CM-f3e module

Modbus communication module for MT880 meters

Technical description

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i. About the Technical description

- This technical description contains detailed information on the CM-f3e Modbus communication module for MT880 meters, its key features and functionalities.
- It is intended for a technical audience, who are responsible for the product and its integration into the system.

ii. Definitions, Acronyms and Abbreviations

CM	Communication Module
Consereth	Communication protocol (made by Iskraemeco) runs over TCP/IP protocol and enables transparent sending of any sort of messages through TCP/IP networks
COSEM	Companion Specification for Energy Metering
DHCP	Dynamic Host Configuration Protocol
DLMS UA	Device Language Message Specification User Association
DNS	Domain Name System
GND	Ground, common reference potential
GUI	Graphical User Interface
HTTP	Hypertext Transfer Protocol
Hz	Hertz
IEEE	Institute of Electrical and Electronics Engineers
IP	Internet Protocol
IPv4	Internet Protocol version 4
kV	kilo Volt
LAN	Local Area Network
LED	Light Emitting Diode
MAC Address	Media Access Control Address
mWh	milliwatt hour
RS	Recommended Standard
RTU	Remote Terminal Unit
RxD	Receive Data
SCADA	Supervisory Control And Data Acquisition
TCP	Transmission Control Protocol
THD	Total Harmonic Distortion
TxD	Transmit Data
W	Watt

iii. Reference documents

- MT880 User manual
- MT880 Installation and maintenance manual

iv. Versioning

Date	Version	Update
05.11.2014	V1.00	First version of document

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1. SAFETY INFORMATION

Safety information used in this Technical description is described with the following symbols and pictograms:

DANGER: for a possibly dangerous situation, which could result in severe physical injury or fatality – attention to a high risk hazards.

WARNING: attention to a medium risk hazards.

CAUTION: for a possibly dangerous situation, which could result in minor physical injury or material damage - attention to a low risk hazards.

Operating instruction: for general details and other useful information.

All safety information in this Technical description describes the type and source of danger; it is possible consequences and measures to avoid the danger.
All safety information written in this document applies to the MT880 meter with or without the module and to the module itself.

1.1. Responsibilities

The owner of the meter/module is responsible to assure that all authorized persons who work with the meter read and understand the parts of this technical description, the MT880 User manual and Installation and maintenance manual that explains the safe handling with the meter.

The personnel must be sufficiently qualified for the work that will be performed. The installation personnel must possess the required electrical knowledge and skills, and must be authorised by the utility to perform the installation procedure.

The personnel must strictly follow the safety regulations and operating instructions, written in the individual chapters in this document, the MT880 User Manual and the Installation and maintenance manual.

The owner of the meter/module responds specially for the protection of the persons, for prevention of material damage and for training of personnel.

1.2. Safety instructions

1.2.1. Handling and mounting

At the beginning of installation at the metering point, the module should be carefully taken out of the box where they were packed. This should prevent the module from falling as well as any other external or internal damage to the device and personal injuries. Should such an incident occur despite all precautions the module may not be installed at the metering point as such damage may result in different hazards. In such case, the module needs to be sent back to the manufacturer for examination and testing.

CAUTION: The module is intended only for indoor use!

DO NOT OPEN THE MODULE COVER!
Opening of the module might result in defects and damages. In such a case the warranty is not valid.

CAUTION: The edges of the seals, sealing wires as well as some edges under (removed) terminal cover are sharp!

DANGER: In case of any damage inside the meter/module (fire, explosion...) do not open the meter/module.

CAUTION: The meter/module may be used only for the purpose of measurement for which it was produced. Any misuse of the meter/module will lead to potential hazards.

WARNING: Safety measures should be observed at all times. Do not break the seals or open the meter/module at any time!

It must be consulted in all cases where symbol  is marked in order to find out the nature of the potential hazards and any actions which have to be taken to avoid them.

The module and the MT880 meter installation procedure is described in the MT880 Installation and maintenance manual. For safety reasons the following instructions should be followed.

See the complete MT880 User manual for detailed technical features of MT880 meter and the module and its intended use.

Only a properly connected meter/module can measure correctly! Every connection error could result in a financial loss for the power company!

1.2.2. Meter/module installation procedure

The installer must consult and comply with local regulations and read the installation instructions written in the MT880 Installation and maintenance manual before installation.

This Installation and maintenance manual provides the instructions for installing MT880 meters and modules. The document provides a short overview of the meter, details of device installation and set-up, installation considerations, and health and safety considerations.

The installer will be considered as a public face by both the power company and its customers. The installer shall adopt the highest standards of behaviour and be respectful to clients and members of the public.

Before the beginning of the installation procedure, check if the metering point is correctly prepared for meter installation. The metering point must always be left clean and in order.

The work location shall be defined and clearly marked. Adequate working space as well as means of access and lighting shall be provided at all parts of an electrical installation on, with, or near which any work activity is to be carried out.

Where necessary, safe access to the work location shall be clearly marked.

The metering point must not be exposed to running water or fire.

Meter/module installation may not be performed by unauthorised and untrained personnel. Such persons are not allowed to cut the seals and open the terminal or meter cover as contact with the live parts of the meter is dangerous for life.

CAUTION: The installer is expected to fully understand the risks and safety issues involved in electrical installations. The installer shall be aware at all times of the potential hazard of electrical shock and shall exercise due caution in completing the task!

Tools, equipment and devices shall comply with the requirements of relevant National or International Standards where these exist. Tools, equipment and devices shall be used in accordance with the instructions and/or guidance provided by the manufacturer or supplier.

Any tools, equipment and devices provided for the purpose of safe operation of, or work on, with, or near electrical installations shall be suitable for that use, be maintained and be properly used.

Personnel shall wear clothing suitable for the locations and conditions where they are working. This could include the use of close-fitting clothing or additional PPE (personal protective equipment).

CAUTION: The installer must be correctly equipped with personal protection equipment (PPE) and use the appropriate tools at all times during the installation.

Working procedures are divided into three different procedures: dead working, live working, and working in the vicinity of live parts. All these procedures are based on the use of protective measures against electric shock and/or the effects of short-circuits and arcing.

The installer must be informed if the national legislation permits the work on the installation under voltage – live work, and must follow the rules of legislation.

Depending on the kind of work, the personnel working in such conditions shall be instructed or skilled. Live working requires the use of specific procedures. Instructions shall be given how to maintain tools, equipment and devices in good working order and how to verify them before working.

This subclause deals with the essential requirements (“the five safety or golden rules”) for ensuring that the electrical installation at the work location is dead and secure for the duration of the work.

This shall require clear identification of the work location. After the respective electrical installations have been identified, the following five essential requirements shall be undertaken in the specified order unless there are essential reasons for doing otherwise: disconnect completely (1.), secure against re-connection (2.), verify that the installation is dead (3.), carry out earthing and short-circuiting (4.) and provide protection against adjacent live parts (5.).

CAUTION: Only one wire or ferrule may be connected in one terminal. Otherwise, the terminal could be damaged or the contact could not be made properly.

CAUTION: Do not use those types of cable, which are not prescribed for the installation site and the power requirements!

DANGER: The insulation of the connecting cable must extend over the whole visible part of the cable. There must be no further bare part of the cable visible above the terminal edge. Touching live parts is dangerous for life. The stripped part of the connecting wire should be shortened if necessary.

1.2.3. Module maintenance

No maintenance is required during the module's life-time. The implemented metering technique, built-in components and manufacturing procedures ensure high long-term stability of meters and the modules. Therefore no recalibration is required during entire meters life-time.

In case the service of the module is needed, the requirements from the meter installation procedure must be observed and followed.

Cleaning of the module is allowed only with a soft dry cloth. Cleaning is allowed only in upper part of the module. Cleaning is forbidden in the back and side sites of the module. Cleaning can be performed only by the personnel responsible for meter/module maintenance.

CAUTION: Never clean soiled meters/modules under running water or with high pressure devices. Penetrating water can cause short circuits. A damp cleaning cloth is sufficient to remove normal dirt such as dust. If the meter/module is more heavily soiled, it should be dismounted and sent to the responsible service or repair centre.

