614 bytes

```

The values are parsed and assigned to the I/O tags. If the I/O tag with the required address does not exist, a warning is displayed:

```

09:44:51.205 06-07-2020|D|DLMS> > Old value for I/O tag 'M.ELMERY_T125_1_25_ApM_15p', (double_long_unsigned)
992660, Re=99266, Tm=06-07-2020 00:00:00 Local
09:44:51.205 06-07-2020|D|DLMS> > Old value for I/O tag 'M.ELMERY_T125_1_25_ApM_15m', (double_long_unsigned) 0,
Re=0, Tm=06-07-2020 00:00:00 Local
09:44:51.205 06-07-2020|W|DLMS> Cannot find I/O tag logical_name=1-0:32.7.0, class_id=3, attribute_index=2 to
assign profile data!
09:44:51.205 06-07-2020|W|DLMS> Cannot find I/O tag logical_name=1-0:3.5.0, class_id=4, attribute_index=2 to
assign profile data!

```

Note: it is necessary to configure a non-zero delay in the time parameters of the station, otherwise the reading of profiles will never get to the run (periodic reading has a higher priority). If there are several stations on the line, the delay must be higher than the duration of the periodic reading of the values of all the stations.

## Supported value types of class attributes

Type	Description, meaning	Supported conversion into D2000 value types
null-data	no data	all, as an invalid value
boolean	boolean (true/false)	Di, Ci, Ai, Txtl
bit-string	unsupported	-
double-long	32-bit signed number	Di, Ci, Ai, Txtl
double-long-unsigned	32-bit unsigned number	Di, Ci, Ai, Txtl
octet-string	string of bytes	Txtl
visible-string	string (text)	Txtl
UTF8-string	UTF8 string (text)	Txtl
bcd	unsupported	-
integer	8-bit signed number	Di, Ci, Ai, Txtl
long	16-bit signed number	Di, Ci, Ai, Txtl
unsigned	8-bit unsigned number	Di, Ci, Ai, Txtl
long-unsigned	16-bit unsigned number	Di, Ci, Ai, Txtl
long64	64-bit signed number	Di, Ci, Ai, Txtl
long64-unsigned	64-bit unsigned number	Di, Ci, Ai, Txtl
enum	enumerated type	Di, Ci, Ai, Txtl
float32	32-bit float	Di, Ci, Ai, Txtl
float64	64-bit float	Di, Ci, Ai, Txtl
date-time	date + time	Txtl, TiA
date	date	Txtl, TiA
time	time	Txtl, TiA, TiR

## I/O tag address - configuration dialog box

The following picture shows a configuration dialog box of the I/O tag address.

Example for Short Name (SN) referencing:

Example for Logical Name (LN) referencing:

The meaning of the parameters in the dialog box:

1	Selection of referencing: <i>Short Name</i> (SN) or <i>Logical Name</i> (LN). Based on the value of the station parameter <a href="#">Application Context</a> , only the I/O tags with either SN or LN referencing will be handled.
2	SN referencing: a required parameter, it is the initial address of the class instance. It is an integer number within the range 0 up to 65520 (0xFFFF hexadecimal). LN referencing: an unused (disabled) parameter.
3	A required parameter, it is an identification number of COSEM class.
4	A required parameter, it is an index of the attribute (a serial number starting from 1).
SN referencing: the parameters <i>base_name</i> , <i>class_id</i> , and <i>attribute_index</i> are mandatory. The parameters <i>base_name</i> and <i>attribute_index</i> are used to calculate Short Name (SN) address according to <a href="#">the formula</a> . Short Name is used to get the value of an attribute from a device. <i>Class_id</i> shows a type of COSEM class. <i>Attribute_index</i> identifies the type of data that was received from a device. LN referencing: parameters <i>class_id</i> , <i>attribute_index</i> , and <i>logical_name</i> are mandatory.	
