ISKRAEMECO

ME382 and MT382

Technical description

Document code: EAD 020.615.810
Version: V2.20
Language: English
Date: 25.08.2016

DISCLAIMER AND LIMITATION OF LIABILITY

This Technical description was written for use of ME382 and MT382 meters. This manual, including all documentation incorporated by reference herein such as documentation provided or made available at Iskraemeco d.d. web site, is provided or made accessible "AS IS" and "AS AVAILABLE" and without condition, endorsement, guarantee, representation, or warranty of any kind by Iskraemeco d.d. and its affiliated companies (hereinafter collectively referred to as »Iskraemeco«). Iskraemeco assumes no responsibility for any typographical, technical, or other inaccuracies, errors, or omissions in this documentation, nor for any loss due to the use of this documentation. Iskraemeco reserves the right to periodically change information that is contained in this documentation; however, Iskraemeco makes no commitment to provide any such changes, updates, enhancements, or other additions to this documentation. Iskraemeco shall not be liable for any type of damages related to this documentation or its use, or performance or non-performance of any software, hardware, service, or any third party products and services.

SAVE AS EXPRESSLY PROVIDED IN YOUR CONTRACT WITH ISKRAEMECO, ISKRAEMECO EXPRESSLY DISCLAIMS ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTIBILITY OR FITNESS FOR A PARTICULARE PURPOSE AND AGAINST INFRINGEMENT. ISKRAEMECO DOES NOT WARRANT THAT THE FUNCTIONS CONTAINED IN THE PRODUCT WILL BE UNITERRUPTED OR ERROR-FREE, OR THAT DEFECTS IN THE PRODUCT OR ERRORS IN THE DATA WILL BE CORRECTED. FURTHERMORE, ISKRAEMECO DOES NOT WARRANT OR MAKE ANY REPRESENTATIONS REGARDING THE USE OR THE RESULTS OF THE USE OF THE PRODUCT OR ITS DOCUMENTATION IN TERMS OF THEIR CORRECTNESS, ACCURACY, RELIABILITY, OR OTHERWISE. NO ORAL OR WRITTEN INFORMATION OR ADVICE, GIVEN BY ISKRAEMECO OR AN ISKRAEMECO AUTHORIZED REPRESENTATIVE SHALL CREATE A WARRANTY OR IN ANY WAY INCREASE THE SCOPE OF THIS WARRANTY. SOME JURISDICTIONS DO NOT ALLOW EXCLUSION OF THE IMPLIED WARRANTIES, SO THE ABOVE EXCLUSION MAY NOT APPLY. UNDER NO CIRCUMSTANCES INCLUDING NEGLIGENCE, SHALL ISKRAEMECO, THEIR DIRECTORS, OFFICERS, EMPLOYEES OR AGENTS BE LIABLE FOR ANY INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES (INCLUDING DAMAGES FOR LOSS OF BUSINESS, LOSS OF PROFITS, BUSINESS INTERRUPTION, LOSS OF BUSINESS INFORMATION, ETC.) ARISING OUT OF THE USE OR INABILITY TO USE THE PRODUCT OR ITS DOCUMENTATION, EVEN IF ISKRAEMECO OR AN ISKRAEMECO AUTHORIZED REPRESENTATIVE HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. SOME JURISDICTIONS DO NOT ALLOW LIMITATION OR EXCLUSION OF LIABILITY FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES OR ALLOW EXCLUSION OR LIMITATION OF LIABILITY ONLY FOR NEGLIGENCE, BUT NOT FOR GROSS NEGLIGENCE OR WILLFULL MISCONDUCT, SO THIS LIMITATION MAY NOT APPLY. ISKRAEMECO'S TOTAL LIABILITY FOR ALL DAMAGES, LOSSES AND CAUSES OF ACTION (WHETHER IN CONTRACT, TORT, INCLUDING NEGLIGENCE, OR OTHERWISE) SHALL BE DEFINED WITH CONTRACT WITH WHICH YOU BOUGHT PRODUCT OR SERVICE. IF LIABILITY IS NOT DEFINED WITHIN PREVIOUSLLY MENTIONED CONTRACT ISKRAEMECO'S LIABILITY FOR ANY AND ALL DAMAGE EVER RELATED TO THIS DOCUMENTATION SHALL NOT EXCEED (IF NOT OTHERWISE DEFINED WITH APPLICABLE LAW) THE AMOUNT:
1) PAID FOR THE PRODUCT/ SERVICE AND ITS DOCUMENTATION, 2) OF 20% OF THE VALUE OF THE CUSTOMER'S ORDERS FROM THE LAST 12 MONTHS BEFORE OCCURENCE OF DAMAGE OR 3) 10.000 EUR, WHICHEVER THE LOWEST.

ME382-D1
1x230 V, 5(85) A

ME382-D1
1x120 V, 5(85) A

ME382-D3
1x230 V, 10(100) A

ME382-D3
1x120 V, 10(100) A

MT382-D1
3x230/400 V, 5(85) A

MT382-D2
3x230/400 V, 5(120) A

MT382-D2
3x120/208 V, 5(100) A

MT382-T1
3x230/400 V, 5(6) A

ELECTRONIC SINGLE AND THREE-PHASE SYSTEM METER
with GSM/GPRS or UMTS communication module

Technical description

i. About the Technical description

- The Technical description is intended to present the Mx382 meters (x stands for E (single-phase meters) or T (three-phase meters)).
- The Technical description represents the purpose of the Mx382 meters, meter construction, the way of deriving the measured quantities and meter functionalities.
- The Technical description is intended for technically qualified personnel at energy supply companies, responsible for system planning and system operation.

ii. Definitions, Acronyms and Abbreviations

3GPP	3rd Generation Partnership Project
ABS	IA+I + IA-I
AC	Alternating Current
A/D	Analog to Digital
AES	Advanced Encryption Standard
AMM	Automatic Meter Management
APDU	Application Protocol Data Unit
APN	Access Point Name
ASCII	American Standard Code for Information Interchange
BS	British Standard
CAV	Current Average Value
CB	Circuit Breaker
CH	Channel
CII	Consumer Information Interface
CIP	Consumer Information Push
COSEM	COmpanion Specification for Energy Metering
CRC	Cyclic Redundancy Check
CS	Central Server
DCS	Data Coding Scheme
CSD	Circuit Switched Data
DC	Direct Current
DIN	Deutsches Institut für Normung
DLC	Data Line Carrier
DLMS	Device Language Message Specification
DLMS UA	DLMS User Association
DRO	Data ReadOut
DST	Daylight Saving Time
EC	Emergency Credit
EDIS	Energie Daten Identifikations System / Energy Data Identification System
EMC	ElectroMagnetic Compatibility
EN	European Norm
ESC	Escape
FF	Fatal Failure
FIFO	First In First Out
FIPS	Federal Information Processing Standard
FRAM	Ferroelectric Random Access Memory
GCM	Galois/Counter Mode
GIZ	Gesellschaft für Internationale Zusammenarbeit / Society for International Cooperation

GMAC	specialization of GCM for generating a MAC on data that is not encrypted
GMT	Greenwich Mean Time
GND	Ground
GPRS	General Packet Radio Service
GSM	Global System Mobile
HDLC	High-level Data Link Control
HES	Head End System
HEX	Hexadecimal
HHU	Hand Held Unit
HLS	High Level Security
HW	Hard Ware
ICCID	Integrated Circuit Card IDentifier
ID	Identification
IDIS	Interoperable Device Interface Specifications
IE	Iskraemeco
IEC	International Electrotechnical Commission
IEDL	Identity Element Data Length
IEI	Identity Element Identifier
IMEI	International Mobile station Equipment Identity
IP	Internet Protocol
IPv4	Internet Protocol version 4
IR	InfraRed
ISO	International Organization for Standardization
kWh	Kilo Watt-hours
LCD	Liquid Crystal Display
LCP	Link Control Protocol
LED	Light Emitting Diode
LLC	Logical Link Control
LLS	Low Level Security
MAC	Media Access Control address
MB	M-Bus
MC	Manufacturer Code
MCU	Micro Controller Unit
MD5	Message Digest algorithm 5
MDI	Maximum Demand Indicator
MP	Measurement Period
MSB	Most Significant Bit
NCT	No Connection Timeout
NET	IA+I - IA-I
NIST	National Institute of Standards and Technology
NV	Non-Volatile
OBIS	OBject Identification System
OSI	Open System Interconnection
OSM	Other Service Module
PAP	Password Authentication Protocol
PC	Personal Computer
PCB	Printed Circuit Board
PDP	Packet Data Protocol
PDA	Personal Digital Assistant

PDU	Protocol Data Unit
PHY	Physical
PLC	Power Line Carrier
PUP	Power UP
RAM	Random Access Memory
RF	Radio Frequency
RM	Register Monitor
RMS	Root Mean Square
RTC	Real Time Clock
SD	Switching Device (Disconnector, Disconnection device, Load switch)
SAP	Service Access Point
SCA	Service Centre Address
SHA-1	Secure Hash Algorithm
SME	Short Message Entity
SMSC	Short Message Service Centre
SN	Serial Number
SSR	Solid State Relay
SUM	Summation
SQ	Signal Quality
TCP	Transmission Control Protocol
TOU	Time Of Use
UDHI	User Data Header Indicator
UDHL	User Data Header Length
UMTS	Universal Mobile Telecommunications System
UTC	Coordinated Universal Time
UV	Ultra Violet
VDEW	Verband Der ElektrizitätsWirtschaft
WAN	Wireless Area Network
WEEE	Waste Electrical and Electronic Equipment
WIP	Wavecom Internet Protocol
WPDU	Wrapper Protocol Data Unit

NOTE

OBIS (Object Identification System) code (according to DLMS UA 1000-1:2001 standard) is composed of 6 groups of digits (A-B:C.D.E*F; i.e. 0-0:1.0.0*255). In a case where the last group of digits (group F) is not written, means the value of F is 255.

iii. Reference documents

- Installation and maintenance manual
- Iskraemeco's general terms and condition

iv. Versioning

Date	Version	Update
31.01.2014	1.00	Initial version of the document.
17.09.2014	1.01	Description of the meter type designation was changed.
17.03.2016	2.00	• The subchapter *5.1. LCD: Table 20* was updated – new cursor meaning • In the subchapter *7.8. RTC backup*: note was added • The subchapter *7.11. Switching device* was renew, data changed in the *Table 69* • The subchapter *7.12.2. Advanced power limitation* was added • In the chapter *11. TECHNICAL CHARACTERISTICS* data was updated • In the subchapters *11.1. ME382 meter* and *11.2. MT382 meter*: Backup power supply, the SuperCap charging time was changed • ME382 and MT382 object lists were updated (see chapters *12.2. Annex* 2: *ME382 object list* and *12.3. Annex 3: MT382 object list*) – new objects in the lists were added, firmware versions (core, module) were added • Detailed procedure description in the subchapter *6.4.9*. *Selecting the cellular network (2G/3G)* was added • In the subchapter *5.3.2.1. Data menu* example of the register value reading on the LCD was added • In the subchapter *3.5. Connection diagram* connection diagrams were changed
03.05.2016	2.10	• In the subchapter *7.7. Alarms* two alarms in the *Table 66* were added. • Next subchapters were added: - *7.16.1.3. Asymmetrical voltage (optional)* - *7.16.1.7. Neutral fault (optional)* - *7.16.1.8. Time period for asymmetry voltage and neutral fault* - *7.16.1.9. Capturing of voltage values* • New object list in the subchapter *12.3. Annex 3: MT382 object list* with new firmware module version
25.08.2016	2.20	• In the subchapter *3.4. Main meter properties* bullet *modes of energy measurement and registration at three-phase meters* was supplemented with descriptions of the methods, *algebraic method* was replaced with *arithmetic meth*od and one new method (*absolute*) was added. • In the subchapter *3.6.1. Energy* paragraph related to the active energy delta registers was added • NOTE related to rollover in the subchapter *3.7.2.1. Transformer measurement type* was added • In the subchapter *3.7.9. Energy* the *Table 15* was updated (NET total tariff) • Description about rollover in the subchapter *5.1. LCD* was added • The subchapter *5.1.1. Display configuration* was added • In the subchapter *7.3. Main load profiles* the *Table 50* was updated (bit 6, PUP) • The subchapter *7.3.1. Load profiles options* was added • The subchapter *7.6.2. Fraud detection log* was updated (hold-off period) • In the subchapter *7.8. RTC backup* two objects with their descriptions were added • The subchapters *7.10.4. Tariffication script table, 7.10.5*. *Tariff switch source* and *7.10.6. Manual tariffication script activation* were added • The subchapter *7.13. Overvoltage monitor and load disconnection* was added • The subchapter *7.16.2. Watchdog counter* was added • In the subchapters *12.2. Annex 2: ME382 object list* and *12.3. Annex 3: MT382 object list* object lists were updated with new objects added

TABLE OF CONTENTS

INDEX OF FIGURES

INDEX OF TABLES

1. SAFETY INFORMATION

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

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

1.1. Responsibilities

The owner of the meter is responsible to assure that all authorized persons who work with the meter read and understand the parts of the Technical description and Installation and maintenance manual that explains 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 the Installation and maintenance manual and the Technical description.

The owner of the meter is responsible 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 meter should be carefully taken out of the box where it was packed. This should prevent the meter 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 meter may not be installed at the metering point as such damage may result in different hazards. In such case, the meter needs to be sent back to the manufacturer for examination and testing.

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

CAUTION: The temperature of the terminal block of the connected and operating meter may rise, therefore the temperature of the terminal cover may rise as well.

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

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

WARNING: Safety measures should be observed at all times. Do not break the seals or open the meter 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 meter installation procedure is described in the Installation and maintenance manual. For safety reasons the following instructions should be followed.

See the complete Technical description for detailed technical features of ME382 and MT382 meters and its intended use.

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

1.2.2. Meter installation procedure

DANGER: The ME382/MT382 electricity meter is a device connected into the electricity network. Any unauthorized manipulation of the device is dangerous for life and prohibited according to the applicable legislation. Any attempt to damage the seals as well as any unauthorized opening of the terminal or meter cover is strictly forbidden.

Installation companies shall implement a training policy that ensures that all installers are adequately trained, understand risk and safety issues and possess the relevant skills before they commence operational duties.

The installer will need to recognise and understand different metering installations, meter types and various equipment associated with those installations applicable to the successful installation of the electricity meter.

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

The Installation and maintenance manual provides the instructions for installing ME382/MT382 meters. 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 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.

Opening the terminal or meter cover is dangerous for life because there are live parts inside.

Installation personnel must possess the required electrical knowledge and skills, and must be authorised by the utility to perform the installation procedure.

The installer is obligated to perform the installation procedure in accordance with the national legislation and internal norms of the utility.

National legislation can set out the minimum age and the competence criteria for installers. In case there are no national requirements defined, the following criteria shall be used by assessing the competence of installers: knowledge of electricity, experiences on electrical work, understanding of the installation

procedures, practical experience of that work, understanding the hazards which can arise during the work and the precautions to be observed, ability to recognize at all times whether it is safe to continue working.

According to the basic principles, either the nominated person in control of the electrical installation or the nominated person in control of the work activity shall ensure that specific and detailed instructions are given to the personnel carrying out the work before starting and on completion of the work.

Before starting work, the nominated person in control of the work activity shall give notification to the nominated person in control of the electrical installation, of the nature, place and consequences to the electrical installation of the intended work.

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: Do not attempt to install the meter before you have isolated the installation site from the network!

DANGER: The relevant preliminary fuses must be removed before making any modifications to the installation, and kept safe until completing the work to prevent the unnoticed reinsertion.

DANGER: Secondary circuit of current transformer must not be opened when current is flowing in the primary circuit. This would produce a dangerous voltage of several thousand volts at the terminals and the insulation of the transformer would be destroyed.

DANGER: Connecting the meter into the network under voltage is dangerous for life so the conductors at the metering point must not be connected to any voltage source during the connection procedure. The meter connection procedure may only be performed by well-trained and adequately authorized personnel.

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: Use only prescribed types of cables for the installation!

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.

CAUTION: At the end of installation at the metering point, no cable should stay unconnected or hanging freely from the metering point.

The meter has to be mounted on a smooth vertical surface and fixed at 2 or 3 points with screws using the proper torque (the meter has two attachment holes and, optionally, a top hanger).

The meter is intended to be mounted at an indoor metering point, in a meter cabinet, secured against the undesired access of unauthorized persons. Only scroll push button may be accessible from the outside.
Do not expose meter surface to very high temperatures even though the surface is made of non-flammable plastics to prevent fire.