Visible signs of fraud attempt (mechanical damages, presence of a liquid, etc.) must be regularly checked.

The quality of seals and the state of the terminals and connecting cables must be regularly checked.

If there exists a suspicion of incorrect operation of the meter/module, the local utility must be informed immediately.

After the end of the meter's/module's lifetime, the meter/module should be treated according to the Waste Electric and Electronic (WEEE) Directive!

2. CM-f3e COMMUNICATION MODULE

2.1. General

The Modbus communication module CM-f3e (see Figure 1) is intended for direct SCADA connection via Modbus RTU and/or Modbus TCP/IP.

Analogue current loop (20 mA loop) is also available on the module.

It is constructed to be inserted or removed from the meter with ease and fixed without any screws, also when meter is powered.

Figure 1: CM-f3e module

CAUTION!

The module is intended only for indoor use!

NOTE!

For proper module operation, the meter firmware version has to be at least **ISKAMMT880100414** or higher.

2.2. Identification

The version and hardware type of module are stored in the module memory. This information provides plug and play operation.

3. MODULE CONFIGURATION

3.1. Power supply

Power supply for the module is provided by the meter. The power consumption depends on communication activity (see Table 1).

	Power consumption (W)
Min. – communication is not active, 4 mA generated via current loop	1,19
Max. – active communication, 20 mA generated via current loop	1,92

Table 1: Module power consumption

3.2. Communication channels

There are two communication channels on the module:

- RS485 serial interface with Modbus/RTU communication protocol
- RJ45 Ethernet interface with Modbus/TCP communication protocol

3.3. Module to meter connector

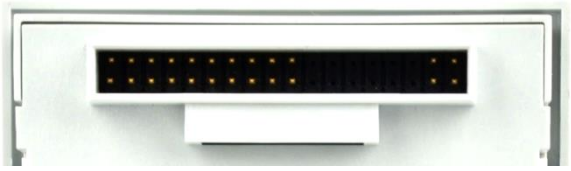

Figure 2: 24 pin connector on the back side of the module

Module to meter connector provides power, control and data signals.

3.4. Modbus TCP/IP interface

The Ethernet interface is standardised to IEEE 802.3. The Ethernet interface permits connection to the LAN (Local Area Network) by means of the transmission control protocol Modbus TCP/IP (Transmission Control Protocol/Internet Protocol). The maximum transmission speed is 100 Mbit/s.

The Ethernet connection of the communication module is made via an RJ45 socket with the pin assignment as it is shown in Table 2 (see Figure 3).

Pin No.	Terminal	Signal
1	TxD+	Transmitted Data +
2	TxD-	Transmitted Data -
3	RxD+	Received Data +
6	RxD-	Received Data -

Table 2: RJ45 socket pin assignment

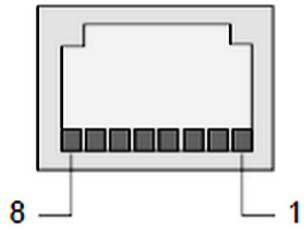

Figure 3: Pin numbering of RJ45 socket

Currently supported protocols are Static address (predefined IPv4 address is used) or DHCP client (IPv4 address is assigned by DHCP server).
DNS servers are not used by application and can be omitted.

To allow module to successfully communicate with meter, meter communication port (channel 2) has to be configured as (see Figure 4):
– physical communication speed: **115200 bit/s**
– communication mode: **DLMS UA**
– HDLC device address: **17**

IEC local port setup channel 2
Logical name: 0-2:20.0.0*255, Class ID: IEC local port setup (19), Version: 1

Communication mode
1 - Protocol according to IEC 62056-46 (DLMS UA)
Default baud rate
115200
Proposed baud rate
115200
Response time
0 - 20ms

IEC HDLC setup channel 2
Logical name: 0-2:22.0.0*255, Class ID: IEC HDLC setup class (23),

Communication speed
115200
Window size transmit
1
Window size receive
1
Max info field length transmit
154
Max info field length receive
154
Inter octet time out
50
Inactivity time out
120
Device address
17

Figure 4: Configuration of meter communication port (channel 2)

L

EDs show current status of modem (see Figure 5 and Table 3).

Figure 5: LEDs status

LED's ID	LED's name	Definition	Description
D1	**Link/Activity**	Ethernet link activity	OFF – no activity on Ethernet ON – activity on Ethernet BLINK – transmitting/receiving Ethernet frames
D2	**Speed 10/100 Mb/s**	10/100 Mbit/s speed selection	OFF – no link or 10 Mbit/s detected ON – link is up and 100 Mbit/s detected BLINK – N/A
D3	**RxD**	RX serial data	OFF – no reception from the meter ON – Ethernet interface is receiving data from the meter BLINK – N/A
D4	**TxD**	TX serial data	OFF – No transmission to the meter ON – Ethernet interface is transmitting data to the meter BLINK – N/A
D5	**Current loop**	Current loop status	OFF – Load in current loop not connected (open loop) ON – Load in current loop connected BLINK – Current load active (Current flow 4-20mA)

Table 3: LEDs description

3.5. Modbus RTU (RS485) interface

Modbus RTU interface can be used for:

- direct meter connection to SCADA system
- cascading functionality under SCADA system – up to 31 meters

RS485 is realized as half-duplex interface with 3 connection terminals (A, B, GND). Terminals are doubled for easy cascading connection. (See Figure 6 and Table 4.)

The meter hosting the communication module controls communication channel settings, communication speed is up to 115200 bit/s.

Same transfer rate needs to be set on all cascaded meters.

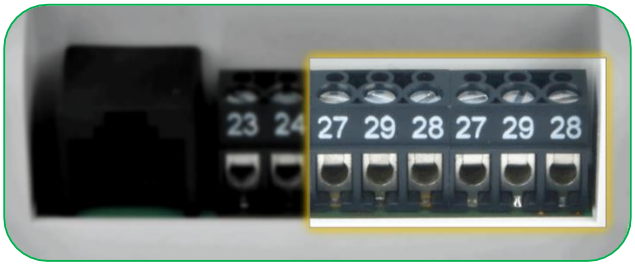

Figure 6: RS485 terminals

Terminal	Signal	Description
27	**A**	RS485 A line
29	**B**	RS485 B line
28	**GND**	Digital ground

Table 4: RS485 terminal description

Technical data for RS485 interface:

- Communication speed: 300-115000 bit/s
- up to 31 connected meters
- Maximum distance: 1200 m

3.5.1. Modbus RTU communication settings

Available Modbus server addresses: 1 ÷ 247

- **Manually**
  Available Modbus server addresses: 1 ÷ 247
- **Automatically** – address is defined from the meter serial number:
  100 + last two digits of the meter factory number
  Example:
  Meter factory number: 35678**21**
  Automatically assigned Modbus server address: 100 + 21 =**121**

Modbus/RTU serial communication:

- Speed: 2400, 4800, 9600,19200, 38400, 57600, 115200 (default = 9600)
- Data bits: 8
- Parity: None, Even, Odd (default = None)
- Stop bits: 1, 2 (default = 1)

3.6. Analogue output

There is one analogue output on the module (Figure 7), realized via active 4 mA – 20 mA current loop.

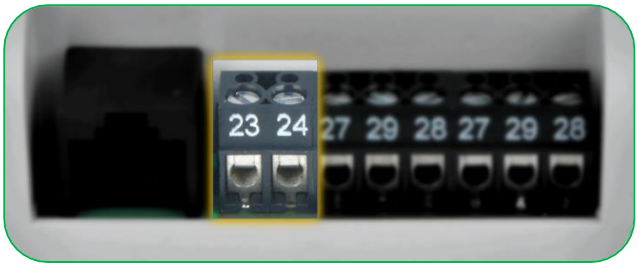

Figure 7: Analogue output

3.6.1. Current levels

Less than 4 mA - Indicates 'Fault' (out of specification or faulty), also known as dead signal
4 mA – indicates 0% of selected value, also known as live zero

20 mA – indicates 100% of selected value
4 mA – 20 mA = Output is proportional to the specified value, also known as live signal

Iskraemeco propose to use 250 Ω precision resistor connected in series with the circuit, which will produce a range of readings from 1 V of drop at 4 mA to 5 V of drop at 20 mA.