5	SN referencing: the <b>Hex</b> checkbox enables entering the <i>base_name</i> address in a hexadecimal form (checked) or decimal (unchecked). When editing an existing I/O tag, this checkbox is marked depending on the address that was entered in the first configuration of the I/O tag (i.e. hexadecimal or decimal). The change of status (checked/unchecked) does not convert automatically the value <i>base_name</i> from hexadecimal to decimal and vice-versa. LN referencing: an unused (disabled) parameter.
6	SN referencing: the parameter <b>logical_name</b> is optional. It is an OBIS address that belongs to the Short Name address, configured by parameters <i>base_name</i> , <i>class_id</i> , and <i>attribute_index</i> . It is in a text format according to the <a href="#">OBIS specification</a> of the object address. <b>Warning:</b> the parameter is required if the values of this object are stored into a load profile. When <a href="#">reading the historical data</a> from the load profile, they are identified by the " <i>logical_name</i> " address, i.e. if the address is not entered, the historical data will not be assigned to the existing I/O tag. LN referencing: parameter <b>logical_name</b> is mandatory. It is the OBIS address of a specific object. It is in a text format according to the <a href="#">OBIS specification</a> of the object address.
7	In the bottom part, there is information about the object address. Its meaning is only to inform the user about a configured object. The information is initialized after choosing the address in the <a href="#">DLMS Object list</a> dialog box.