Electrical connection: mounting cables must be properly dimensioned and of proper shape. They must be mounted using the proper torque. The meter should be connected according to the meter connection diagram that is attached to the inner side of the meter terminal cover. Screws on the current terminal must be tightened with proper torque.

CAUTION: If it is possible to install the meter without isolation from the network, i.e. on live network, then appropriate instructions and safety warnings shall be provided.

CAUTION: Specific aspects and safety hazards related to external voltage and current transformers, auxiliary supplies and local generation shall be covered.

DANGER: The preliminary fuses and/or voltage arresters must be re-inserted before commissioning and functional check of the meter.

Seals on the meter have to be checked at the end of the installation procedure so that the final customer cannot come into contact with live parts of the meter.

DANGER: If the terminal cover is not screwed tight, there exists a danger of contact with the connection terminals. Contact with live parts of the meter is dangerous for life.

CAUTION: For safety reasons, place the terminal cover immediately after the installation procedure and fix it with fixing screws!

DANGER: Switch on the power. Beware of the risk of electric shock at all times!

The functional check requires voltage to be applied and load applied to all phases. Determine first the energy flow direction.

If no main voltage is present, commissioning and functional check must be performed at a later date.

1.2.3. Meter maintenance

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

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

Cleaning of the meter is allowed only with a soft dry cloth. Cleaning is allowed only in upper part of the meter – in the area of the LCD (Liquid Crystal Display). Cleaning is forbidden in the area of terminal cover, where cables are connected to the meter. Cleaning can be performed only by the personnel responsible for meter maintenance.

CAUTION: Never clean soiled meters 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 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, the local utility must be informed immediately.

DANGER: Breaking the seals and removing the terminal cover or meter cover will lead to potential hazards because there are live electrical parts inside.

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

2. ENERGY METERING AND Mx382 METERS

Mx382 family meters are designed for up to eight tariff measuring of active, reactive and apparent energy in one or two energy flow directions. The meter measures consumed energy in three-phase four-wire networks for direct or indirect connection.

Measuring and technical characteristics of the meter comply with the IEC 62052-11 and IEC 62053-21 international standards for electronic active energy meters, class 1 and 2, and reactive energy meters, classes 2 or 3 in compliance with IEC 62053-23 as well as a standard for time switches IEC 62052-21.

Meters are designed and manufactured in compliance with the standards and ISO 9001 as well as more severe Iskraemeco standards.

Meter utilizes the DLMS communication protocol in compliance with the IEC 62056-46 standard as well as IEC 62056-21.

The Mx382 meters are members of the fourth generation of Iskraemeco electronic single and three-phase meters for a deregulated market of electric power, with the following common functional properties:

- time-of-use (TOU) measurement of active energy and maximum demand (in up to 8 tariffs),
- load profile (LP) registration,
- liquid crystal display (LCD),
- internal real-time clock (RTC),
- two push buttons: **Reset** and **Scroll** button,
- optical port (IEC 62056-21 standard) for local meter programming and data downloading,
- P1 port for sending data to in-house display (IHD),
- built-in GSM/GPRS or UMTS (3G) modem for a remote two-way communication,
- two inputs (alarm input, external button input),
- impulse output,
- 6 A bi-stable relay output,
- M-Bus for reading up to 4 other meters (heat, gas, water meters),
- integrated switching device at single-phase meters and external switching device at three-phase meters (option) for remote disconnection/reconnection of the customer premises,
- remote connection and disconnection the energy supply of individual customers (option),
- the external magnetic field detector,
- the meter cover opening (MCO) and the terminal cover opening (TCO) detector.

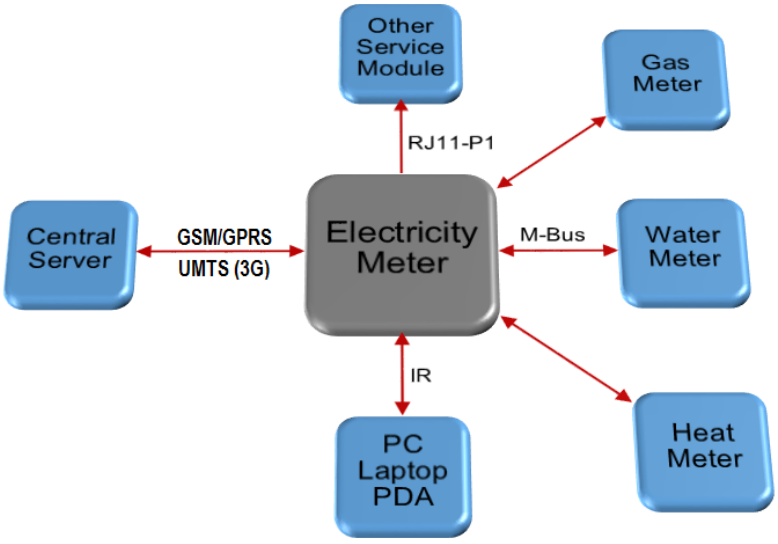


Figure 1: Smart metering system

3. Mx382 METERS INTRODUCTION

3.1. Standards and references

DIN 43857-1	Elektrizitätszähler in Isolierstoffgehäusen für unmittelbaren Anschluß bis 60A Grenzstromm; Hauptmaße für Wechselstromzähler
DIN 43857-2	Elektrizitätszähler in Isolierstoffgehäusen für unmittelbaren Anschluß bis 60A Grenzstromm; Hauptmaße für Drehstromzähler
DIN 43863-3	Elektrizitätszähler; Tarifgeräte als Zusatzeinrichtung zum Elektrizitätszähler EDIS (Energie-Daten-Identifikations-System)
BS 7856	Code of practice for Design of alternating current, watthour meters for active energy (classes 1 and 2)
EN 13757-2	Communication systems for meters and remote reading of meters Part 2: Physical and link Layer
EN 13757-3	Communication systems for meters and remote reading of meters Part 3: Dedicated application Layer
EN 13757-4	Communication systems for meters and remote reading of meters Part 4: Wireless meter readout (Radio Meter reading for operation in the 868-870 MHz SRD band)
EN 50022	Hutschienen 35mm breit zur Schnappbefestigung von Geraten
EN 50160	Voltage characteristics of electricity supplied by public electricity networks, 2010
EN 50470-1	Electricity metering equipment (a.c.) - Part 1: General requirements, tests and test conditions Metering equipment (class indexes A, B and C)
EN 50470-3	Electricity metering equipment (a.c.) - Part 3: Particular requirements - Static meters for active energy (class indexes A, B and C)
EN 61000-4-6	Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques- Immunity to conducted disturbances, induced by radio-frequency fields
EN 61000-4-18	Testing and measurement techniques - Damped oscillatory wave immunity test
IEC 60068-2-75	Environmental testing - Part 2: Tests - Test Eh: Hammer tests
IEC 61000-4-2	Electromagnetic compatibility (EMC) - Part 4-2: Testing and measurement techniques- Electrostatic discharge immunity test
IEC 61000-4-3	Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques- Radiated, radio-frequency, electromagnetic field immunity test
IEC 61000-4-4	Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques- Electrical fast transient/burst immunity test
IEC 61000-4-5	Electromagnetic compatibility (EMC) - Part 4-5:Testing and measurement techniques- Surge immunity test
IEC 61038	Time switches for tariff and load control
IEC 62056-21	Data exchange for meter reading, tariff and load control - Direct local connection (3rd edition of IEC 61107)
IEC 62056-46	Electricity metering; Data exchange for meter reading, tariff and load control; Data link layer using HDLC-Protocol
IEC 62056-47	Electricity metering; Data exchange for meter reading, tariff and load control; COSEM transport layers for IPv4 networks
IEC 62056-53	Electricity metering; Data exchange for meter reading, tariff and load control COSEM Application Layer
IEC 62056-61	Electricity metering; Data exchange for meter reading, tariff and load control obis object identification system (OBIS)
IEC 62053-21	Electricity metering equipment; Particular requirements; Electronic meters for active energy (classes 1 and 2)
IEC 62053-23	Electricity metering equipment (AC.); Particular requirements; Static meters for reactive energy (classes 2 and 3)

IEC 62052-11	Electricity metering equipment (AC.): General requirements, tests and test conditions - Metering equipment
IEC 62052-21	Electricity metering equipment (AC.) General requirements, tests and test conditions - Tariff and load control equipment
IEC 61334-4-32	Distribution automation using distribution line carrier systems - Data communication protocols - Data link layer - Logical link control (LLC)
IEC 60529	Degrees of protection provided by enclosures (IP code)
ISO/IEC 8802.2	Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Specific requirements; Logical link control
IDIS 2	IDIS package 2, IP profile, Edition 2.0 (including G3-PLC), 03-09-2014
NIST	Recommendation for Block Cipher Modes of Operation: Galois/Counter Mode (GCM) and GMAC, November 2007
RFC 1321	MD5 (Message Digest algorithm 5)
RFC 1332	The Internet Protocol Control Protocol (IPCP)
RFC 1700	Assigned Numbers
RFC 3241	Robust Header Compression
DSMR	Dutch Smart Meter Requirements, V3.0
FIPS PUB 180-1	Secure Hash Standard (SHA-1), 1993
COSEM Blue Book 12th Edition, DLMS UA 1000-1:2014, Ed. 12.0	
COSEM Green Book 8th Edition, “DLMS/COSEM – Architecture and Protocols”, DLMS User Association, DLMS UA 1000-2 Ed. 8.0, 2014-07-07	
VDEW-specification for “Electronic Meters with load curve“ Version 2.1.2 7th November 2003	
WELMEC	WELMEC 7.2, Software guide, Measuring Instruments Directive 2014/32/EU, page 77