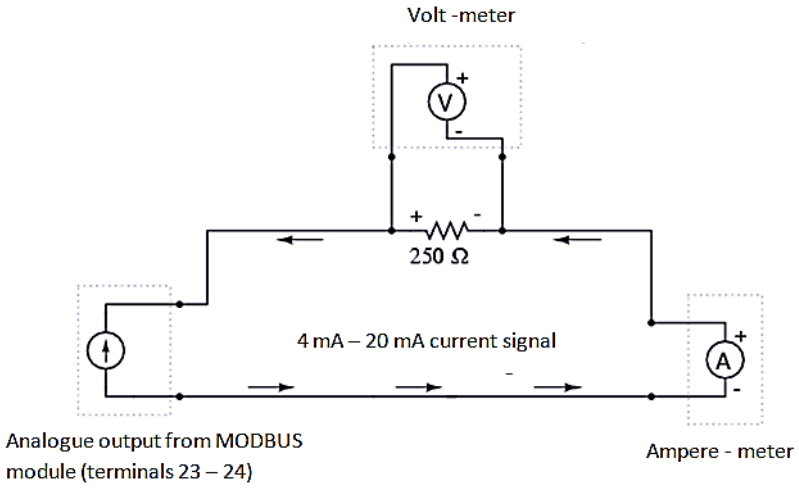

Figure 8: Analogue output connection

Percent of measurement	4 mA – 20 mA signal [mA]	1 V – 5 V signal (by using 250 Ω precise resistor) [V]
0	4	1
10	5.6	1.4
20	7.2	1.8
30	8.8	2.2
40	10.4	2.6
50	12	3
60	13.6	3.4
70	15.2	3.8
80	16.8	4.2
90	18.4	4.6
100	20	5

Table 5: Signal levels

4. MODULE CONNECTION

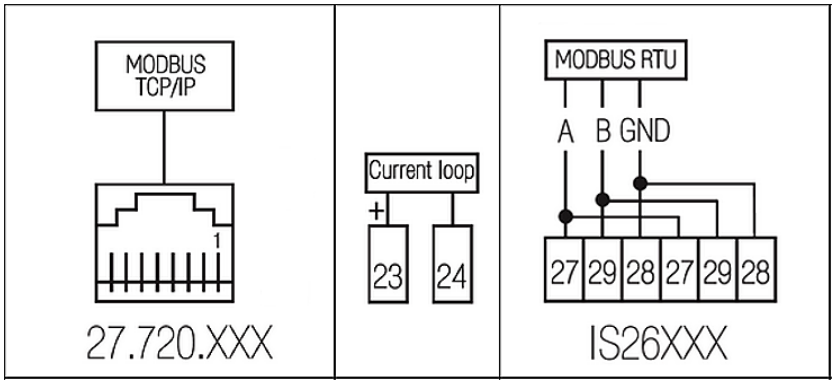

Figure 9: Connection diagram

Figure 10: CM-f3e module terminals

5. MODBUS APPLICATION

Modbus module provides the following functionalities:

- mapping metering values available in COSEM General local port readout object (0-0:21.0.0.255) to Modbus registers
- all the registers can be read using the Modbus function “03: Read Holding Registers”
- default setup for measurement resolution is 100 mWh. In case of other meter measurement resolution setup in the meter, data from the Modbus module have to be multiplied or divided – use appropriate values as they are presented in Table 6.
- Modbus parameters could be configured over WEB GUI
- current loop (sense) output is controlled based on selected COSEM object by the user over WEB GUI only
- IP networking configuration is stored in the meter and is periodically read by application, configuration can we changed over WEB GUI or directly in COSEM objects in the meter
- The Power Quality functional module must be enabled for proper module functionality.

Meter resolution	Modbus energy and demand values
1 Wh	**Multiply** Modbus energy/demand values with 10
100 mWh (default meter setting)	—
10 mWh	**Divide** Modbus energy/demand values with 10
1 mWh	**Divide** Modbus energy/demand values with 100

Table 6: Meter measurement resolution – adaptation factors

5.1. Modbus registers description and mapping from COSEM objects

Meter COSEM object (0-0:21.0.0*255) has to be properly set in the MT880 meter:

- Capture object (0-0:21.0.0*255, attribute 2); proper setting is required
- Capture period (0-0:21.0.0*255, attribute 3); set to 10 seconds

NOTE!

For the proper operation MT880 meter has to be programmed accordingly. For more information, please contact your representative or manufacturer.

Reg.	#	Description	Format*	OBIS code	Note**
0	2	Device ID 1, manufacturing number	long	0-0:96.1.0.255	
2	3	Current System Time	integer	0-0:0.9.1.255	1
5	3	Current System Date	integer	0-0:0.9.2.255	2
8	4	Active energy import (+A)	double	1-0:1.8.0.255	
12	4	Active energy export (−A)	double	1-0:2.8.0.255	
16	4	Reactive energy import (+R)	double	1-0:3.8.0.255	
20	4	Reactive energy export (-R)	double	1-0:4.8.0.255	
24	4	Reactive energy QI (+Ri)	double	1-0:5.8.0.255	
28	4	Reactive energy QII (+Rc)	double	1-0:6.8.0.255	
32	4	Reactive energy QIII (-Ri)	double	1-0:7.8.0.255	
36	4	Reactive energy QIV (-Rc)	double	1-0:8.8.0.255	
40	4	Apparent energy import (+VA) (QI+QIV)	double	1-0:9.8.0.255	
44	4	Apparent energy export (-VA) (QII+QIII)	double	1-0:10.8.0.255	
48	4	Active energy import (+A) – L1	double	1-0:21.8.0.255	

Reg.	#	Description	Format*	OBIS code	Note**
52	4	Active energy import (+A) – L2	double	1-0:41.8.0.255	
56	4	Active energy import (+A) – L3	double	1-0:61.8.0.255	
60	4	Active energy export (-A) – L1	double	1-0:22.8.0.255	
64	4	Active energy export (-A) – L2	double	1-0:42.8.0.255	
68	4	Active energy export (-A) – L3	double	1-0:62.8.0.255	
72	4	Reactive energy import (+R) – L1	double	1-0:23.8.0.255	
76	4	Reactive energy import (+R) – L2	double	1-0:43.8.0.255	
80	4	Reactive energy import (+R) – L3	double	1-0:63.8.0.255	
84	4	Reactive energy export (-R) – L1	double	1-0:24.8.0.255	
88	4	Reactive energy export (-R) – L2	double	1-0:44.8.0.255	
92	4	Reactive energy export (-R) – L3	double	1-0:64.8.0.255	
96	4	Reactive energy QI (+Ri) – L1	double	1-0:25.8.0.255	
100	4	Reactive energy QI (+Ri) – L2	double	1-0:45.8.0.255	
104	4	Reactive energy QI (+Ri) – L3	double	1-0:65.8.0.255	
108	4	Reactive energy QII (+Rc) – L1	double	1-0:26.8.0.255	
112	4	Reactive energy QII (+Rc) – L2	double	1-0:46.8.0.255	
116	4	Reactive energy QII (+Rc) – L3	double	1-0:66.8.0.255	
120	4	Reactive energy QIII (-Ri) – L1	double	1-0:27.8.0.255	
124	4	Reactive energy QIII (-Ri) – L2	double	1-0:47.8.0.255	
128	4	Reactive energy QIII (-Ri) – L3	double	1-0:67.8.0.255	
132	4	Reactive energy QIV (-Rc) – L1	double	1-0:28.8.0.255	
136	4	Reactive energy QIV (-Rc) – L2	double	1-0:48.8.0.255	
140	4	Reactive energy QIV (-Rc) – L3	double	1-0:68.8.0.255	
144	4	Apparent energy import (+VA) (QI+QIV) – L1	double	1-0:29.8.0.255	
148	4	Apparent energy import (+VA) (QI+QIV) – L2	double	1-0:49.8.0.255	
152	4	Apparent energy import (+VA) (QI+QIV) – L3	double	1-0:69.8.0.255	
156	4	Apparent energy export (-VA) (QII+QIII) – L1	double	1-0:30.8.0.255	
160	4	Apparent energy export (-VA) (QII+QIII) – L2	double	1-0:50.8.0.255	
164	4	Apparent energy export (-VA) (QII+QIII) – L3	double	1-0:70.8.0.255	
168	2	Instantaneous active power (|+A|+|-A|)	float	1-0:15.7.0.255	
170	2	Instantaneous active import power (+A)	float	1-0:1.7.0.255	
172	2	Instantaneous active import power (+A) L1	float	1-0:21.7.0.255	
174	2	Instantaneous active import power (+A) L2	float	1-0:41.7.0.255	
176	2	Instantaneous active import power (+A) L3	float	1-0:61.7.0.255	
178	2	Instantaneous active export power (-A)	float	1-0:2.7.0.255	
180	2	Instantaneous active export power (-A) L1	float	1-0:22.7.0.255	
182	2	Instantaneous active export power (-A) L2	float	1-0:42.7.0.255	
184	2	Instantaneous active export power (-A) L3	float	1-0:62.7.0.255	
186	2	Instantaneous reactive import power (+R)	float	1-0:3.7.0.255	
188	2	Instantaneous reactive import power (+R) L1	float	1-0:23.7.0.255	
190	2	Instantaneous reactive import power (+R) L2	float	1-0:43.7.0.255	
192	2	Instantaneous reactive import power (+R) L3	float	1-0:63.7.0.255	
194	2	Instantaneous reactive export power (-R)	float	1-0:4.7.0.255	
196	2	Instantaneous reactive export power (-R) L1	float	1-0:24.7.0.255	
198	2	Instantaneous reactive export power (-R) L2	float	1-0:44.7.0.255	
200	2	Instantaneous reactive export power (-R) L3	float	1-0:64.7.0.255	
202	2	Reactive energy QI Instantaneous (+Ri)	float	1-0:5.7.0.255	
204	2	Reactive energy QI Instantaneous (+Ri) – L1	float	1-0:25.7.0.255	