8	Clicking on the <b>Browse</b> button enables selecting the address from the <a href="#">DLMS Object List</a> dialog box.  There are two methods for how to configure the addresses of I/O tags: <ol style="list-style-type: none"><li><i>Offline method</i> - you have to get all information about device configuration in electronic or another form as an output from the configuration tool or directly from a device producer.</li><li><i>Online method</i> - if the device is connected to D2000 System, you can use an online selection from the list of objects, directly on the device, through the <a href="#">DLMS Object List</a> dialog box.</li></ol>

## DLMS Object List dialog box

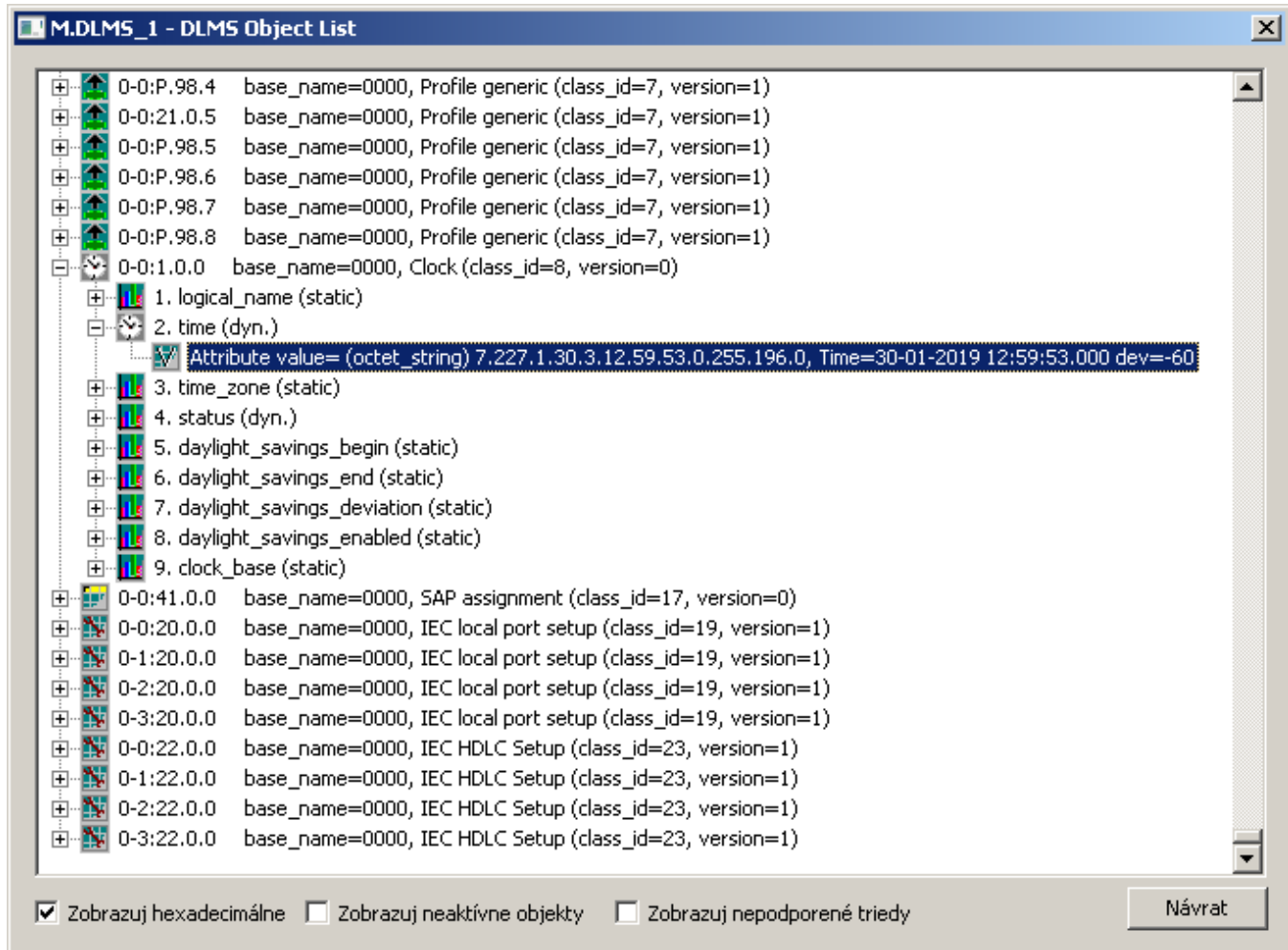
If these conditions are fulfilled - the device is connected to D2000 System, a communication station exists and the device communicates, you can define the parameters of the I/O tag address by the selection of the object from the list of all objects on the device. A list of objects is queried from the device:

- in SN referencing mode: from a special class "Association SN" with predefined address base\_name 0xFA00
- in LN referencing mode: from a special class "Association LN" with predefined address logical\_name 0.0.40.0.0.255

There is no need to configure any other I/O tags, just click on the **Browse** button.

The first reading of the list takes up to several minutes depending on the baud rate. The window displays the information "Waiting for data...".

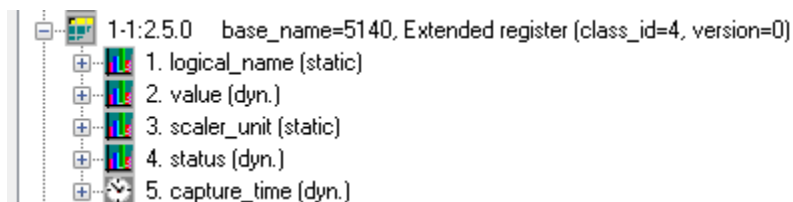
After data is read, the list of objects and their descriptions will show in the window:



You can find the following information in the list:

- each row represents one instance of COSEM class,
- the OBIS address of the object follows the icon of class,
- then there is the information about the SN address (*base\_name*) of a particular instance of COSEM class and about its type (*class\_id* and *version*),
- COSEM classes, which are supported in the D2000 System, can be expanded by clicking on the symbol (+).