3.2. ME382 meter description

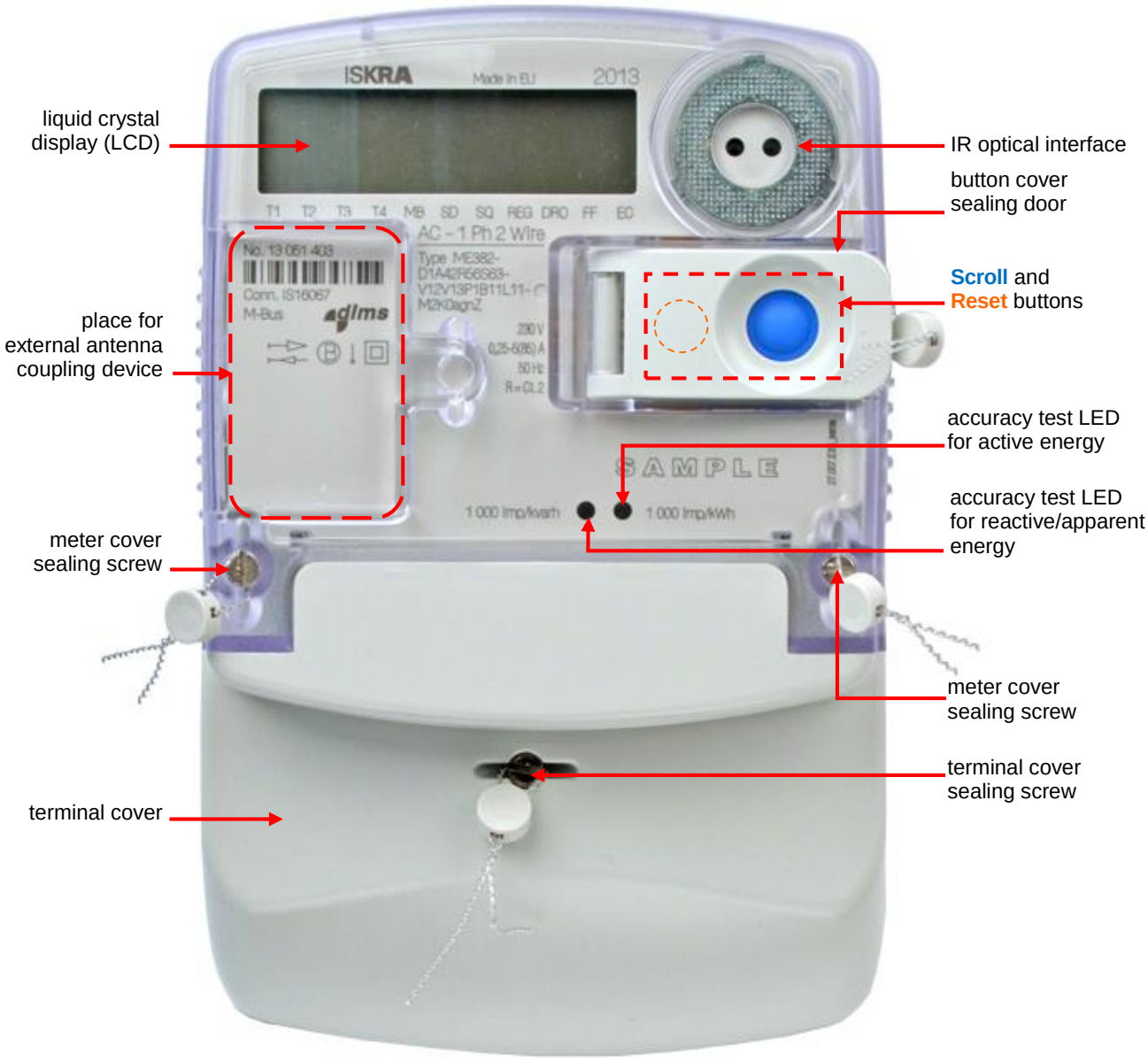


Figure 2: ME382 meter appearance – front view

3.2.1. Terminal block constituent parts – ME382-D1 (85 A) DIN connection

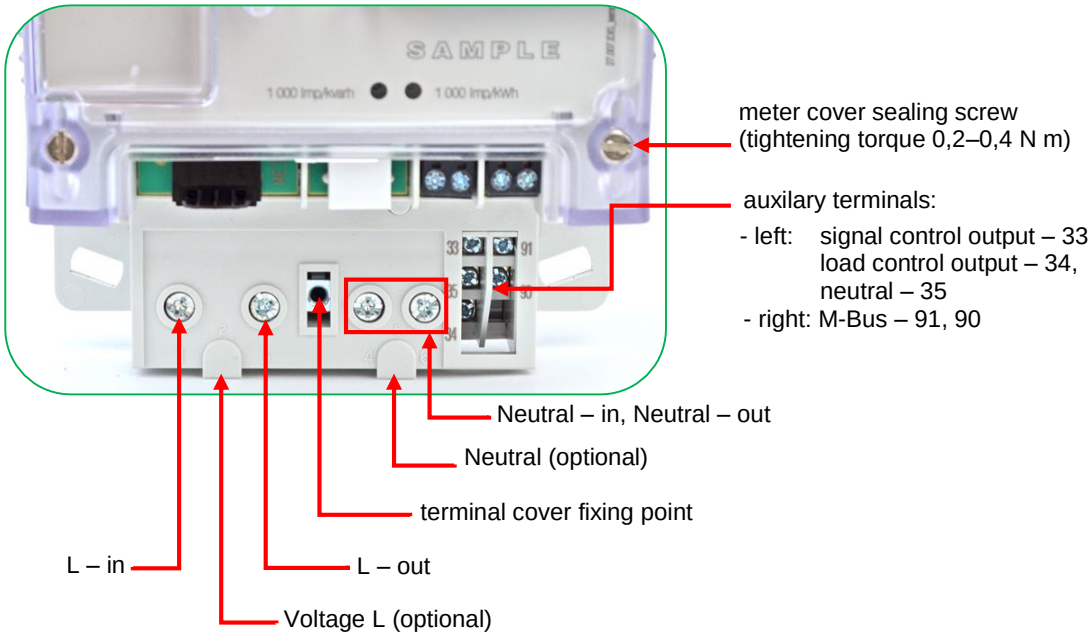


Figure 3: Terminal block – ME382-D1 (85 A) DIN connection

3.2.2. Terminal block constituent parts – ME382-D3 (100 A) BS connection

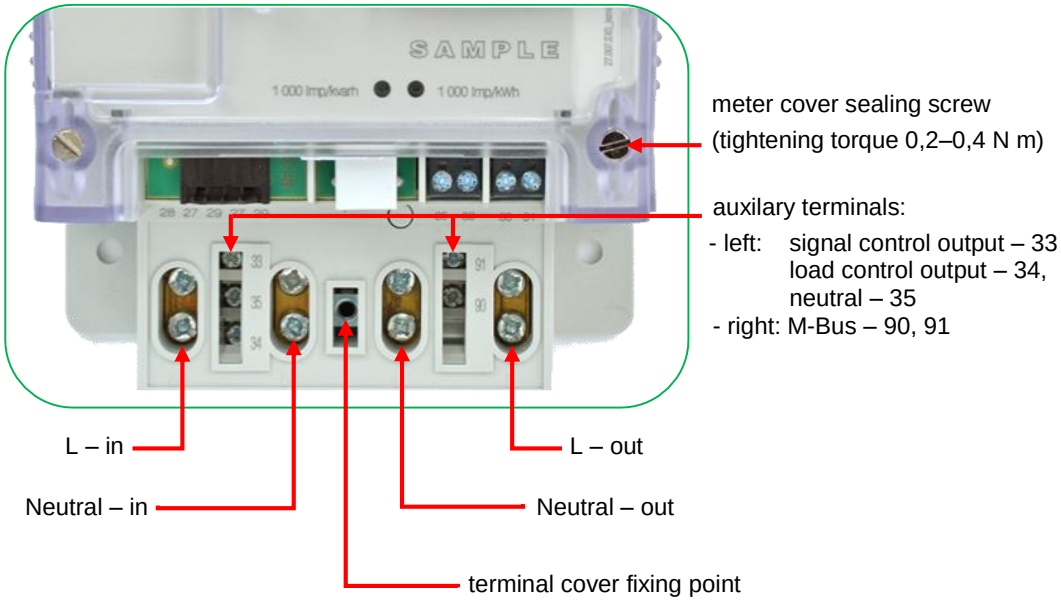


Figure 4: Terminal block – ME382-D3 (100 A) BS connection

3.2.3. Terminal block constituent parts – common for D1 (DIN) and D3 (BS) type

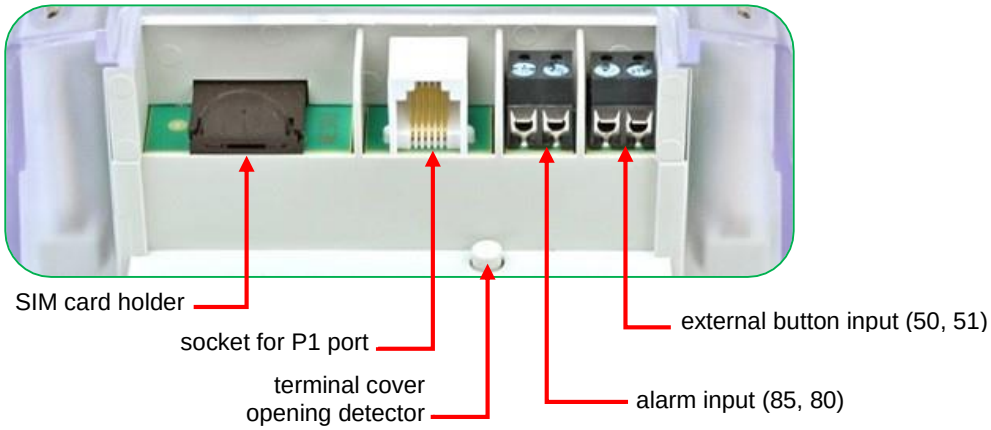


Figure 5: Terminal block constituent parts – common for D1 (DIN) and D3 (BS) type

NOTE
For detailed information, see the Installation and maintenance manual.

3.3. MT382 meter description

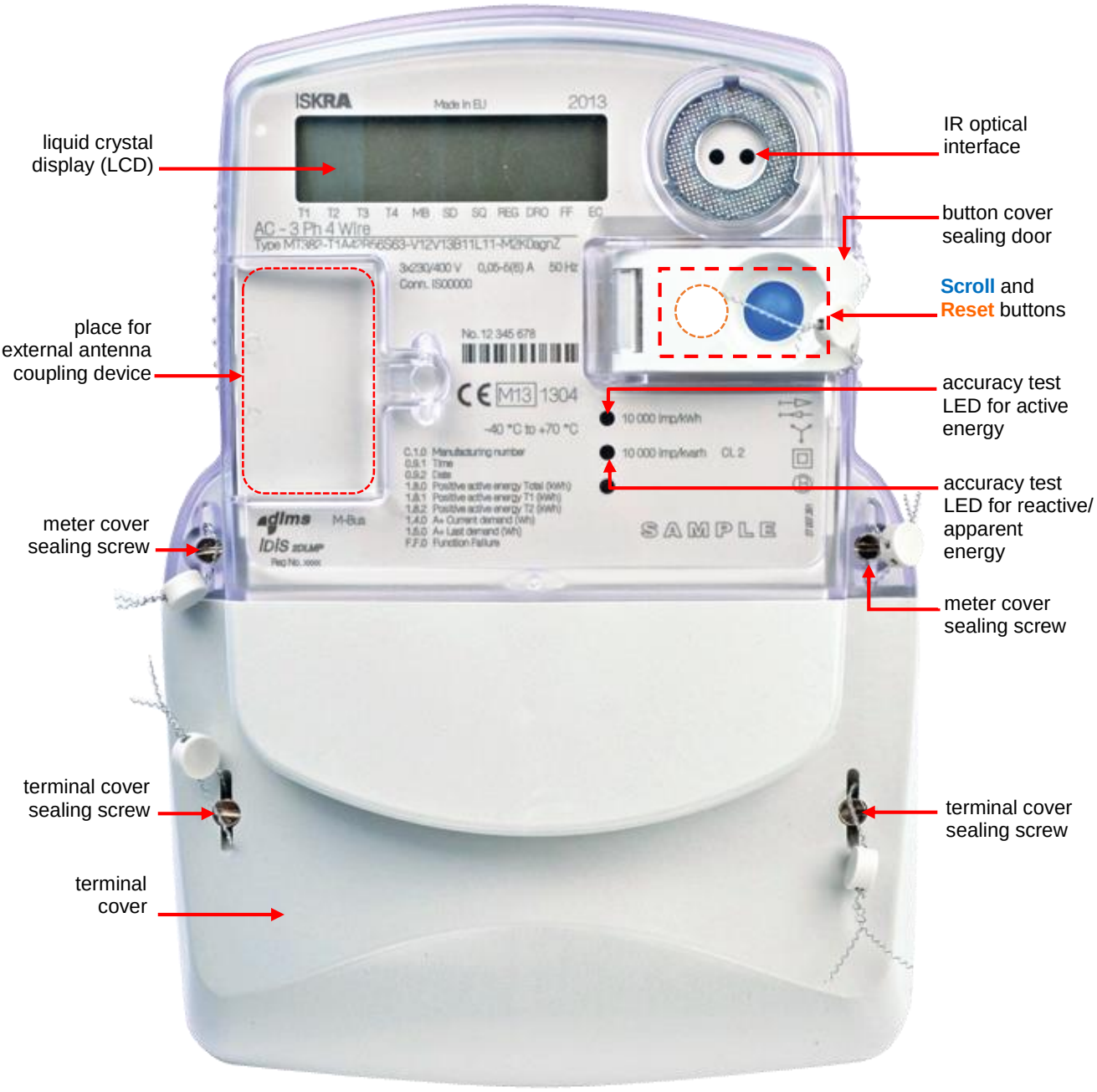


Figure 6: MT382 meter appearance – front view

3.3.1. Terminal block constituent parts – MT382-D1/D2

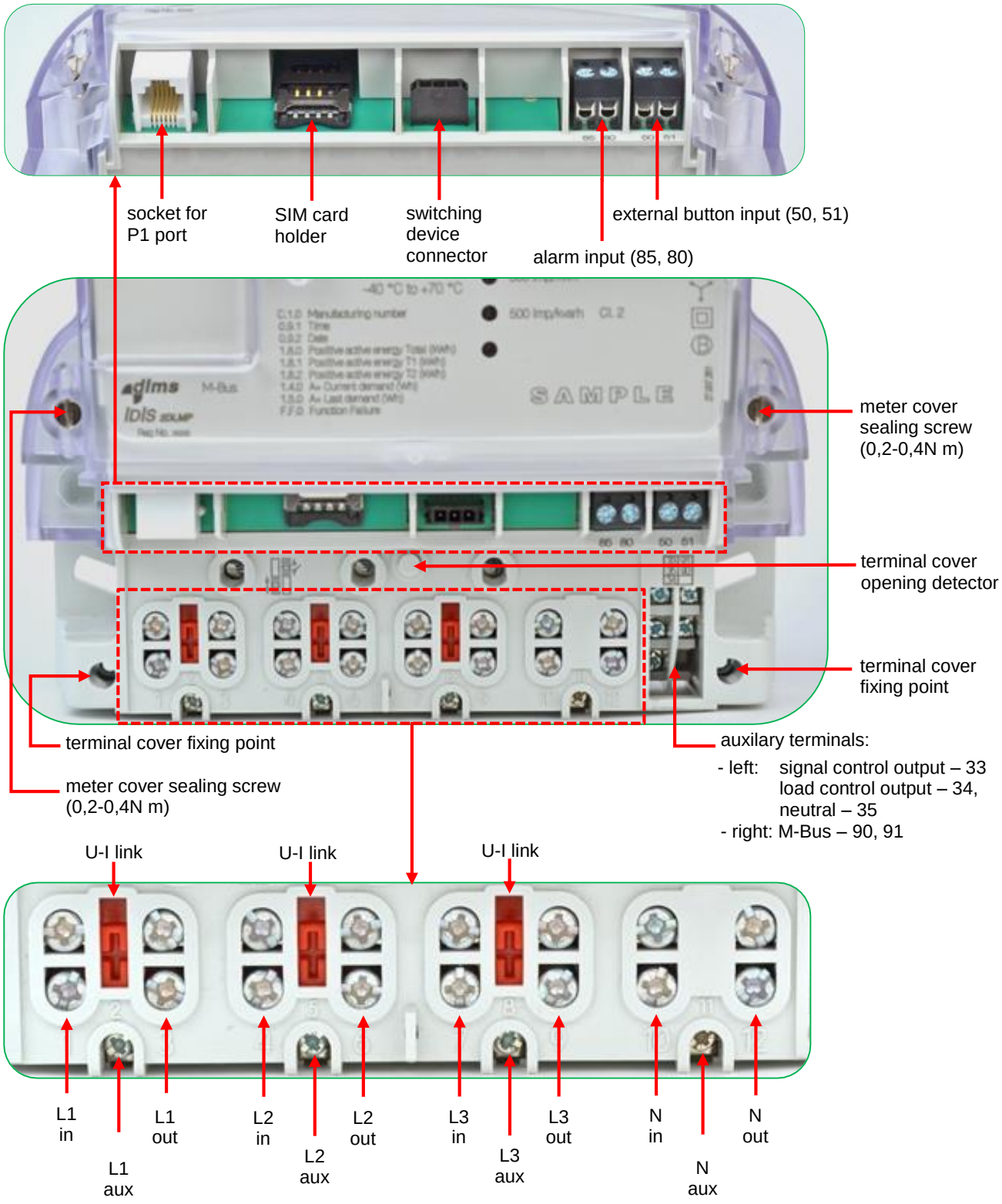


Figure 7: Terminal block – MT382-D1/D2

NOTE

For detailed information, see the Installation and maintenance manual.

3.3.2. Terminal block constituent parts – MT382-T1

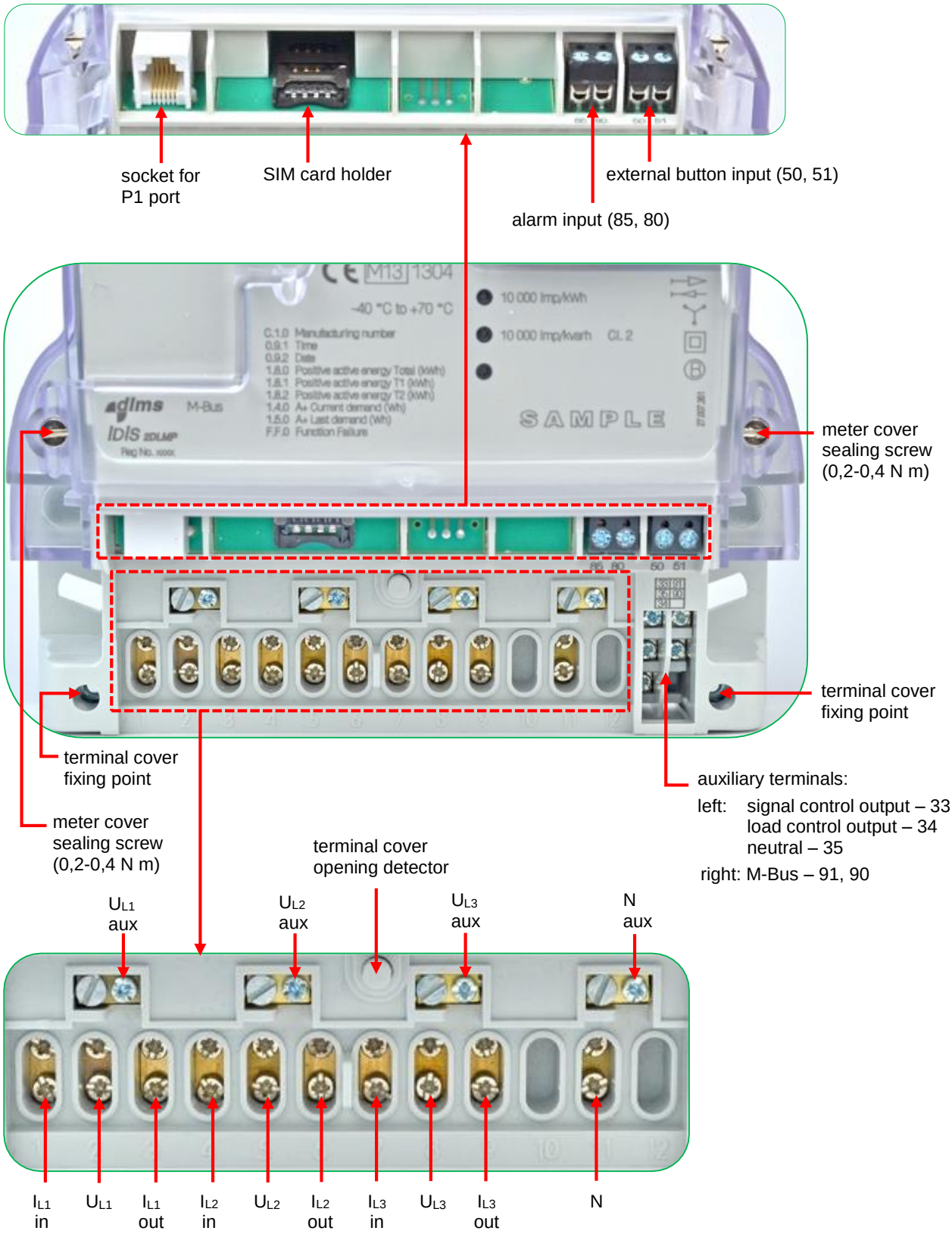


Figure 8: Terminal block – MT382-T1

NOTE

For detailed information, see the Installation and maintenance manual.

3.4. Main meter properties

- Active energy and demand meter of accuracy class 1 or 2 (according to IEC 62053-21).
- Reactive energy and demand meter of accuracy class 2 or 3 (according to IEC 62053-23).
- Apparent energy meter of accuracy class 2 or 3.
- Modes of energy measurement and registration at single-phase meters:
  - for one-way energy flow direction,
  - for two-way energy flow direction,
  - for two-way energy flow direction but registered in one (absolute) register.
- Modes of energy measurement and registration at three-phase meters:
  - vector sum method of energies per phases; with this method the meter takes account to the energy direction (flow direction), when summates the values of the individual phases. The result of the measurement corresponds to the difference between positive and negative values (the sum of the different energy directions, A+ or A-),
  - arithmetic sum method of energies per phases; with this method the meter separates the positive from the negative values according to the phase direction. The same values are grouped together (either positive or negative) and be calculated individually (∑A+ or ∑A-),
  - absolute sum method of energies per phases; whether the energy direction is positive or negative, this method is always calculated like the energy flows only in the positive direction despite the negative direction of any phase (|A+| + |A-| or |A+| - |A-|).
- Measurement and registration of under- and over-voltage.
- Measurement of nominal and instantaneous frequency in any phase.
- Measurement and recording electric energy in three-phase four-wire networks:
  - total (∑Li),
  - positive and negative active energy (A+, A-) separately,
  - reactive energy per quadrants (QI, QII, QIII, QIV),
  - positive and negative reactive energy (Q+, Q-) separately (Q+=QI+QII, Q-=QIII+QIV),
  - positive and negative apparent energy (S+, S-) separately,
  - absolute active energy (IA+I + IA-I),
  - net energy (IA+I- IA-I).
- Power factor measurement.
- Daily peak and minimum values of the phase voltages and average voltage of all three phases.
- Detection of phase and voltage unbalance.
- Meter quality: recalibration of the meter is not needed over entire meter lifetime.
- Auxiliary inputs / outputs:
  - P1 interface,
  - alarm input,
  - external button input,
  - M-Bus interface,
  - output for load control with a 6 A relay,
  - output for signal control with an solid state relay (SSR),
  - active switching device output (MT382 meter only).
- Compact plastic meter case:
  - made of high quality self-distinguishing UV (ultra violet) stabilized material that can be recycled,
  - IP54 protection against dust and water penetration (by IEC 60529).
- Two LED (Light Emitting Diode) indicators – one for Imp/kWh and one for Imp/kvarh or Imp/kVAh.
- Multifunctional LCD backlight display with scroll function (data readout (DRO), fatal failure (FF), emergency credit (EC) indicator on display).
- General display readout mode: automatic cyclic data display (10 sec display time).