Reg.	#	Description	Format*	OBIS code	Note**
206	2	Reactive energy QI Instantaneous (+Ri) – L2	float	1-0:45.7.0.255	
208	2	Reactive energy QI Instantaneous (+Ri) – L3	float	1-0:65.7.0.255	
210	2	Reactive energy QII Instantaneous (+Rc)	float	1-0:6.7.0.255	
212	2	Reactive energy QII Instantaneous (+Rc) – L1	float	1-0:26.7.0.255	
214	2	Reactive energy QII Instantaneous (+Rc) – L2	float	1-0:46.7.0.255	
216	2	Reactive energy QII Instantaneous (+Rc) – L3	float	1-0:66.7.0.255	
218	2	Reactive energy QIII Insatntaneous (-Ri)	float	1-0:7.7.0.255	
220	2	Reactive energy QIII Insatntaneous (-Ri) – L1	float	1-0:27.7.0.255	
222	2	Reactive energy QIII Insatntaneous (-Ri) – L2	float	1-0:47.7.0.255	
224	2	Reactive energy QIII Insatntaneous (-Ri) – L3	float	1-0:67.7.0.255	
226	2	Reactive energy QIV Instantaneous (-Rc)	float	1-0:8.7.0.255	
228	2	Reactive energy QIV Instantaneous (-Rc) – L1	float	1-0:28.7.0.255	
230	2	Reactive energy QIV Instantaneous (-Rc) – L2	float	1-0:48.7.0.255	
232	2	Reactive energy QIV Instantaneous (-Rc) – L3	float	1-0:68.7.0.255	
234	2	Instantaneous apparent import power (+VA)	float	1-0:9.7.0.255	
236	2	Instantaneous apparent import power (+VA) L1	float	1-0:29.7.0.255	
238	2	Instantaneous apparent import power (+VA) L2	float	1-0:49.7.0.255	
240	2	Instantaneous apparent import power (+VA) L3	float	1-0:69.7.0.255	
242	2	Instantaneous apparent export power (-VA)	float	1-0:10.7.0.255	
244	2	Instantaneous apparent export power (-VA) L1	float	1-0:30.7.0.255	
246	2	Instantaneous apparent export power (-VA) L2	float	1-0:50.7.0.255	
248	2	Instantaneous apparent export power (-VA) L3	float	1-0:70.7.0.255	
250	2	Instantaneous net frequency	float	1-0:14.7.0.255	
252	2	Last Average Power factor positive (+A/ +VA)	float	1-0:13.5.0.255	
254	2	Instantaneous Power factor positive (+A/ +VA)	float	1-0:13.7.0.255	
256	2	Last Average Power factor L1 positive (+A/ +VA)	float	1-0:33.5.0.255	
258	2	Instantaneous Power factor L1 positive (+A/+VA)	float	1-0:33.7.0.255	
260	2	Last Average Power factor L2 positive (+A/ +VA)	float	1-0:53.5.0.255	
262	2	Instantaneous Power factor L2 positive (+A/+VA)	float	1-0:53.7.0.255	
264	2	Last Average Power factor L3 positive (+A/ +VA)	float	1-0:73.5.0.255	
266	2	Instantaneous Power factor L3 positive (+A/+VA)	float	1-0:73.7.0.255	
268	2	Last Average Power factor negative (-A/VA)	float	1-0:84.5.0.255	
270	2	Instantaneous Power factor negative (-A/VA)	float	1-0:84.7.0.255	
272	2	Last Average Power factor L1 negative (-A/VA)	float	1-0:85.5.0.255	
274	2	Instantaneous Power factor L1 negative (A/-VA)	float	1-0:85.7.0.255	
276	2	Last Average Power factor L2 negative (-A/VA)	float	1-0:86.5.0.255	
278	2	Instantaneous Power factor L2 negative (-A/-VA)	float	1-0:86.7.0.255	
280	2	Last Average Power factor L3 negative (-A/VA)	float	1-0:87.5.0.255	
282	2	Instantaneous Power factor L3 negative (A/-VA)	float	1-0:87.7.0.255	
284	2	Instantaneous current L1	float	1-0:31.7.0.255	
286	2	Instantaneous Current THD L1	float	1-0:31.7.124.255	
288	2	Instantaneous current L2	float	1-0:51.7.0.255	
290	2	Instantaneous Current THD L2	float	1-0:51.7.124.255	
292	2	Instantaneous current L3	float	1-0:71.7.0.255	
294	2	Instantaneous Current THD L3	float	1-0:71.7.124.255	
296	2	Instantaneous voltage L1	float	1-0:32.7.0.255	
298	2	Instantaneous voltage THD L1	float	1-0:32.7.124.255	
300	2	Instantaneous voltage L2	float	1-0:52.7.0.255	