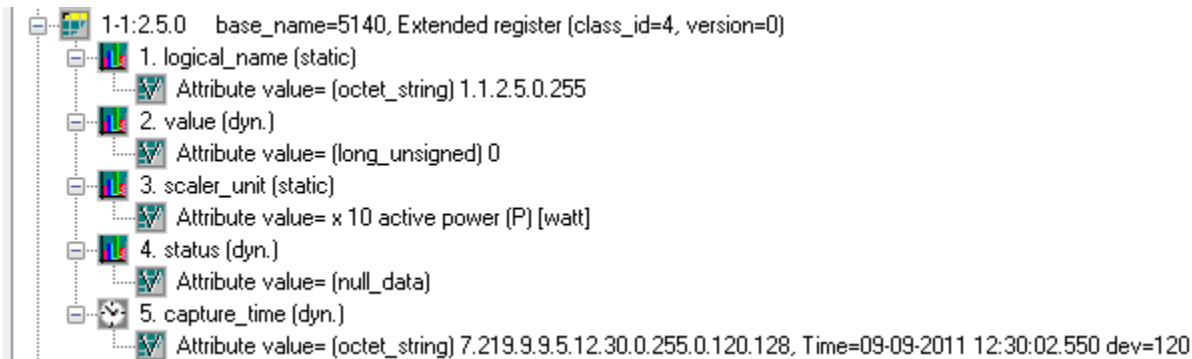
When expanding a specific instance of the COSEM class, the supported attributes of the class will be displayed:



The information about attribute includes:

- attribute index (attribute\_index) - a sequential number of the attribute, it is displayed next to the icon,
- attribute name (e.g. logical\_name, value, scaler\_unit, time\_zone ...),
- static or dynamic attribute.

There can be an "expand" symbol (+) near the icon. When opening it and clicking on the "Attribute value=" row, the current value of the attribute will be retrieved from the device:



This feature enables fast browsing of the attributes of all supported COSEM classes. The dialog window works as both "Object List" and "Value Browser".

The bottom part of the dialog box contains these check-boxes:

- **Show hexadecimal** - shows all the addresses of base\_name classes as hexadecimal numbers or decimal ones.
- **Show inactive objects**
- **Show unsupported classes** - enables to display the instances of unsupported COSEM classes.

To close the dialog box without any changes, click the **Cancel** button.

To insert the addressing parameters of the attribute of an instance into the address of I/O tag, double-click on the particular row. This closes the "DLMS SN Object List" dialog and the parameters of the I/O tag will be configured based on the selection.

## OBIS address specification

The definition of OBIS address according to IEC 62056-61 is following:

A	B	C	D	E	F
---	---	---	---	---	---

- **Value group A** defines the energy type (0=abstract objects, 1=electricity, 7=gas),
- **Value group B** defines a channel number,
- **Value group C** defines a measured physical value,
- **Value group D** defines a type of processing,
- **Value group E** defines further processing or classification according to the algorithm,
- **Value group F** defines the storage of processed historical data.

Value group A up to F represents a positive number in the range 0 up to 255.

For Value group C and D you can enter also the character values:

- character 'C' represents 96,
- character 'F' represents 97,
- character 'L' represents 98,
- character 'P' represents 99.

The address is written in text format:

**A-B:C.D.E\*F**

Value groups C, D, and E must always contain the value. Other unspecified values will be set to zero (0).

For more information see "List of standard OBIS codes and COSEM objects" on <http://www.dlms.com>, the document "List of standardized OBIS codes, DLMS UA, V2.3, (c) Copyright 1997-2005 DLMS User Association".

## Literature

- DLMS User Association, COSEM Architecture and Protocols, Seventh Edition, (c) Copyright 1997-2009 DLMS User Association (Green book).
- DLMS User Association, COSEM Identification System and Interface Classes, Ed. 10.0, (c) Copyright 1997-2010 DLMS User Association (Blue book).

- International Standard IEC 62056-21, Direct Data Local Exchange, First edition 2002-05.
- International Standard IEC 62056-61, Object Identification System (OBIS), Second edition 2006-11.
- List of standardized OBIS codes, DLMS UA, V2.3, (c) Copyright 1997-2005 DLMS User Association.



#### Blog

You can read blogs about the DLMS protocol:

- [Communication - DLMS/COSEM protocol](#)
- [Communication - DLMS and Iskraemeco AC750 concentrator](#)

## Changes and modifications

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## Document revisions

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- Ver. 1.0 - May 30, 2011 - Document created.
- Ver. 1.1 - January 30, 2019 - Support for LN referencing.
- Ver. 1.2 - November 11, 2021 - Support for TCP/UDP Wrapper and Gateway protocol.



#### Related pages:

[Communication protocols](#)