- Data menu on display (enter by pressing the **Scroll** button, see the Figure 48):
  - alternate display readout mode: manual data display mode (cannot be disabled),
  - load profile with period 1 (optional),
  - load profile with period 2 (optional),
  - certification data log (optional).

  Optional items can be configured by the **Display configuration** object (0-0:196.1.3).
  See chapters *5.3.1. Reduced console menu type* and *5.3.2. Normal console menu type.*
- Communication channels:
  - infrared optical port by IEC 62056-21 or IEC 62056-46 (DLMS – Device Language Message Specification) for local meter programming and data downloading,
  - built-in RJ11 communication interface (P1 port) by IEC 62056-21 or IEC 62056-46 (DLMS) for one way communication with the in-house display,
  - built-in GSM/GPRS (Global System for Mobile communications / General Packet Radio Service) or UMTS (Universal Mobile Telecommunications System) 3G modem,
  - built-in M-Bus communication interface by EN 13757-2 and EN 13757-3.
- Communication protocols:
  - Identification system by IEC 62056-61,
  - COSEM (Companion Specification for Energy Metering) organization of data by IEC 62056-53,
  - M-Bus: EN 13757-2 and EN 13757-3,
  - Optical port: IEC 62056 – 21, mode C or DLMS (in compliance with IEC 62056 – 46).
- Fraud detection functions:
  - detection of missing/broken neutral conductor,
  - registration of unexpected consumption,
  - detection of opening meter and terminal block covers and
  - detection of external magnetic field.
- Security:
  - physical (seal protection, parameter protection button),
  - logical (LLS (low-level security), HLS (high-level security)).
- Time-of-use registration in up to 8 tariffs: tariffs change-over via internal RTC (by IEC 61038).
- Two Load-profile recorders.
- Two Billing profile recorders.
- Four M-Bus profiles.
- Prepayment functionality.
- Push functionality.
- Automatic configuration of an AMM (Automatic Meter Management) system.
- Programming of the meter as well as FW upgrade can be done locally (via an optical port) or remotely in compliance with the predefined security levels.

3.5. Connection diagram

Connection diagram shows the correct connection of a device into the electrical network. Every meter has the appropriate connection diagram attached to the inner side of the meter terminal cover.

To each connection diagram, corresponding identification number is assigned. It is generated by Iskraemeco and looks like **IS 0xx.xxx**, where x represents any number from 0 to 9. On the nameplate of each meter, corresponding identification number of the connection diagram is printed, and it can be found as **Conn. ISxxxxx** (the leading zero number and the dot between numbers are removed).

Hereinafter-represented connection diagrams are general for each type separately and valid for all types of Mx38y meters (where **x** represents E – single-phase meter, T – three-phase meter and **y** represents 1 (PLC communication), 2 (GSM/GPRS or UMTS communication) or 3 (RS-485 communication)).

Every Mx38y meter has built-in communication interface. The type of the communication determines, which communication interface is integrated in the meter:

- **PLC**,
- **GSM/GPRS**,
- **UMTS (3G)**,
- **RS-485**.

The Mx382 meter has integrated only the **GSM/GPRS** or **UMTS (3G)** communication interface.

NOTE

The **PLC** interface is intended for the Mx381 meter only.
The **RS-485** communication interface is intended for the Mx383 meter only.

In meters and in connection diagrams, auxiliary terminals of meters are marked with dedicated numbers. See the Table 1 for their meanings.

Auxiliary terminal designation	Terminal numbers
M-Bus	90, 91
alarm input	80, 85 (neutral)
passive external button input	50, 51
signal control output	33, 35 (neutral)
load control output	34, 35 (neutral)

Table 1: Auxiliary terminals designation

The ME38y meter operates in several phase voltage areas (either 230 V or 120 V).

The MT38y meter operates in several phase voltage areas (either 3x230 V or 3x120 V) as well. The exception is MT38y-T1 meter, which operates only in 3x230 V phase voltage area and allows only a current transformer (CT) connection.

3.5.1. ME382-D1 meter

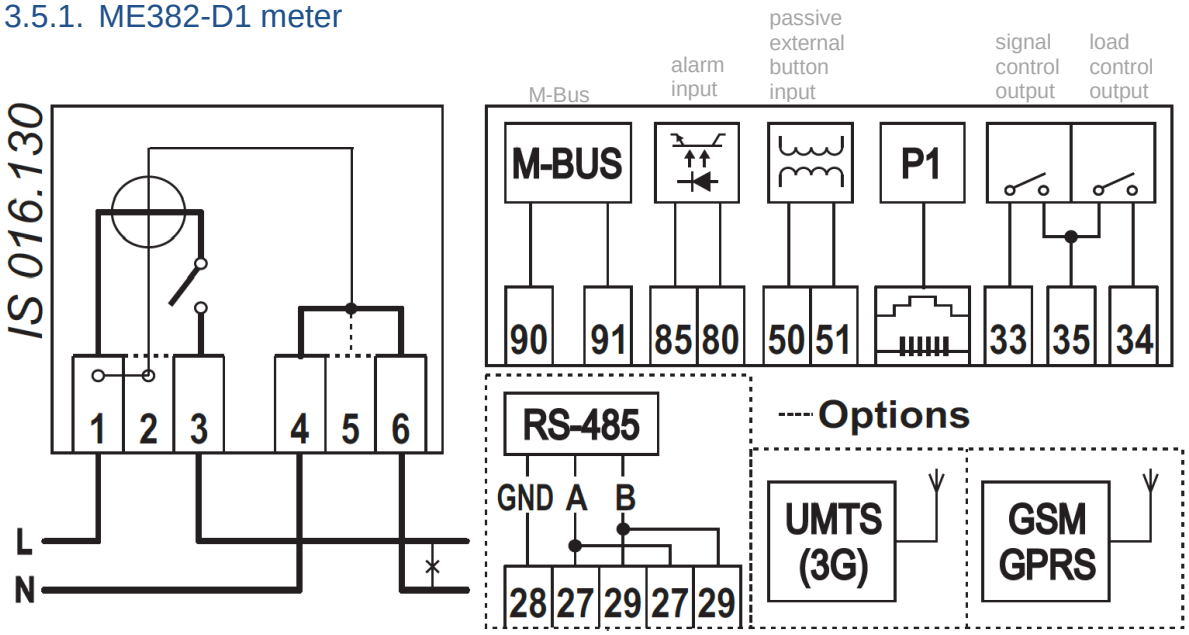


Figure 9: ME38y-D1 meter connection diagram – DIN connection

NOTE

To connect the ME382-D1 meter into the electrical network use the connection diagram in the Figure 9. Ignore RS-485 and PLC options, because only the UMTS (3G) or GSM/GPRS communication interface is presented in the ME382-D1 meter. For more information, see the introduction in the chapter *3.5. Connection diagram*.

3.5.2. ME382- D3 meter

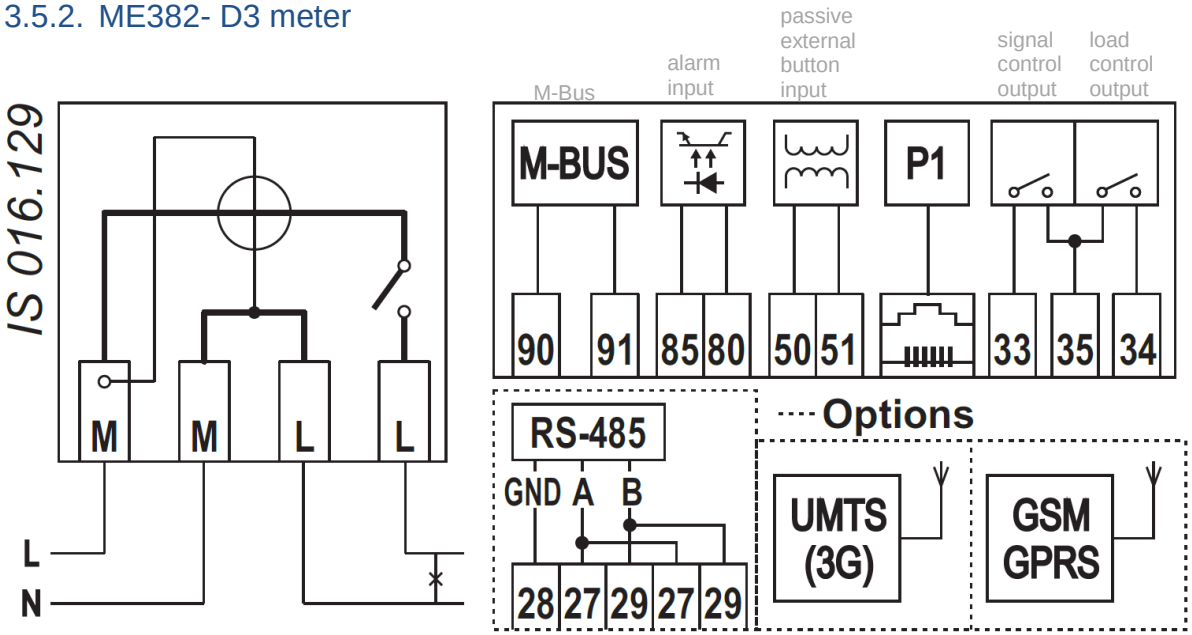


Figure 10: ME38y-D3 meter connection diagram – BS connection

NOTE

To connect the ME382-D3 meter into the electrical network use the connection diagram in the Figure 10. Ignore RS-485 and PLC options, because only the UMTS (3G) or GSM/GPRS communication interface is presented in the ME382-D3 meter. For more information, see the introduction in the chapter *3.5. Connection diagram.*

3.5.3. MT382 meter

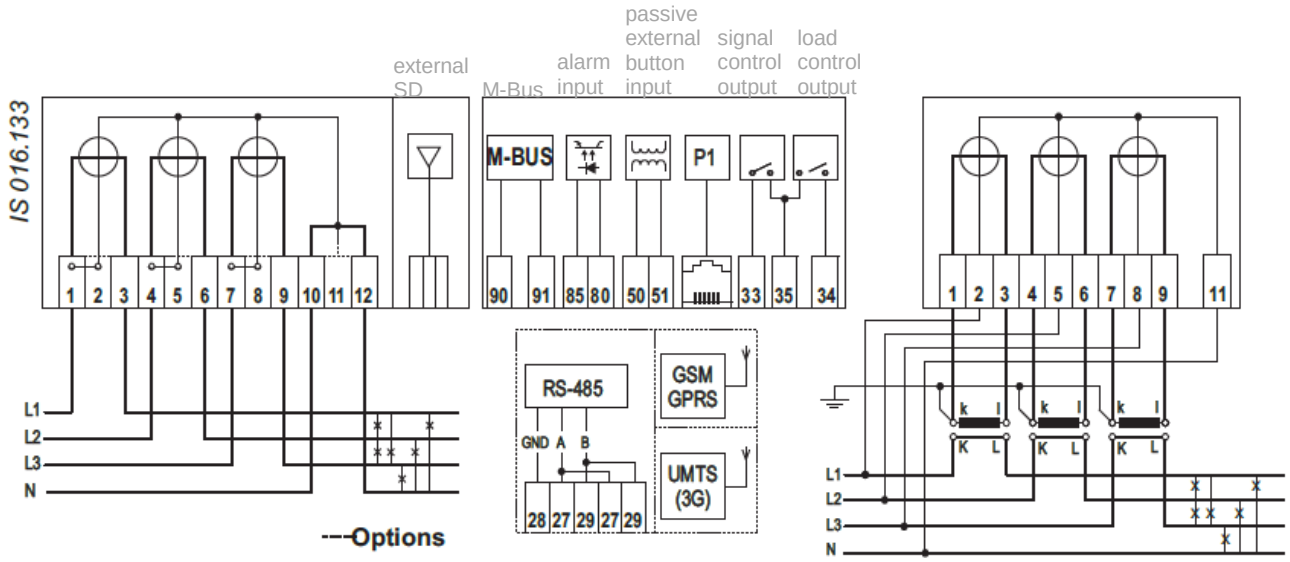


Figure 11: MT38y meter connection diagram – direct connection (left), transformer connection (right)

NOTE

The connection diagram presented in the Figure 11 is intended for:

- direct connected meters – MT382-D1 and MT382-D2 (left)
- transformer-connected meters – MT382-T1 (right).

The transformer meter allows only a current transformer (CT) connection.

NOTE

To connect the MT382 meter into the electrical network use the connection diagram in the Figure 11. Ignore RS-485 and PLC options, because only the UMTS (3G) or GSM/GPRS communication interface is presented in the MT382 meter. For more information, see the introduction in the chapter *3.5. Connection diagram.*

3.6. Energy and demand registration

The meter measures and records electric energy/power in:

- single-phase two wire network;
- three-phase four-wire network (MT382 meter only):
  - positive and negative active energy and power (A+, A-), per phase, sum of all phases;
  - positive and negative reactive energy and power (Q+, Q-), per phase, sum of all phases;
  - reactive energy per quadrants (QI, QII, QIII, QIV);
  - positive and negative apparent energy and power (S+, S-), per phase, sum of all phases;
  - ABS (absolute) active energy and power (IA+I + IA-I);
  - NET active energy (IA+I- IA-I).

Positive and negative reactive energy and power can be registered as R+=QI+QII and R-=QIII+QIV (see the Figure 12). See also the Table 15 for total and tariff energy objects.

Meters are provided with two LEDs on the front plate. They are intended for checking the meter accuracy. Impulse constant depends on the meter version.

Power is measured inside a measuring period. The measuring period is a meter parameter and can be set. Values that can be set are 5, 10, 15, 30 and 60 minutes. At the end of the measuring period, the measured meter value is transferred from current measuring period registers to registers for previous measuring period that can be later used for the formation of billing values.

Values are recorded for each tariff and stored in corresponding tariff register from 1 to 8.

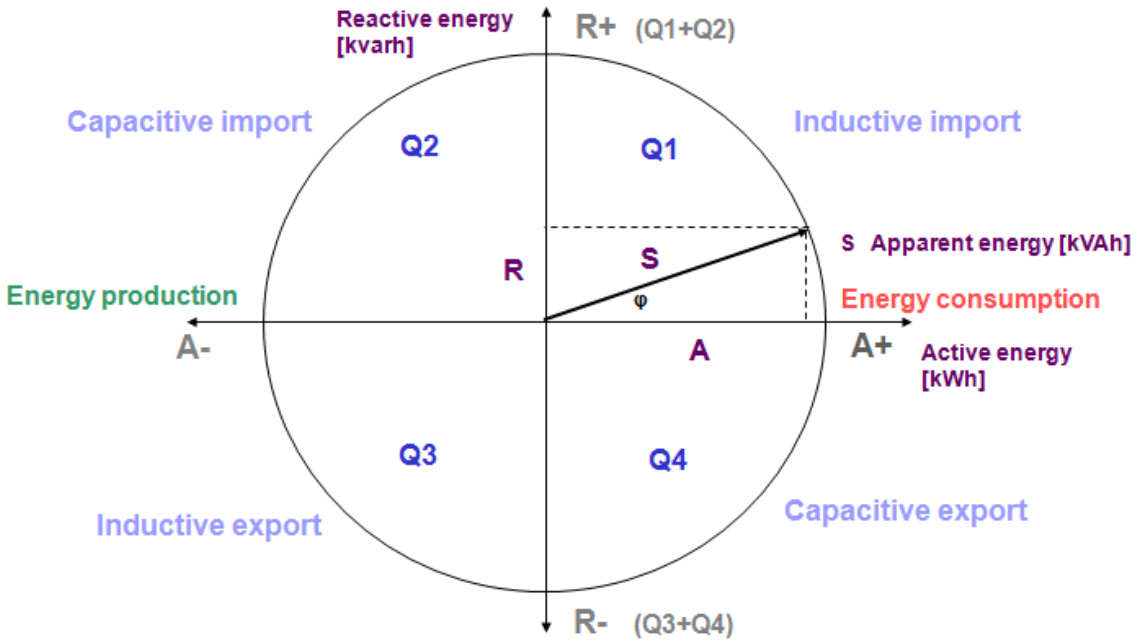


Figure 12: Measured energy and demand

3.6.1. Energy

Electrical meter energy is accumulated in respective registers (A+ or A-) until 1 Wh is reached thus energy measurement is carried out in latter unit (scaler is 0). Default representation of the energy values on display is in kWh with 6 digits without decimals. This representation can be changed via communication interfaces. Nevertheless, full value with each Wh counted could be obtained through communication interfaces in form of value, unit and scaler.