Reg.	#	Description	Format*	OBIS code	Note**
302	2	Instantaneous voltage THD L2	float	1-0:52.7.124.255	
304	2	Instantaneous voltage L3	float	1-0:72.7.0.255	
306	2	Instantaneous voltage THD L3	float	1-0:72.7.124.255	
308	2	Active energy import (+A) Last Average Demand	float	1-0:1.5.0.255	
310	2	Active energy export (-A) Last Average Demand	float	1-0:2.5.0.255	
312	2	Reactive energy import (+R) Last Average Demand	float	1-0:3.5.0.255	
314	2	Reactive energy export (-R) Last Average Demand	float	1-0:4.5.0.255	
316	2	Reactive energy QI (+Ri) Last Average Demand	float	1-0:5.5.0.255	
318	2	Reactive energy QII (+Rc) Last Average Demand	float	1-0:6.5.0.255	
320	2	Reactive energy QIII (+Ri) Last Average Demand	float	1-0:7.5.0.255	
322	2	Reactive energy QIV (-Rc) Last Average Demand	float	1-0:8.5.0.255	
324	2	Apparent energy import (+VA) (QI+QIV) Last Average Demand	float	1-0:9.5.0.255	
326	2	Apparent energy export (-VA) (QII+QIII) Last Average Demand	float	1-0:10.5.0.255	
328	2	Average voltage in load profile period 2 - phase R	float	1-0:32.28.0.255	
330	2	Average voltage in load profile period 2 - phase S	float	1-0:52.28.0.255	
332	2	Average voltage in load profile period 2 - phase T	float	1-0:72.28.0.255	
334	2	Average current in registration period 1 - phase R	float	1-0:31.28.0.255	
336	2	Average current in registration period 1 - phase S	float	1-0:51.28.0.255	
338	2	Average current in registration period 1 - phase T	float	1-0:71.28.0.255	
340	1	number of decimal digits for energy	short		
341	2	Active energy import (+A)	long	1-0:1.8.0.255	3
343	2	Active energy import (+A) – L1	long	1-0:21.8.0.255	3
345	2	Active energy import (+A) – L2	long	1-0:41.8.0.255	3
347	2	Active energy import (+A) – L3	long	1-0:61.8.0.255	3
349	2	Active energy export (−A)	long	1-0:2.8.0.255	3
351	2	Active energy export (-A) – L1	long	1-0:22.8.0.255	3
353	2	Active energy export (-A) – L2	long	1-0:42.8.0.255	3
355	2	Active energy export (-A) – L3	long	1-0:62.8.0.255	3
357	2	Reactive energy import (+R)	long	1-0:3.8.0.255	3
359	2	Reactive energy import (+R) – L1	long	1-0:23.8.0.255	3
361	2	Reactive energy import (+R) – L2	long	1-0:43.8.0.255	3
363	2	Reactive energy import (+R) – L3	long	1-0:63.8.0.255	3
365	2	Reactive energy export (-R)	long	1-0:4.8.0.255	3
367	2	Reactive energy export (-R) – L1	long	1-0:24.8.0.255	3
369	2	Reactive energy export (-R) – L2	long	1-0:44.8.0.255	3
371	2	Reactive energy export (-R) – L3	long	1-0:64.8.0.255	3
373	2	Reactive energy QI (+Ri)	long	1-0:5.8.0.255	3
375	2	Reactive energy QI (+Ri) – L1	long	1-0:25.8.0.255	3
377	2	Reactive energy QI (+Ri) – L2	long	1-0:45.8.0.255	3
379	2	Reactive energy QI (+Ri) – L3	long	1-0:65.8.0.255	3
381	2	Reactive energy QII (+Rc)	long	1-0:6.8.0.255	3
383	2	Reactive energy QII (+Rc) – L1	long	1-0:26.8.0.255	3
385	2	Reactive energy QII (+Rc) – L2	long	1-0:46.8.0.255	3
387	2	Reactive energy QII (+Rc) – L3	long	1-0:66.8.0.255	3
389	2	Reactive energy QIII (-Ri)	long	1-0:7.8.0.255	3
391	2	Reactive energy QIII (-Ri) – L1	long	1-0:27.8.0.255	3
393	2	Reactive energy QIII (-Ri) – L2	long	1-0:47.8.0.255	3
395	2	Reactive energy QIII (-Ri) – L3	long	1-0:67.8.0.255	3

Reg.	#	Description	Format*	OBIS code	Note**
397	2	Reactive energy QIV (-Rc)	long	1-0:8.8.0.255	3
399	2	Reactive energy QIV (-Rc) – L1	long	1-0:28.8.0.255	3
401	2	Reactive energy QIV (-Rc) – L2	long	1-0:48.8.0.255	3
403	2	Reactive energy QIV (-Rc) – L3	long	1-0:68.8.0.255	3
405	2	Apparent energy import (+VA) (QI+QIV)	long	1-0:9.8.0.255	3
407	2	Apparent energy import (+VA) (QI+QIV) – L1	long	1-0:29.8.0.255	3
409	2	Apparent energy import (+VA) (QI+QIV) – L2	long	1-0:49.8.0.255	3
411	2	Apparent energy import (+VA) (QI+QIV) – L3	long	1-0:69.8.0.255	3
413	2	Apparent energy export (-VA) (QII+QIII)	long	1-0:10.8.0.255	3
415	2	Apparent energy export (-VA) (QII+QIII) – L1	long	1-0:30.8.0.255	3
417	2	Apparent energy export (-VA) (QII+QIII) – L2	long	1-0:50.8.0.255	3
419	2	Apparent energy export (-VA) (QII+QIII) – L3	long	1-0:70.8.0.255	3

* Format – Data types are complaint with the C programming language standard data types

- short 2 bytes 16 bit two's complement
- integer 4 bytes 32 bit two's complement
- float 4 bytes 32 bit floating point IEEE 754 format
- double 8 bytes 64 bit floating point IEEE 754 format

** Note:

1 Actual time:
Bytes 0, 1: hours (0-24)
Bytes 2,3: minutes (0-59)
Bytes 4, 5: seconds (0-59)

2 Actual date:
Bytes 0, 1: year
Bytes 2, 3: month
Bytes 4, 5: day

3 Fixed point presentation of floating point register, unit used for conversion is read from object 0-0:196.1.5.255

Table 7: Modbus mapping table

All the values are expressed in accordance with the engineering units. Since the proper energy and demand presentation is related to the meter measurement resolution, we suggest you to check the meter resolution in object 0-0:196.0.3*255, if it is set up to 100 mWh, otherwise, you need to multiplied or divided the energy/demand values getting from the Modbus module according the multiplier/divider from the Table 6.

Active energy	kWh
Active power	kW
Frequency	Hz
THD	%
Reactive energy	kvarh
Reactive power	kvar
Current	A
Power factor	
Apparent power	kVA
Voltage	V

Table 8: Units

6. SETTINGS

Parameters can be changed via:

- Meter objects – TCP/IP settings
- Web GUI (Web Graphical User Interface) – related to TCP/IP, Modbus TCP, Modbus RTU and analogue output

6.1. Change settings via meter object

After installing module into the meter, module read the basic configuration from the meter and save them in the module memory.

NOTE!

In case that module is inserted into the meter by Iskraemeco, then default parameters are already written in the meter/module.

If modem is delivered as standalone product, then you need to take care about the initial meter parameterization.

New values are automatically stored in the meter in a predefined COSEM objects. Changed values are applied immediately.

6.1.1. TCP/IP settings

TCP/IP settings (Table 9) can be set also directly in COSEM objects and will be applied latest in 10 seconds after set.

	Description	Default value	Storage (meter memory)
DL reference	DL reference	0.0.25.1.0.255	0-0:25.1.0.255, attribute 2
IPv4 netmask	device IPv4 subnet mask	255.255.255.0	0-0:25.1.0.255, attribute 6
IPv4 gateway	device IPv4 default gateway	0.0.0.0	0-0:25.1.0.255, attribute 7
Protocol	use DHCP for IPv4 assignment	False	0-0:25.1.0.255, attribute 8
DNS servers	primary DNS server address	0.0.0.0	0-0:25.1.0.255, attribute 9
DNS servers	secondary DNS server address	0.0.0.0	0-0:25.1.0.255, attribute 10
IPv4 address	device IPv4 address	192.168.1.1	0-0:25.3.0.255, attribute 4