The meter records different types of energy (active, reactive, apparent) for all phases in one or more tariffs and stores these values in various registers according to energy direction and active tariff.

Active Energy delta registers (total and tariffs) contains active energy flow within billing period in the following objects:

- **Import active energy registers A+** (1-0:1.9.e, (e = 0 … 8))
- **Export active energy registers A-** (1-0:2.9.e, (e = 0 … 8))

Several energy types (A+, A-, Q+, Q-, QI, QII, QIII, QIV, S+, S-, ABS and NET) are registered as total register value and rate register values (see the Table 15).

3.6.2. Demand

Meter calculates an average demand in a time interval as a quotient of registered energy during measurement period and elapsed time Td (see the Figure 13).

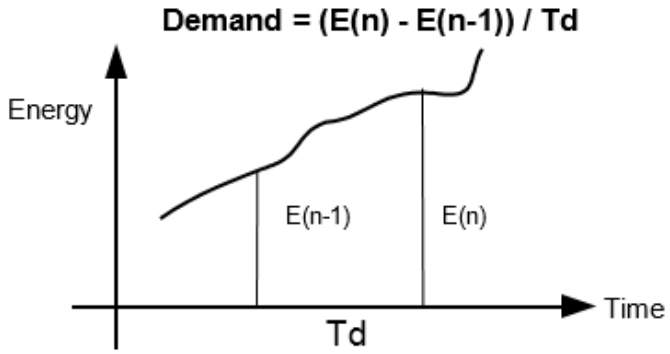


Figure 13: Demand calculation sample

During the measuring period, current demand is stored in the 1-0:c.4.0 register. At the end of the measuring period, this value is stored as the last demand value in the 1-0:c.5.0 register and the value in the 1-0:c.4.0 register is set to 0 (zero). 1-0:c.5.0 register is compared with highest maximum value stored in the relevant register 1-0:c.6.0. If new value is larger than the one in the register for the maximum value, the new value is stored as new maximum value. At the same time timestamp, representing the conclusion of measuring period is stored.

At the end of the billing period the values in the maximum demand registers 1-0:c.6.e are recorded to billing profiles. Maximum demand values 1-0:c.6.e are added to cumulative maximum demand registers 1-0:c.2.e, then the values in the maximum demand registers are set to 0. At the same time billing period counter is increased by one (see the Figure 14).

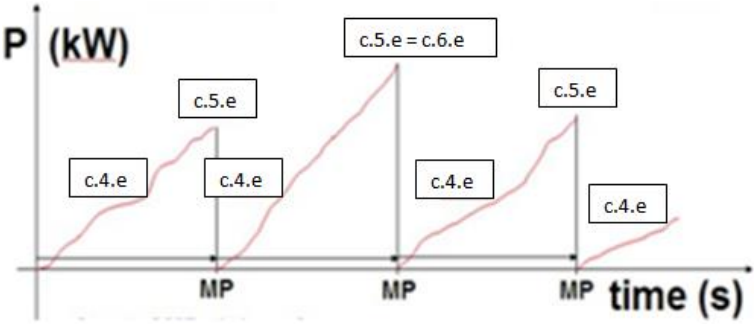


Figure 14: Measuring principle

Demand can be measured in the Mx382 meter according to:

- **block demand method** or
- **sliding demand method**.

Block demand method

At block demand method, the first time period (block) begins at the time when measurement period starts and lasts the time Td. When this time period ends, the new time period begins (see the Figure 15).

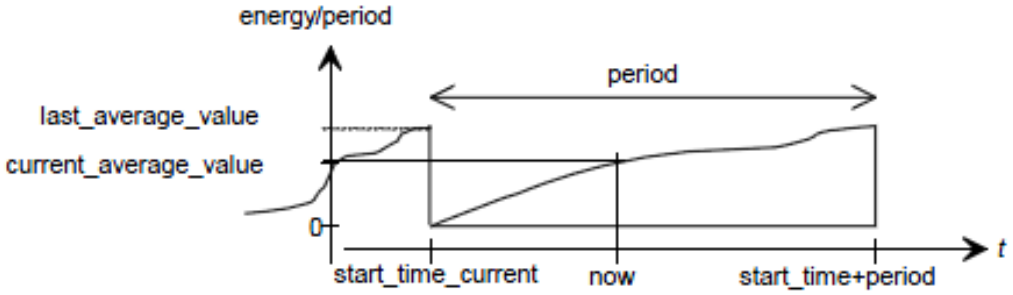


Figure 15: Attributes in the case of block demand (1 period)

Sliding demand method

At sliding demand method the time period is divided into **N** (natural number) subperiods **t** (time). The time period is then Td=N*t.

First time period starts at the time when measurement period starts. The demand is measured until time **t** elapses, when second time period starts. The measuring of the demand in the first time period is going on while the new measurement of the demand starts in the second time period. After another time **t** the third time period starts. The time period slides step by step forward. (See the Figure 16.)

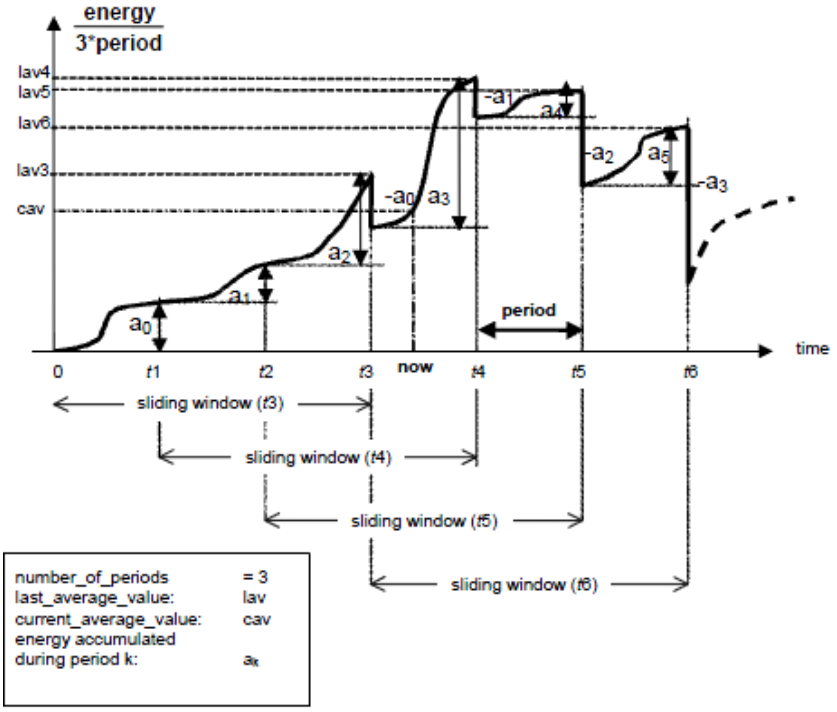


Figure 16: Attributes in case of sliding demand

At the block demand method, only one average demand is calculated in one time period, while at sliding demand **N** average values are calculated. In this way, the measurement at sliding demand method is much more accurate. (See the Figure 17.)

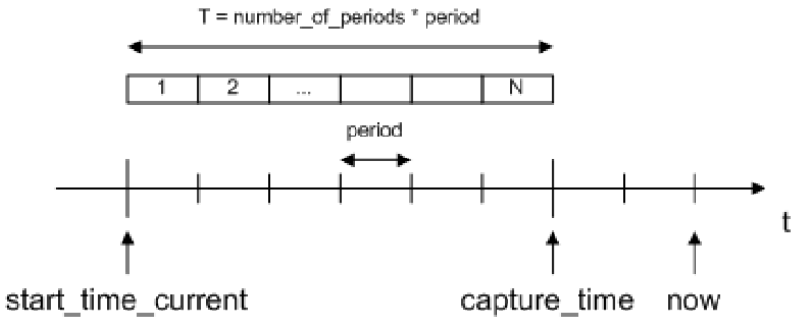


Figure 17: Time attributes when measuring sliding demand

3.6.2.1. Other demand registers

In addition to sliding demand registers, Mx382 meter also has other demand measuring registers.
Last average demand registers (1-0:c.5.0) are stored as separate registers for possible display on the LCD.

	SUM	Tariff 1 … 8
A+	1-0:1.5.0	(not applicable)
A-	1-0:2.5.0	(not applicable)
Q+	1-0:3.5.0	(not applicable)
Q-	1-0:4.5.0	(not applicable)
S+	1-0:9.5.0	(not applicable)
S-	1-0:10.5.0	(not applicable)
ABS	1-0:15.5.0	(not applicable)

Table 2: Last average demand registers

Maximum demand registers (total) represent the biggest CAV (Current Average Value) from average demand registers, measured in one period. See the Table 3.

	SUM	Tariff 1 … 8
A+	1-0:1.6.0	1-0:1.6.e
A-	1-0:2.6.0	1-0:2.6.e
Q+	1-0:3.6.0	1-0:3.6.e
Q-	1-0:4.6.0	1-0:4.6.e
S+	1-0:9.6.0	1-0:9.6.e
S-	1-0:10.6.0	1-0:10.6.e
ABS	1-0:15.6.0	1-0:15.6.e

<e> is used as tariff index from 1 to 8

Table 3: Maximum demand registers – total

Cumulative maximum demand registers represent the sum of all maximum demand register values (1-0:c.6.e) at the end of billing period. Before the values in maximum demand registers are cleared, they are added to the appropriate cumulative maximum demand register (1-0:c.2.e). See the Table 4.

	SUM	tariff 1..8
A+	1-0:1.2.0	1-0:1.2.e
A-	1-0:2.2.0	1-0:2.2.e
Q+	1-0:3.2.0	1-0:3.2.e
Q-	1-0:4.2.0	1-0:4.2.e
S+	1-0:9.2.0	1-0:9.2.e
S-	1-0:10.2.0	1-0:10.2.e
ABS	1-0:15.2.0	1-0:15.2.e

<e> is used as tariff index from 1 to 8

Table 4: Cumulative maximum demand registers

In the Table 5 are shown average demand, last average demand, and maximum demand.

	Average demand SUM	Last average demand SUM	Maximum demand SUM	Maximum demand tariffs 1 … 8
A+	1-0:1.4.0	1-0:1.5.0	1-0:1.6.0	1-0:1.6.e
A-	1-0:2.4.0	1-0:2.5.0	1-0:2.6.0	1-0:2.6.e
Q+	1-0:3.4.0	1-0:3.5.0	1-0:3.6.0	1-0:3.6.e
Q-	1-0:4.4.0	1-0:4.5.0	1-0:4.6.0	1-0:4.6.e
S+	1-0:9.4.0	1-0:9.5.0	1-0:9.6.0	1-0:9.6.e
S-	1-0:10.4.0	1-0:10.5.0	1-0:10.6.0	1-0:10.6.e
ABS	1-0:15.4.0	1-0:15.5.0	1-0:15.6.0	1-0:15.6.e

<e> is used as tariff index from 1 to 8

Table 5: Average demand objects

3.7. Measurement platform

These objects are used to define the type of the measurement platform. One platform can be used for various different meter configurations. Configuration defines basic meter parameters such as calibration, current and voltage constants, configuration of measurement circuits, etc.

3.7.1. Measuring configuration

The Table 6 shows possible measurement platform variations for the Mx382 meter. The appropriate number has to be entered into the **Measuring configuration** (0-0:196.0.0) object. If the meter is turned on for the first time, the entered number should be 0.

Meter Type	Measuring probe
ME382 D3	Shunt 0,20 mΩ
ME382 D1	Shunt 0,18 mΩ
MT382 D1/D2	Rogowsky
MT382 T1	Rogowsky

Table 6: Measuring configuration type

One (in the ME382 meter) or three (in the MT382 meter) metering elements can be built in the meter. The current sensor for MT382 meters is Rogowsky coil (a current transformer with an air core) and shunt for ME382 meter, while voltage sensor is a resistive voltage divider. Signals of currents and voltages are fed into the A/D (Analog to Digital) converters where they are further processed.

3.7.1.1. Rogowski coil

Rogowsky coil does not contain magnetic material that could be saturated by an external magnet; consequently, the meter's accuracy cannot be affected by an external DC (Direct Current) or AC (Alternating Current) magnetic field.

3.7.1.2. Shunt

Shunt resistor is made of manganin alloy, which makes this sensor type stable over a temperature range and long term very robust. Meter accuracy cannot be affected by external DC or AC magnet. Shunt measuring system does not contain any magnetic materials that could be saturated or affected by external magnet. Sensor is connected directly on a PCB (Printed Circuit Board), so there is no additional loop between shunt and PCB where disturbance voltage could be induced.

3.7.2. Energy metrological pulse output

Solid-state relay output can be used as metrological pulse (metropulse) output. To enable metropulse output there is the service control functionality object used.

Metropulse output constants (1-0:0.3.d) are used for the following energies:

- absolute active energy output (d=3),
- absolute reactive energy output (d=4),
- absolute apparent energy output (d=5).

If the value in the register is 0 or higher than 1000000, the metropulse output is disabled, otherwise the metropulse output is enabled and switches (connected/disconnected) according to the constant selected and according to the energy consumption (impulse/unit).

Metropulse output function, idle state that indicates closure and pulse duration are configurable. Maximal pulse duration value is 200 ms. See the Table 7.

IO Function	Description
NONE	No function is assigned to the metropulse output
absAA	Pulse output for absolute A
absRA	Pulse output for absolute R
absSA	Pulse output for absolute S

Table 7: List of a metropulse output functions

3.7.2.1. Transformer measurement type

At transformer type of MT382 meters, the transformer measurement type defines if current transformer ratio **K** ((the ratio between the objects **Transformer ratio – current (numerator)**, 1-0:0.4.2 and **Transformer ratio – current (denominator**), 1-0:0.4.5)) will be used in measuring process or not. The transformer ratio is used at transformer-connected meter, which performs the primary measurement. It is not used at direct connected meter, which performs the secondary measurement.

Transformer ratio is used to configure meter where results on the secondary side need to be different (lower) than on the primary side. For correct results, constant **K** on the secondary side must be also considered. Constant **K** is the correction factor between secondary and primary side of the transformer.

K = Current Numerator (primary current) / Current Denominator (secondary current)

Example: the ideal transformer induces secondary voltage Us as proportion of the primary voltage Up and respective winding turns Np and Ns of the transformer (**K** = Up/Us = Np/Ns = 100/5 = 20).

NOTE
Voltage Numerator and Voltage Denominator are set to 1 (default).

NOTE
Due to maximum count value (rollover, see the chapter *5.1. LCD*), the primary current (nominator) can be max. 300 A.

3.7.3. Measured quantities

Quantities that can be measured by Mx382 meter are:

- tariff energy values,
- total energy values,
- power factor,
- power and voltage failures.
- Average values:
  - average voltage per phase,
  - average daily peak and minimum voltage (current, previous),
  - sliding average current per phase,
  - average power,
  - last average power factor,
  - last average demand – active, reactive, apparent,
  - average import, net and total power.
- Demand values:
  - maximum demand register – active, reactive, apparent,
  - cumulative maximum demand.
- Instantaneous values:
  - instantaneous active energy/demand,
  - instantaneous reactive energy/demand, values per quadrant,
  - instantaneous apparent energy/demand,
  - instantaneous voltage, per phase,
  - instantaneous daily peak and minimum voltage,
  - instantaneous current, per phase,
  - instantaneous current – sum of all three phases,
  - instantaneous power, per phase,
  - instantaneous power– sum of all three phases,
  - instantaneous power factor,
  - instantaneous net frequency in any phase.
- Previous values:
  - billing period counter,
  - data of billing period.
- Voltage values:
  - voltage levels counters,
  - voltage levels counters per phase,
  - voltage sags and swells,
  - magnitude and duration of last voltage sag and swell per phase,
  - daily peak/minimum voltage per phase.

3.7.4. Voltage

3.7.4.1. Instantaneous voltage

Instantaneous voltage is measured in the meter every 100 ms per each phase with the **Instantaneous voltage** objects (1-0:32.7.0 for L1, 1-0:52.7.0 for L2 and 1-0:72.7.0 for L3).

3.7.4.2. Daily peak and minimum values

	L1	L2	L3
Daily peak voltage (current)	0-0:128.8.10	0-0:128.8.20	0-0:128.8.30
Daily peak voltage (previous)	0-0:128.8.11	0-0:128.8.21	0-0:128.8.31
Daily minimum voltage (current)	0-0:128.8.12	0-0:128.8.22	0-0:128.8.32
Daily minimum voltage (previous)	0-0:128.8.13	0-0:128.8.23	0-0:128.8.33

Table 8: Peak and minimum values of voltage

3.7.4.3. Average voltage

	ALL	L1	L2	L3
Average voltage		1-0:32.24.0	1-0:52.24.0	1-0:72.24.0
Average voltage daily peak (current)	0-0:128.8.0	x	x	x
Average voltage daily peak (previous)	0-0:128.8.1	x	x	x
Average voltage daily minimum (current)	0-0:128.8.2	x	x	x
Average voltage daily minimum (previous)	0-0:128.8.3	x	x	x

Table 9: Average values of voltage

3.7.4.4. Voltage levels

	ANY	L1	L2	L3
Level 1: U > +10%	0-0:128.7.41	0-0:128.7.11	0-0:128.7.21	0-0:128.7.31
Level 2: +5% < U < +10%	0-0:128.7.42	0-0:128.7.12	0-0:128.7.22	0-0:128.7.32
Level 3: 0% < U < +5%	0-0:128.7.43	0-0:128.7.13	0-0:128.7.23	0-0:128.7.33
Level 4: -5% < U < 0%	0-0:128.7.44	0-0:128.7.14	0-0:128.7.24	0-0:128.7.34
Level 5: -10% < U < -5%	0-0:128.7.45	0-0:128.7.15	0-0:128.7.25	0-0:128.7.35
Level 6: -15% < U < -10%	0-0:128.7.46	0-0:128.7.16	0-0:128.7.26	0-0:128.7.36
Level 7: U < -15%	0-0:128.7.47	0-0:128.7.17	0-0:128.7.27	0-0:128.7.37

Table 10: Voltage levels counters

3.7.4.5. Voltage sags and swells

	ANY
Magnitude for voltage sag	1-0:12.34.0
Magnitude for voltage swell	1-0:12.38.0

Table 11: Magnitude for voltage sags and swells

	L1	L2	L3
Magnitude of last voltage sag	1-0:32.34.0	1-0:52.34.0	1-0:72.34.0
Magnitude of last voltage swell	1-0:32.38.0	1-0:52.38.0	1-0:72.38.0

Table 12: Magnitude of last voltage sag and swell

3.7.5. Current

3.7.5.1. Instantaneous current

Instantaneous current is measured in the meter every 100 ms per each phase with the **Instantaneous current** objects (1-0:31.7.0 for L1, 1-0:51.7.0 for L2 and 1-0:71.7.0 for L3). Sum of all phases is also measured, with the 1-0:90.7.0 object.

3.7.6. Net frequency

The meter cans measures instantaneous net frequency in any phase by the dedicated **Instantaneous net frequency** (1-0:14.7.0) object.

3.7.7. Power

3.7.7.1. Instantaneous power

	SUM
A+	1-0:1.7.0
A-	1-0:2.7.0
Q+	1-0:3.7.0
Q-	1-0:4.7.0
S+	1-0:9.7.0
S-	1-0:10.7.0
ABS	1-0:15.7.0

Table 13: Instantaneous power objects

3.7.7.2. Average power

	SUM
A+	1-0:1.24.0
ABS	1-0:15.24.0
NET	1-0:16.24.0

Table 14: Average power

3.7.8. Power factor

Power factor measurements are accessible with next dedicated objects:

- with the **Instantaneous power factor** object for sum of instantaneous power factor (1-0:13.7.0) and for instantaneous power factor per phase (1-0:33.7.0 for L1, 1-0:53.7.0 for L2 and 1-0:73.7.0 for L3),
- with the **Last average power factor** (1-0:13.5.0) object for the last average power factor.

3.7.9. Energy

3.7.9.1. Total energy values

	Total SUM	Total tariff
A+	1-0:1.8.0	1-0:1.8.e
A-	1-0:2.8.0	1-0:2.8.e
Q+	1-0:3.8.0	1-0:3.8.e
Q-	1-0:4.8.0	1-0:4.8.e
QI	1-0:5.8.0	1-0:5.8.e
QII	1-0:6.8.0	1-0:6.8.e
QIII	1-0:7.8.0	1-0:7.8.e
QIV	1-0:8.8.0	1-0:8.8.e
S+	1-0:9.8.0	1-0:9.8.e
S-	1-0:10.8.0	1-0:10.8.e
ABS	1-0:15.8.0	1-0:15.8.e
NET	1-0:16.8.0	1-0:16.8.e

<e> is used as tariff index from 1 to 8

Table 15: Total and tariff energy objects

3.7.10. Measurement period

There are two measurement periods in use, configured in dedicated measurement period parameterization object:

- measurement period 1 (MP1), used for demand measurements (for average values), configured in the **Measurement period 1** (1-0:0.8.0) object; recommended periods are 5 min, 15 min, 30 min and 60 min,
- measurement period 3 (MP3), used for energy and power limits (for instantaneous values), configured in the **Measurement period 3** (1-0:0.8.2) object.

NOTE

For effective use of functionalities, the meter must be properly configured.

4. METER CONSTRUCTION

4.1. Technical figures and dimensions of the ME382 meter

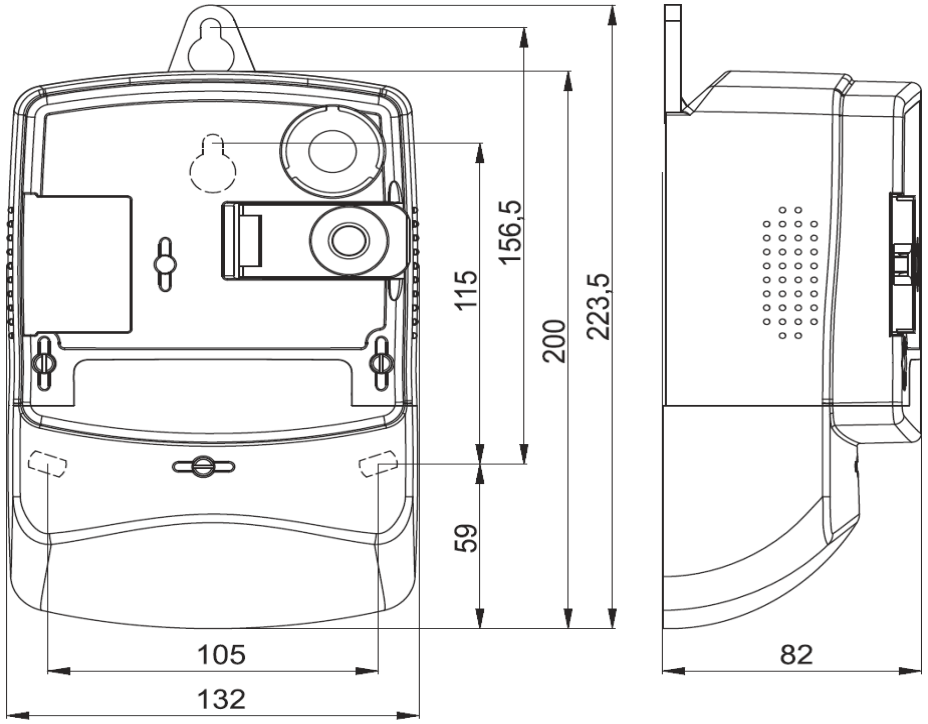


Figure 18: Overall and fixing dimensions of the ME382-D1 meter fitted with a regular terminal cover

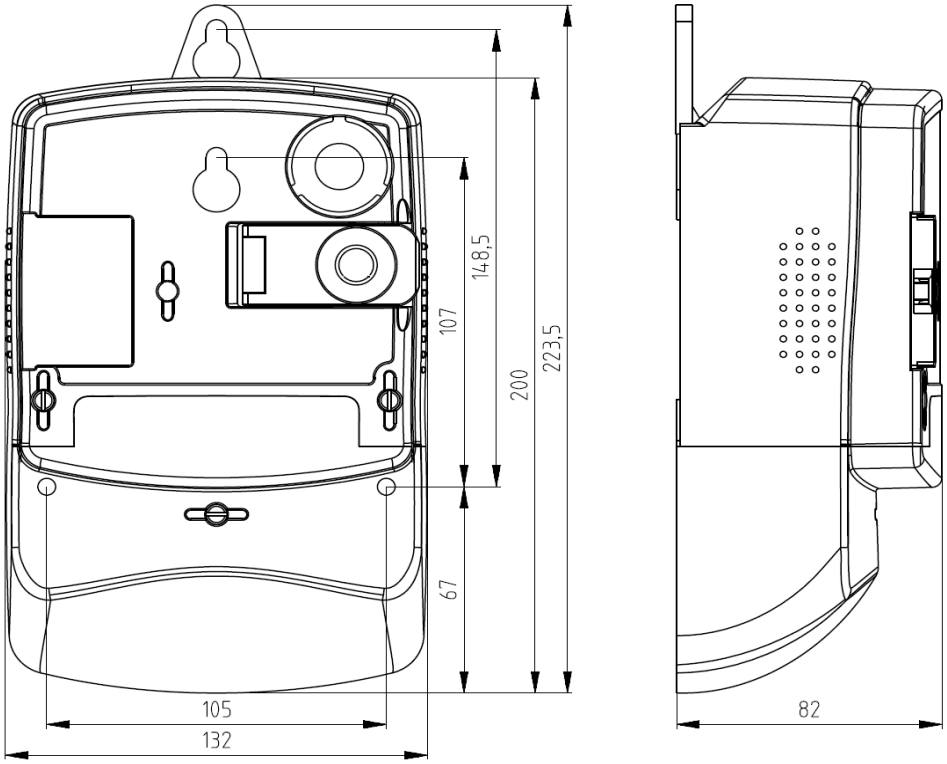


Figure 19: Overall and fixing dimensions of the ME382-D3 meter fitted with a regular terminal cover

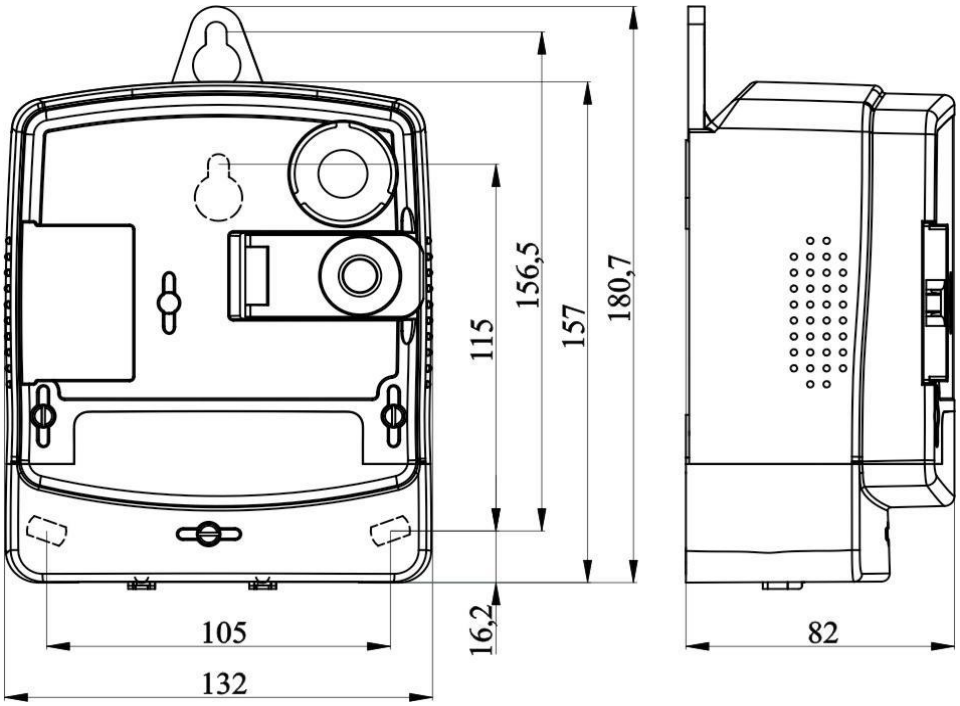


Figure 20: Overall and fixing dimensions of the ME382-D1 meter fitted with a short terminal cover

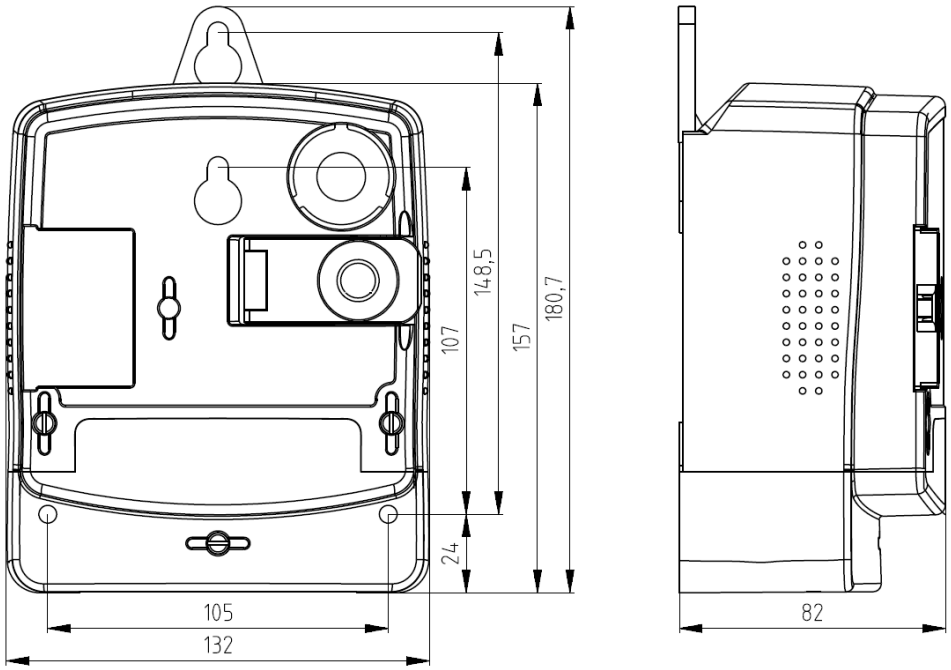


Figure 21: Overall and fixing dimensions of the ME382-D3 meter fitted with a short terminal cover

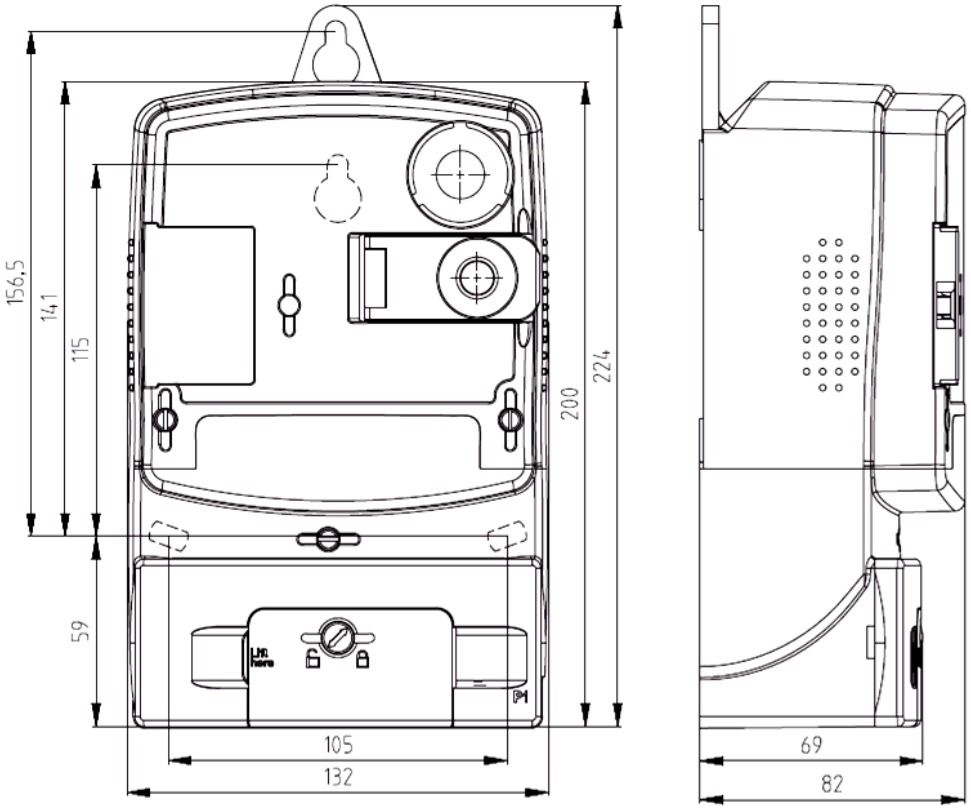


Figure 22: Overall and fixing dimensions of the ME382-D1 meter fitted with a P1+M-Bus terminal cover