Table 9: Ethernet configuration

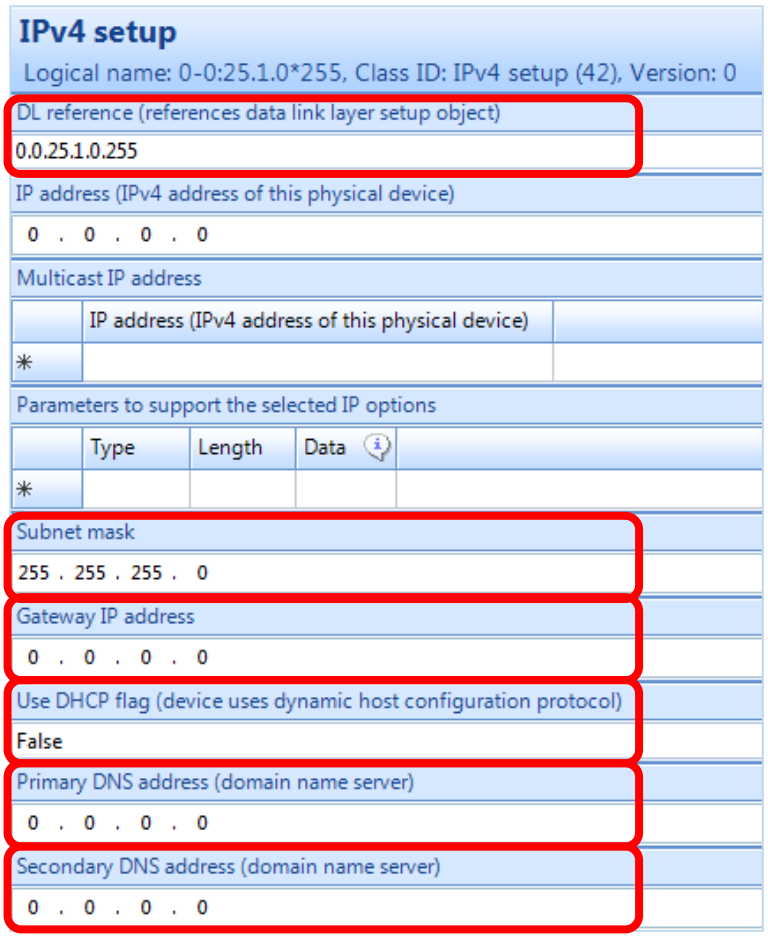

Figure 11: Ethernet configuration

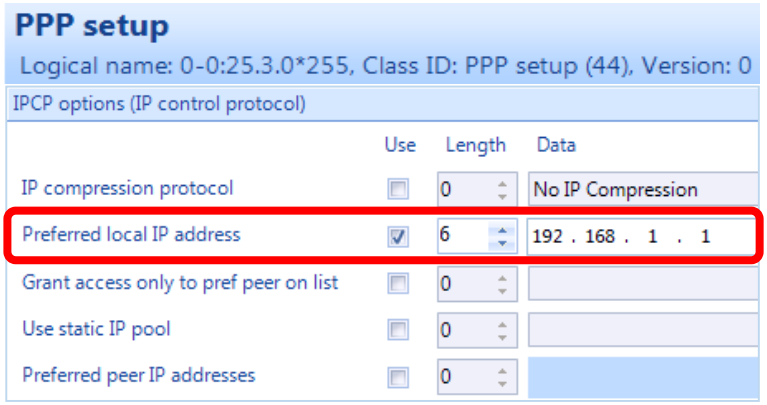

Figure 12: Preferred local IP

6.2. Change settings via Web GUI

Access to WEB server can be enabled/disabled by COSEM object 0-0:128.103.2.255, attribute 2.

	Description	Default value	Storage (meter memory)
Device Flags	WEB GUI access selection (bit 15) • 32768 – enabled • 0 – disabled	32768	0-0:128.103.2.255, attribute 2

Table 10: Web GUI selection

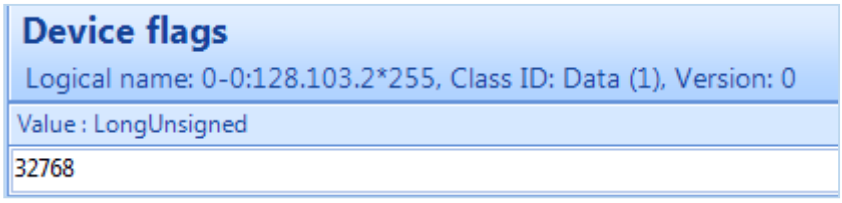

Figure 13: Web GUI selection – enabled

WEB server provides configuration interface and module firmware upgrade (only with administration rights). Access to the management WEB service is protected by username and password.

WEB GUI is accessible at IP address defined in COSEM object 0-0:25.3.0.255, attribute 4, parameter Preferred Local IP (example http://192.168.1.1) or address assigned by DHCP server, port 80.
Pages can be opened with any modern WEB browser like Firefox, Internet Explorer, Chrome and Safari.

Webuser (see Table 11) has access to configure application parameters: LAN settings, Modbus TCP, Modbus RTU and Analogue output settings.

	Description	Default value	Storage location
HTTP user username	Name used to login into HTTP server – limited access	webuser	Module
HTTP user password	Password used to login into HTTP server	webuser	Module

Table 11: System configuration of Webuser

1. In a browser address bar enter a preferred local IP (example http://192.168.1.1) or an address assigned by DHCP, port 80.
2. *Webuser* has to login (see Table 11 and Figure 14).
   Username: **webuser**
   Password: **webuser**

NOTE!
Username and password cannot be changed. Both of them are case sensitive.

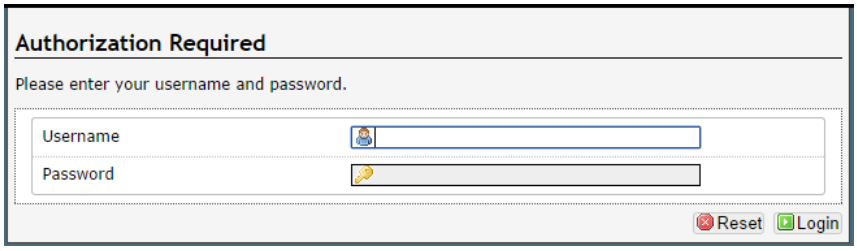

Figure 14: WEB GUI login page

3. After successful login, page with configuration tabs is shown (see Figure 15).
   Click on tabs to view or change (**Edit**) any configuration.

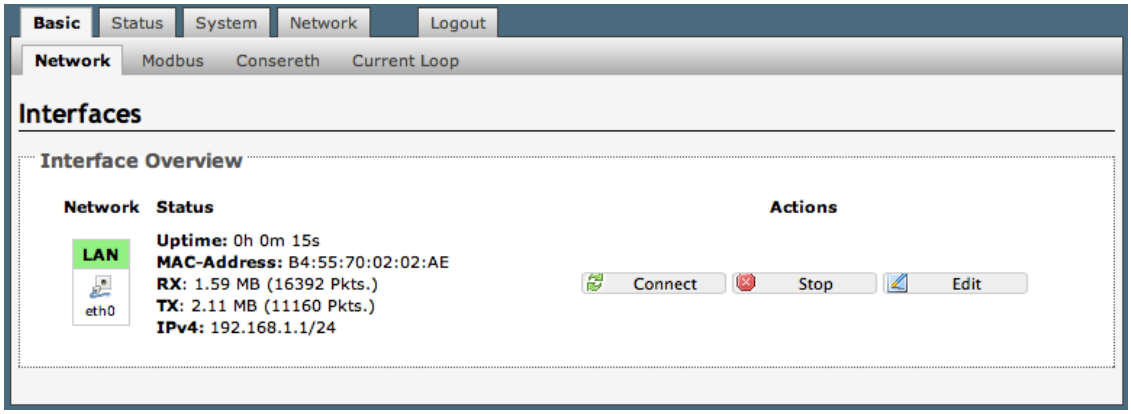

Figure 15: Page with configuration tabs

4. After any change of configuration **Save & Apply** button needs to be pressed to apply changes to the system.

Figure 16: Save & Apply command

NOTE!

Please note, **do not forget applied settings**. If you do, module has to be send back to factory to restore default settings or has to be changed in the meter over other meter communication ports if available.

6.2.1. LAN settings

To change IP network settings under **Network** tab, press **Edit** button (see Figure 15 and Figure 17).