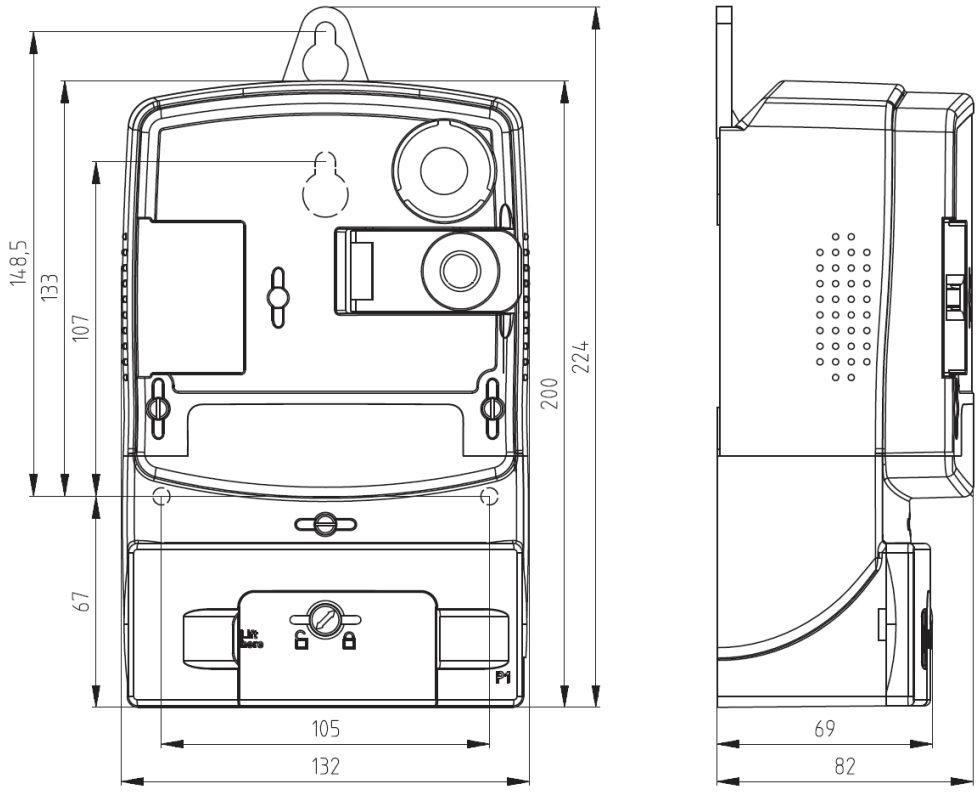


Figure 23: Overall and fixing dimensions of the ME382-D3 meter fitted with a P1+M-Bus terminal cover

4.2. Technical figures and dimensions of the MT382 meter

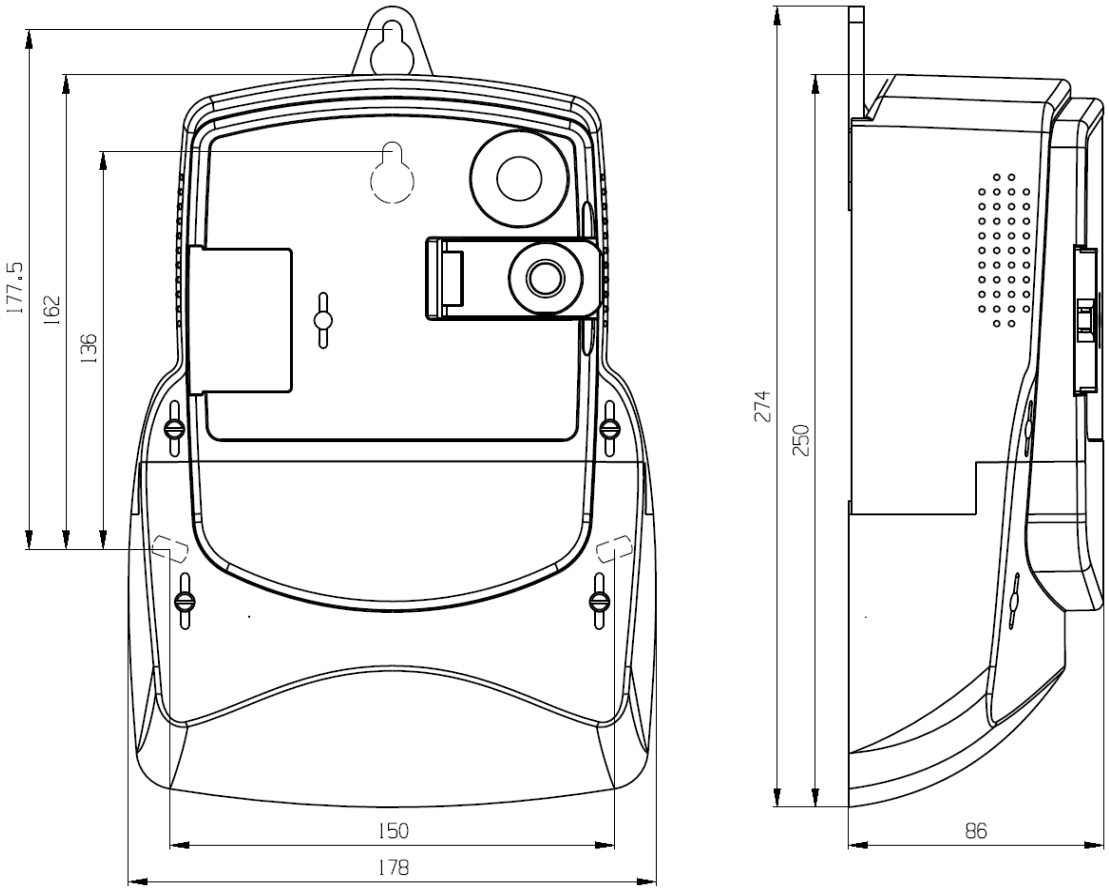


Figure 24: Overall and fixing dimensions of an MT382 meter fitted with a regular terminal cover

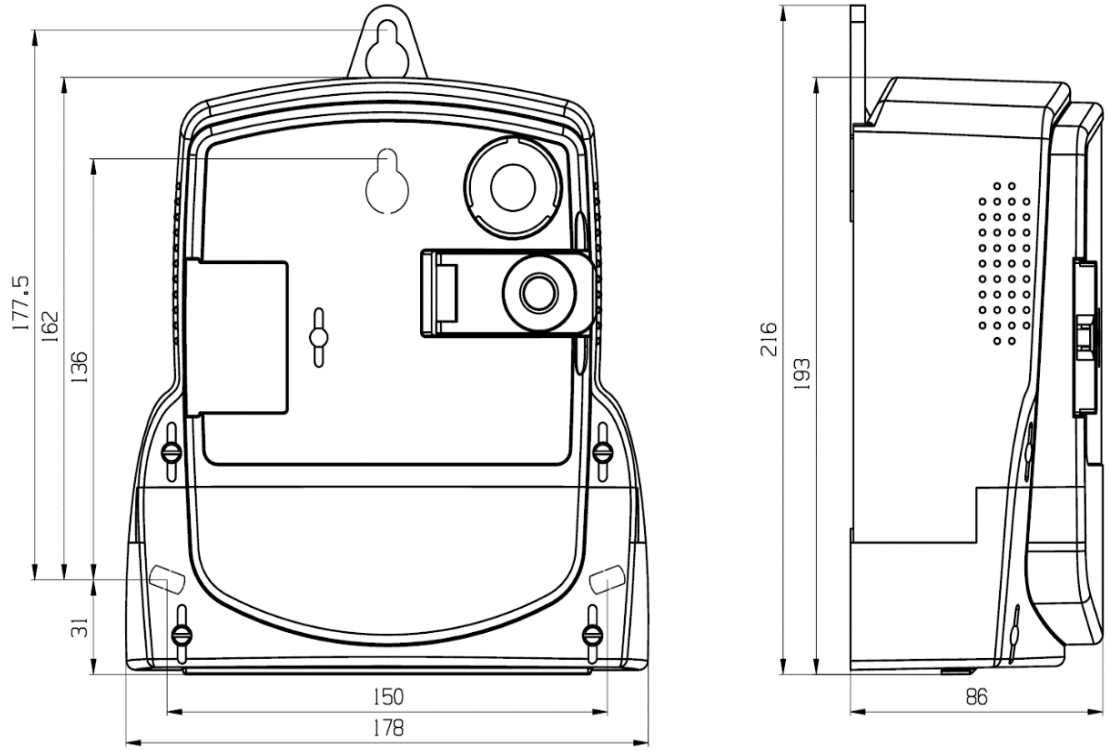


Figure 25: Overall and fixing dimensions of an MT382 meter fitted with a short terminal cover

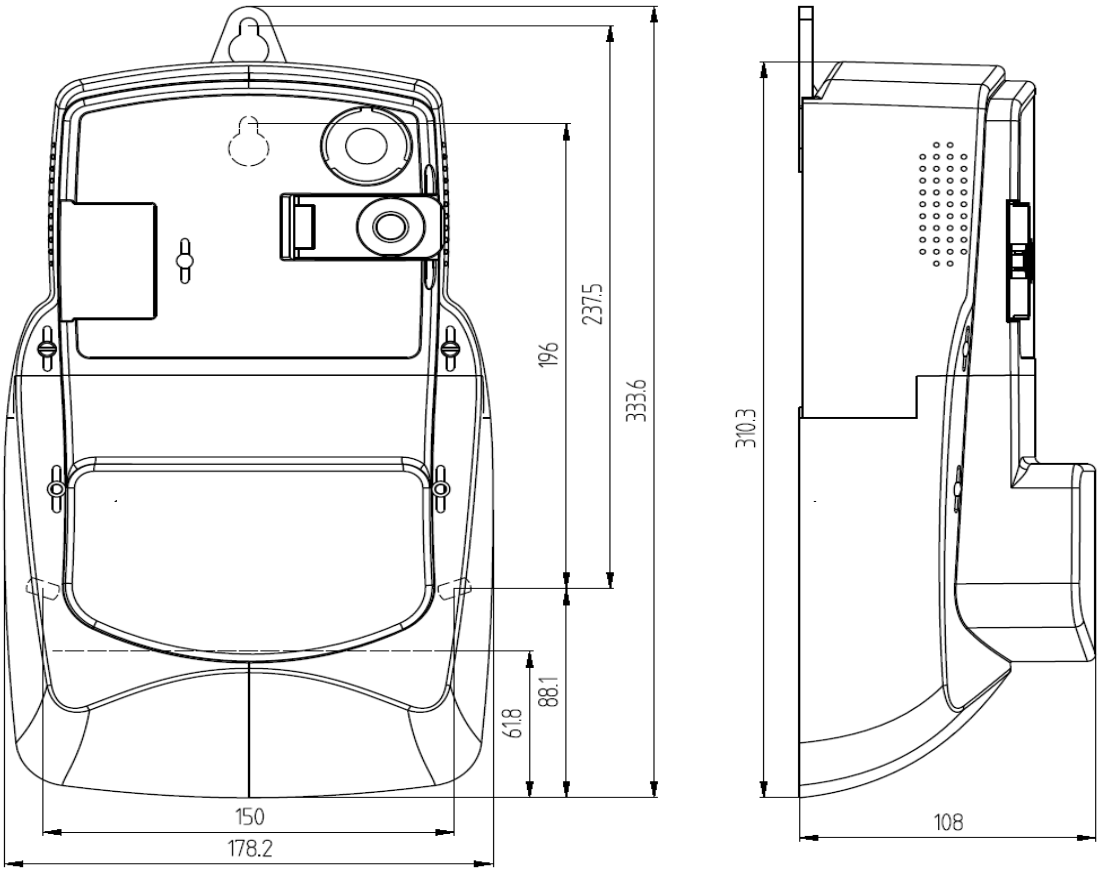


Figure 26: Overall and fixing dimensions of the MT382 meter fitted with an external SD terminal cover

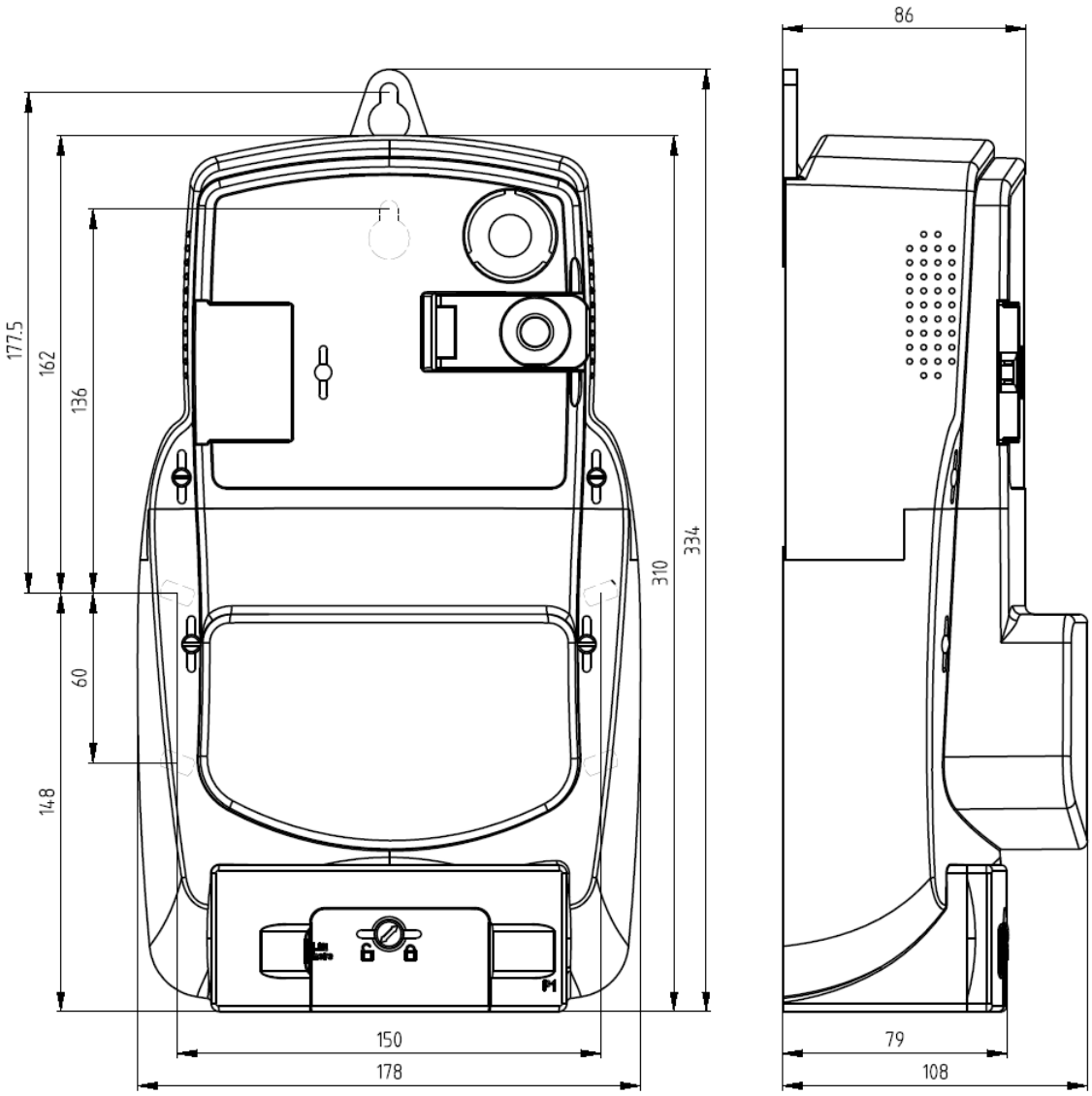


Figure 27: Overall and fixing dimensions of the MT382 meter fitted with a P1+M-Bus+SD terminal cover

4.3. Meter case

A compact meter case consists of a meter base with a terminal block and fixing elements for mounting the meter, a meter cover and a terminal cover. The meter case is made of high quality self-extinguishing UV stabilized polycarbonate that can be recycled. The case ensures double isolation and IP54 protection level against dust and water penetration.