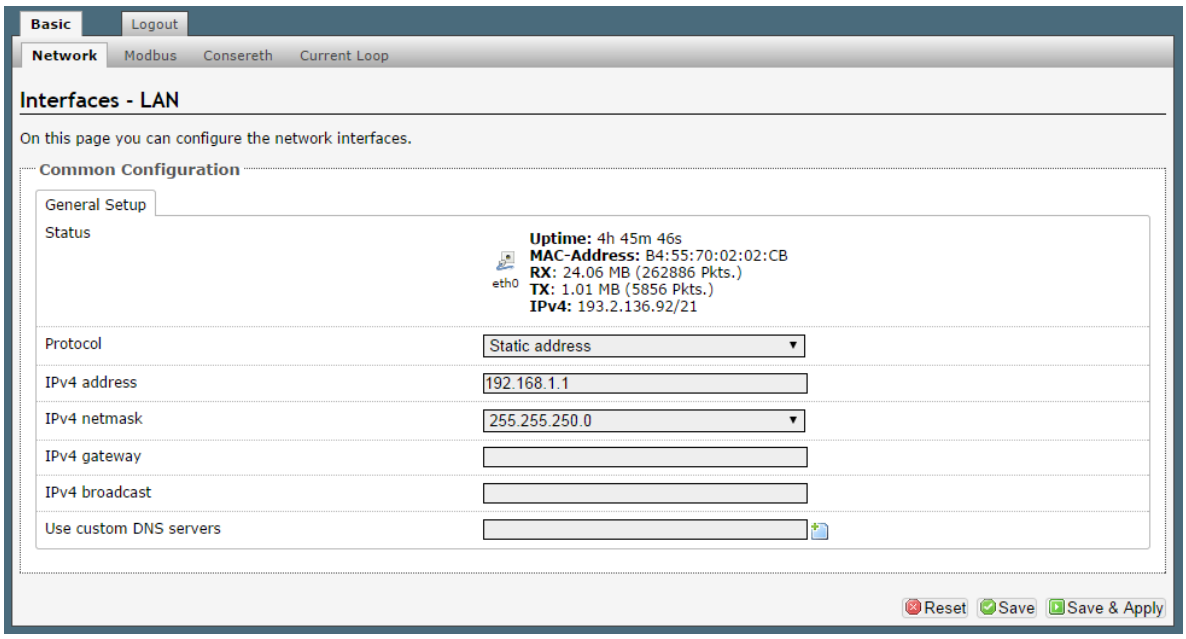

Figure 17: LAN configuration

Currently supported protocols are Static address (predefined IPv4 address is used) or DHCP client (IPv4 address is assigned by DHCP server).

DNS servers are not used by application and can be omitted.

New values are automatically stored in the meter in a predefined COSEM objects. Changed values are applied immediately.

Networking settings can be set also directly in COSEM objects and will be applied immediately.

6.2.2. Modbus TCP settings

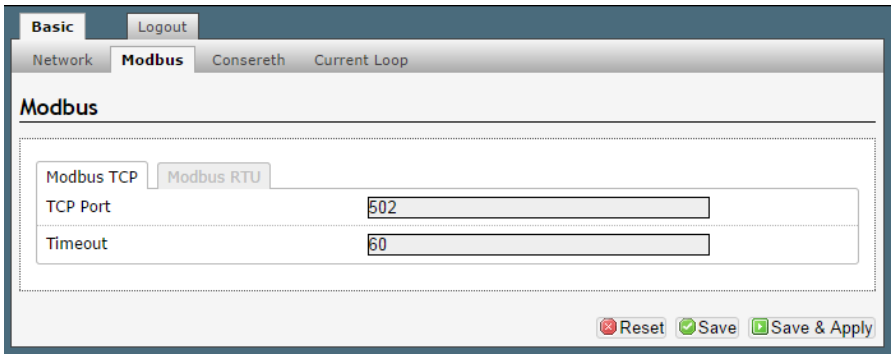

Figure 18: Configuring Modbus TCP

	Description	Default value	Storage
TCP Port	TCP listen port number (1 - 65535)	502	module
Time	TCP inactivity timeout	60	module

Table 12: Modbus TCP settings

Changed values are applied immediately or after Modbus TCP connection is terminated. Do not select TCP ports used by other protocols, like 80 (http) or 22 (ssh).

6.2.3. Modbus RTU settings

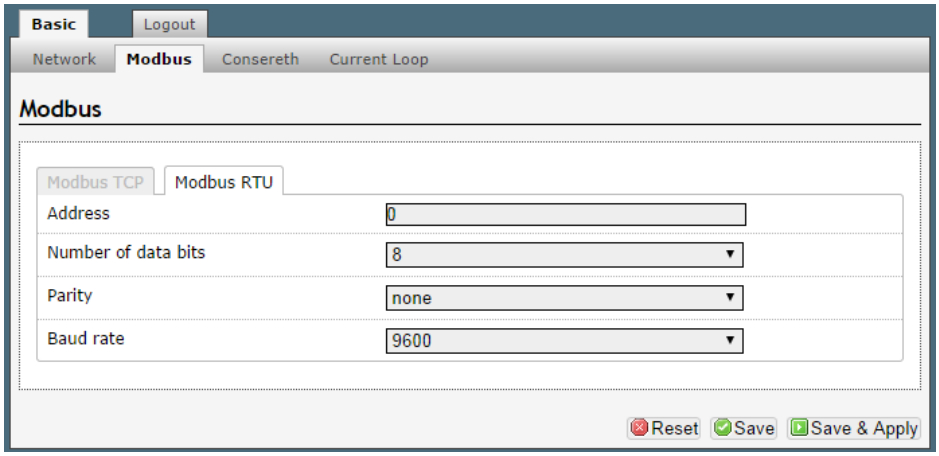

Figure 19: Configuring Modbus RTU

Changed values are applied immediately.

	Description	Default value	Storage
Address	0 – automatically assigned, see chapter 3.5.1. 1 ... 247 – manually assigned	0	module
Number of data bits	number of data bits	8	module
Parity	None, even, odd parity	None	module
Communication speed	serial port communication speed	9600	module

Table 13: Modbus RTU settings

6.2.4. Analogue output (current loop) settings

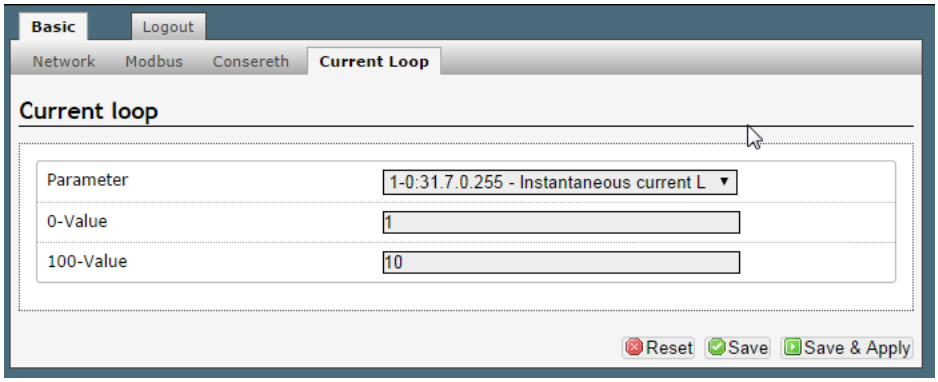

Figure 20: Configuring current loop

	Description	Default value	Storage location
Parameter	selected parameter for monitoring via the loop	disabled	module
0-Value	parameter value to reflect 0% on current loop	0	module
100-Value	parameter value to reflect 100% on current loop	0	module

Table 14: Current loop settings

List of parameters available as current loop output control is shown in Table 15.

	OBIS code	Min value	Max value	Units	Description
1	1-0:15.7.0.255	0	2100000	kW	Instantaneous active power (|+A|+|-A|)
2	1-0:1.7.0.255	0	2100000	kW	Instantaneous active import power (+A)
3	1-0:21.7.0.255	0	2100000	kW	Instantaneous active import power (+A) L1
4	1-0:41.7.0.255	0	2100000	kW	Instantaneous active import power (+A) L2
5	1-0:61.7.0.255	0	2100000	kW	Instantaneous active import power (+A) L3
6	1-0:2.7.0.255	0	2100000	kW	Instantaneous active export power (-A)
7	1-0:22.7.0.255	0	2100000	kW	Instantaneous active export power (-A) L1
8	1-0:42.7.0.255	0	2100000	kW	Instantaneous active export power (-A) L2
9	1-0:62.7.0.255	0	2100000	kW	Instantaneous active export power (-A) L3
10	1-0:13.7.0.255	0.000	1.000		Instantaneous Power factor positive (+A/+VA)
11	1-0:33.7.0.255	0.000	1.000		Instantaneous Power factor L1 positive (+A/+VA)
12	1-0:53.7.0.255	0.000	1.000		Instantaneous Power factor L2 positive (+A/+VA)
13	1-0:73.7.0.255	0.000	1.000		Instantaneous Power factor L3 positive (+A/+VA)
14	1-0:84.7.0.255	0.000	1.000		Instantaneous Power factor negative (-A/-VA)
15	1-0:85.7.0.255	0.000	1.000		Instantaneous Power factor L1 negative (-A/-VA)
16	1-0:86.7.0.255	0.000	1.000		Instantaneous Power factor L2 negative (-A/-VA)
17	1-0:87.7.0.255	0.000	1.000		Instantaneous Power factor L3 negative (-A/-VA)
18	1-0:31.7.0.255	0.000	22.000	A	Instantaneous current L1
19	1-0:51.7.0.255	0.000	22.000	A	Instantaneous current L2
20	1-0:71.7.0.255	0.000	22.000	A	Instantaneous current L3
21	1-0:32.7.0.255	0.000	280.000	V	Instantaneous voltage L1
22	1-0:52.7.0.255	0.000	280.000	V	Instantaneous voltage L2
23	1-0:72.7.0.255	0.000	280.000	V	Instantaneous voltage L3

Table 15: List of available current loop (sense) objects

7. ERROR IN COMMUNICATION

Figure 21: LEDs position on the front plate

LEDs description when no error in communication with meter is detected is shown in Table 16.

LED's ID	LED's name	Definition	Description
D1	**Link/Activity**	Ethernet link activity	OFF – no activity on Ethernet ON – activity on Ethernet BLINK - transmitting/receiving Ethernet frames
D2	**Speed 10/100 Mb/s**	10/100 speed selection	OFF – no link or 10 Mbit/s detected ON – link is up and 100 Mbit/s detected BLINK – N/A
D3	**RxD**	RX serial data	OFF – no data activity between meter and module ON – Ethernet interface is receiving data from the meter BLINK – N/A
D4	**TxD**	TX serial data	OFF – no data activity between meter and module ON – Ethernet interface is transmitting data to the meter BLINK – N/A
D5	**Current loop**	Current loop status	OFF – Load in current loop not connected (open loop) ON – Load in current loop connected BLINK – Current load active (Current flow 4-20mA)

Table 16: LEDs description

If an error in communication between module and meter is detected LEDs definition changes (see Table 17).

LEDs state and blinking frequency	Description
all blinking – 1 Hz	Cannot communicate with meter; please, check channel 2 settings.
all blinking – 5 Hz	Meter has stopped responding, backing of for specific time before restarting communication.
D3 – 5Hz, D4 – 2 Hz, D5 – 1 Hz	Module type is not supported by this software.
D3 – ON, D4 – OFF, D5 – OFF	Hardware failure; module will restart in 1 minute.

Table 17: LED signalization in a case of error in communication

8. TECHNICAL DATA

Technical characteristics of the module comply with the:

- IEC/CISPR 22
- IEC61000-4-2
- IEC61000-4-3
- IEC61000-4-4
- IEC61000-4-5
- IEC62052-11

8.1. Ethernet interface

10/100 Mbit/s Ethernet port, IEEE 1588 available.

8.2. Power consumption

Consumption depends on communication activity.
Max. 1,92 W with all communications active.

8.3. RS485 interface

Technical data for RS485 interface:

- Communication speed: 300-115000 bit/s
- up to 31 connected meters
- 2-wire (half-duplex) transfer mode
- Maximum distance: 1200 m

8.4. Environment conditions

Temperature ranges:

- operation: -40 °C to + 85 °C
- storage: -40 °C to + 85 °C

Air humidity:

- 5% to 95% Non-Condensing

9. DIMENSIONS

Width / Height / Length (mm) – see Figure 22

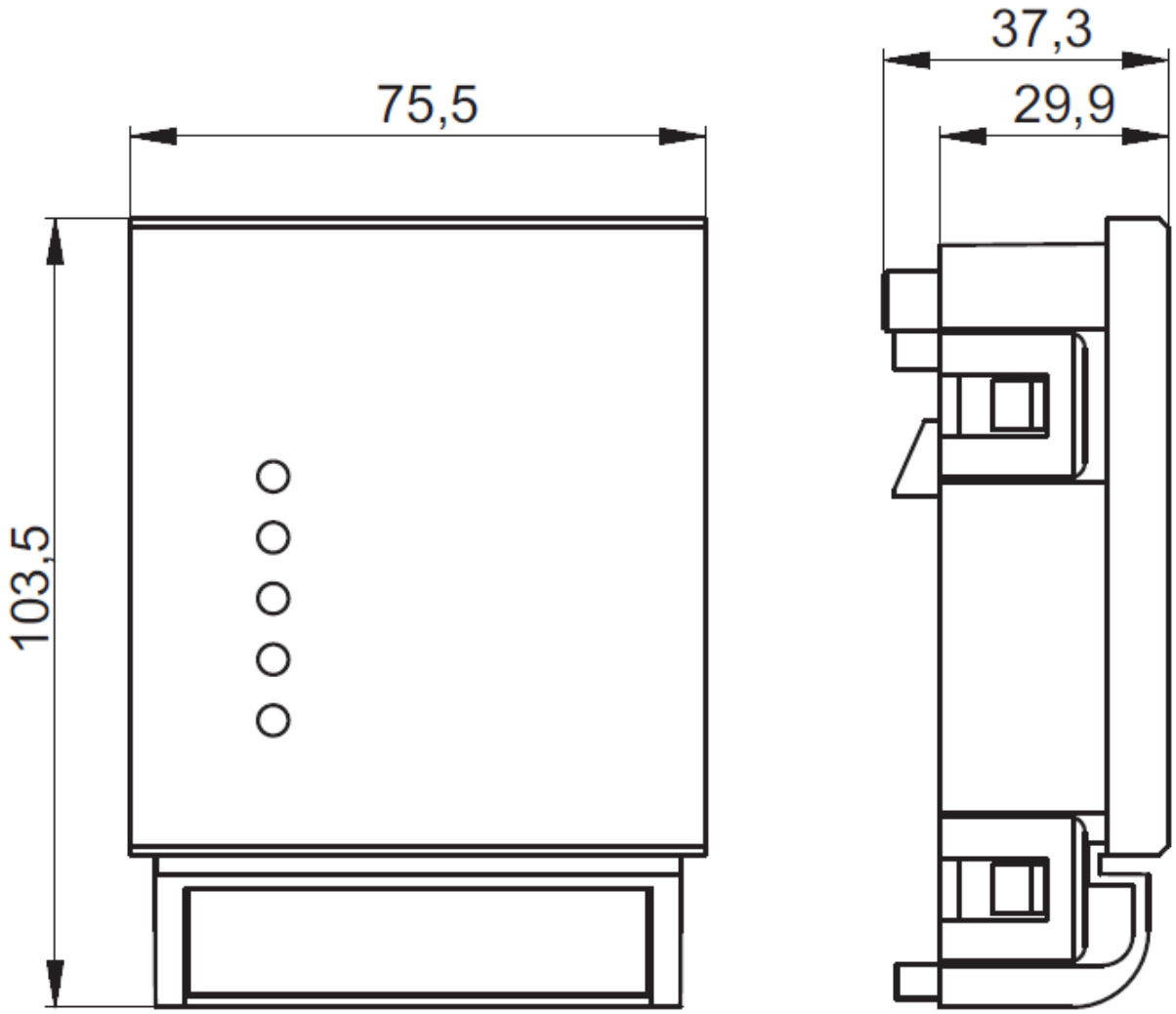

Figure 22: Dimensions of the CM-f3e module

10. MODULE TYPE DESIGNATION

Figure 23: CM-f3e module type designation

CM-f3e

CM	Communication Module
f	Active Current loop
3	RS485 interface
e	Ethernet

Table 18: Description of CM-f3e module type designation

Owing to periodically improvements of our products the supplied products can differ in some details from data stated in this manual.

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