Each meter can be fixed with three screws (two lower and one upper fixing holes). The upper fixing hole is placed 115 mm (version D1) or 107 mm (version D3) at ME382 meter and 136 mm at MT382 meter above the line connecting the bottom fixing holes (DIN 43857). The movable top hanger is provided on the backside of the meter base under the top edge. The top hanger ensures the upper fixing hole 41,5 mm higher than upper fixing hole on the meter base.

On the front side of the meter, there is a lid, which is fixed to the meter cover with a hinge. The lid covers the **Reset** button and can be sealed in the closed position. The optical port is utilized for attaching an optical probe. The optical port is designed in accordance with standards.

The meter connection diagram is in the form of label and is placed on the inner side of the terminal cover.

4.3.1. Terminal block

A terminal block (see the Figure 3 for ME382 meter and the Figure 7 / the Figure 8 for MT382 meter) complies with the DIN 43857 standard, while the terminal block for BS connected meters (see the Figure 4) complies with the BS 7856 standard. It is made of self-extinguishing high quality polycarbonate. Terminal cover is made in the colour of the meter – light grey.

At single phase meters ME382-D1 with 85 A terminal block (see the Figure 3) the current terminals are made of nickel-plated steel. Voltage terminals and screws are made of zinc plated steel, pozidrive nr. 2 head type. The conductors can be fixed with one screw per terminal and Iskraemeco's design of cage clamps.

At ME382-D3 with 100 A terminal block (see the Figure 4), the current terminals are made of brass. The surface of terminals can be additionally protected with nickel for the areas with extreme climatic conditions (e.g. tropical area). Screws are made of zinc-plated steel with pozidrive nr. 2 head type. The conductors can be fixed with two screws per terminal.

At three phase meters MT382-D1 with 85 A terminal block (see the Figure 7) the current terminals are made of nickel-plated steel. Voltage terminals and screws can be made of zinc-plated steel with pozidrive nr. 2 head type.
The conductors can be fixed with one screw per terminal and Iskraemeco's design of cage clamps.

At MT382-D2 with 120 A terminal block, the current terminals are made of nickel-plated steel. Voltage terminals and screws can be made of zinc-plated steel with pozidrive nr. 2 head type or can be made of nickel plated brass with slot head type. The conductors can be fixed with two screws per terminal and Iskraemeco's design of cage clamps.

At MT382-T1 meters (see the Figure 8), the current and voltage terminals are made of brass. The surface of terminals can be additionally protected with nickel for the areas with extreme climatic conditions (e.g. tropical area). Screws can be made of nickel-plated brass with slot head type, or can be made of zinc-plated steel with pozidrive
nr. 1 head type. The conductors can be fixed with two screws per terminal.

Universal clamping terminals at direct connected meters assure the same quality of the contact irrespective of the shape of the connection conductor (a compact wire, a stranded wire, of greater or smaller cross-sections). They also assure faster meter assembly.

Current terminals at ME382 and direct connected MT382 meter has 8,5 mm hole diameter for 85 A terminal block and 9,5 mm hole diameter for 120 A terminal block. Current terminals at transformer connected MT382-T1 meter has 5 mm hole diameter.

The meter is equipped with two additional voltage terminals - 2 (L1) and 5 (N) at ME382 meter and with max. four additional voltage terminals - 2 (L1), 5 (L2), 8 (L3) and 11 (N) at MT382 meter. They enable simple connection of additional external devices. See the Figure 3 and the Figure 7.

4.3.1.1. U-I link between voltage and current circuits

A sliding U-I link is a mechanical device (used only on MT382 direct connected meters) intended for fast and simple separation of meter current and voltage circuit, used for calibration or accuracy testing. The U-I link can be integrated into the meter or can be optionally a part of the meter terminal block (see the Figure 7). In this case, a special slider is built in each phase of the connection terminal. It can be shifted up and down with a screwdriver.

When a U-I link is in position "down" the voltage part is not separated from the current part. During the normal meter operation, the potential links should be closed (position "down"). Upon request, the potential links can be built under the meter cover.

When a U-I link is in "up" position, it means that the voltage part is separated from the current part. During the meter testing and calibration the sliding U-I link should be in position "up". See the Figure 28.

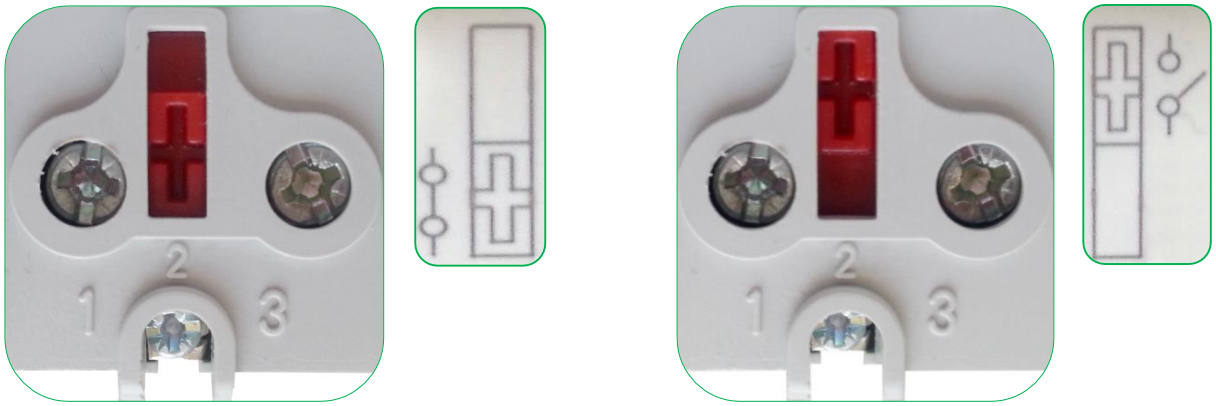


Figure 28: Sliding U-I link (left: position down; right: position up)

4.3.1.2. Inputs and outputs

Every meter has built-in input and output terminals. They are driven through the meter firmware functionality and can have different shared functions on the same pin through the specific configuration. Some functions (for hardware reasons) are not available on all meters. Functions can be used to operate with:

- P1 interface,
- M-Bus interface,
- relay output (load control output),
- solid state relay output (signal control output),
- non-potential input (alarm input / external button input),
- output for the active switching device.

Load control output – load management

Load Control registers are used to configure bi-stable relay output with maximum capability of 6 A at 250 V. Load control terminals are 34 – Relay output and 35 – Neutral. Load control can be configured as relay to switch on and off external load or it can have function of a switching device to drive external switching device.

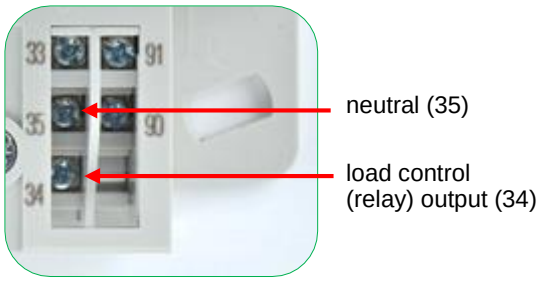


Figure 29: Load control terminal

This output can also be triggered via tariff program. Tariffication script table needs to be configured accordingly. With Load Control Mode, different types of switching can be set. Available mode options are:

- Normal,
- Switch on Delayed,
- Switch on Random Delayed,
- Switch On Delayed with Power on Delay,
- Switch On Delayed with Power on Random Delay,
- Switch On Random Delayed with Power on Delay,
- Switch On Random Delayed with Power on Random Delay.

Load control power on delay defines delay time, before it is switched on when power returns. Delay time is set in seconds. It is used for grid power balance, when power returns.

The meter enables that the Load control of each meter in the system switches on at different time inside a configured period of time. The random delay time is defined with **Load management switch on delay** object (0-0:128.30.3). Delay time is set in seconds. This prevents the system from unbalance state.

The **Load management – Relay control 1** object (0-1:96.3.10) or the **Disconnect control** object (0-0:96.3.10) (when the meter external switching device functionality is enabled) controls relay. By default, outputs are in disconnected state.

For relay state transitions, see the chapter *12.1. Annex 1: Relay, SD and M-Bus disconnect states and transitions*.

Solid-state relay (SSR) – signal control

Signal (service) control registers are used to configure solid state relay output with maximum capability of 0,1 A at 250 V. Signal control terminals are 33 – solid state relay output and 35 – Neutral. SSR output can behave as signal driver for external relay or can function as an impulse output.

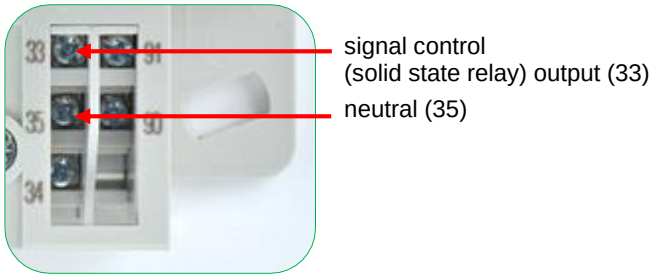


Figure 30: Signal control terminal

Signal control functionality defines a function of service control. The function can be either output or metropulse output function. If metropulse output function is selected other service control parameters have no influence on behaviour of solid-state relay output. This output can be triggered via tariff program.

Switching off either of the outputs can be controlled via built in time of use by setting the switching times for corresponding tariffs. By default, outputs are active when the low tariff is active.

Inputs

Inputs are simple passive inputs with capability to detect a presence of voltage level on dedicated terminals. There are two variations of input type:

- High Voltage AC input,
- Non-potential External button input.

Inputs can be configured for alarm or external button use only. There is a maximum of four input terminals (two functional inputs) intended for alarm or external button function use. Terminal labels are the same for all system meter types.

Terminals are labelled as (see the Figure 31):

- 85 – Neutral,
- 80 – Alarm input,
- 50 – Passive External button input,
- 51 – Passive External button input.

Figure 31: Mx382 input terminals

4.3.1.2.1. Output for active switching device

There are three output pins on the terminal block, which serve these output and is present only in MT382 meters. They are intended for the switching device. When external switching device functionality is enabled, these signals are not driven (see the Figure 32).

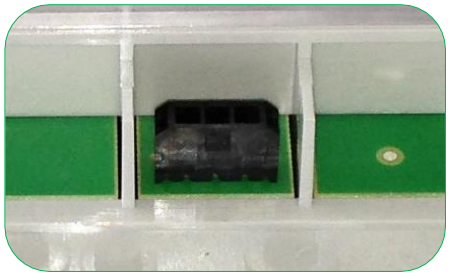


Figure 32: Output for active SD

4.3.1.2.2. Input/output status

This is read only information of I/O status. I/O Status is represented as a decimal number, which is a result of all input or output function statuses. Each input or output function has its own designated bit in 16 bit input or output register. This bit can be enabled (logical 1) or disabled (logical 0). According to that, HEX (hexadecimal) number is a result of the whole binary register word. Not all bits in the register are used and some are reserved for future functions.

x x x x x x x x x x x x x x x x

Bit 15 0

Input control status register (0-0:96.3.1) includes this input function bits (see the Table 16).

Bit	HEX (when bit set)	Bit name	Remarks
0-5			unused
6	0x0040	EXTERNAL BUTTON	50/51
7	0x0080	ALARM IN	85/80
8-12			unused
13	0x2000	SCROLL BUTTON	Button pressed
14	0x4000	RESET BUTTON	Button pressed
15	0x8000	PARAM LOCK SWITCH	Locked

Table 16: Input state control register of ME382 and MT382 meter

Output control status register (0-0:96.3.2) of single-phase (ME382) meter is shown in the Table 17.

Bit	HEX (when bit set)	Bit name	Remarks
0	0x0001	RELAY OUTPUT	Relay ON
1	0x0002	RELAY OUTPUT	Relay OFF
2-3			unused
4	0x0010	BREAKER OUTPUT	Breaker ON
5	0x0020	BREAKER OUTPUT	Breaker OFF
6-7			unused
8	0x0100	SERVICE OUTPUT	SSR ON
9-15			unused

Table 17: Output state control register of single-phase (ME382) meter

Output control status register (0-0:96.3.2) of three phase (MT382) meter is shown in the Table 18.

Bit	HEX (when bit set)	Bit name	Remarks
0	0x0001	RELAY OUTPUT	Relay ON
1	0x0002	RELAY OUTPUT	Relay OFF
2-3			unused
4	0x0010	BREAKER OUTPUT	Breaker OFF
5	0x0020	BREAKER OUTPUT	Breaker ON
6-7			unused
8	0x0100	SERVICE OUTPUT	SSR ON
9-15			unused

Table 18: Output state control register of three phase (MT382) meter

4.3.2. Meter cover

The meter cover is made of transparent high quality self-extinguishing UV stabilized polycarbonate that can be recycled. Mx382 meter is equipped with the meter cover opening detector.

4.3.3. Terminal cover

The meter terminal cover covers the meter terminal block. It is made of non-transparent high quality self-extinguishing UV stabilized polycarbonate that can be recycled. The Mx382 meter is equipped with the terminal cover opening detector. On the inner side of the terminal cover, there is the place for the connection diagram, which is in the form of the label. For meter connection diagrams see the chapter *3.5., Connection diagram*.

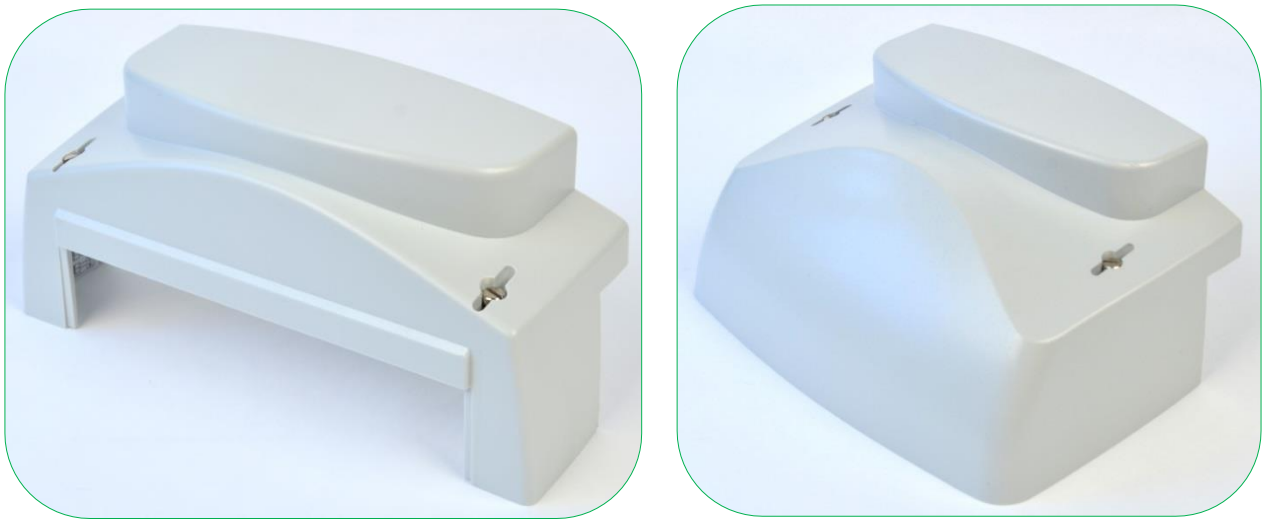


Figure 33: Short terminal cover (left) and regular terminal cover (right)

Figure 34: External SD terminal cover for the meter with SD unit (left) and P1+M-Bus+SD terminal cover (right)

Figure 35: P1+M-Bus terminal cover (left: with the sealable lid; right: without the sealable lid)

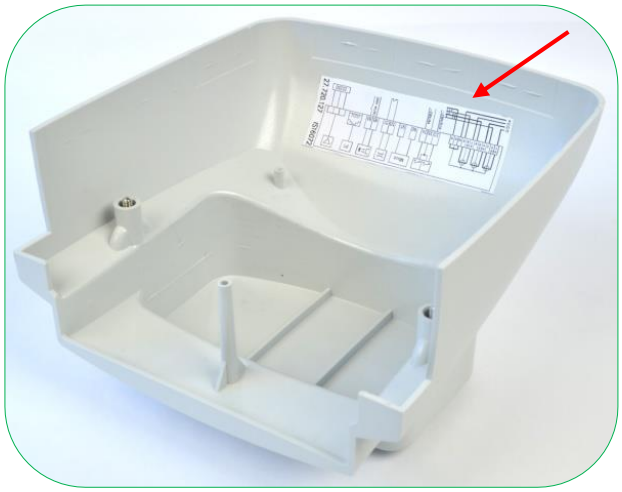


Figure 36: Meter connection diagram on the inner side of the terminal cover

4.4. Name plate

Basic data and type designation of the meter can be found on a name plate (see the Figure 37 for the ME382 meter and the Figure 38 for the MT382 meter).

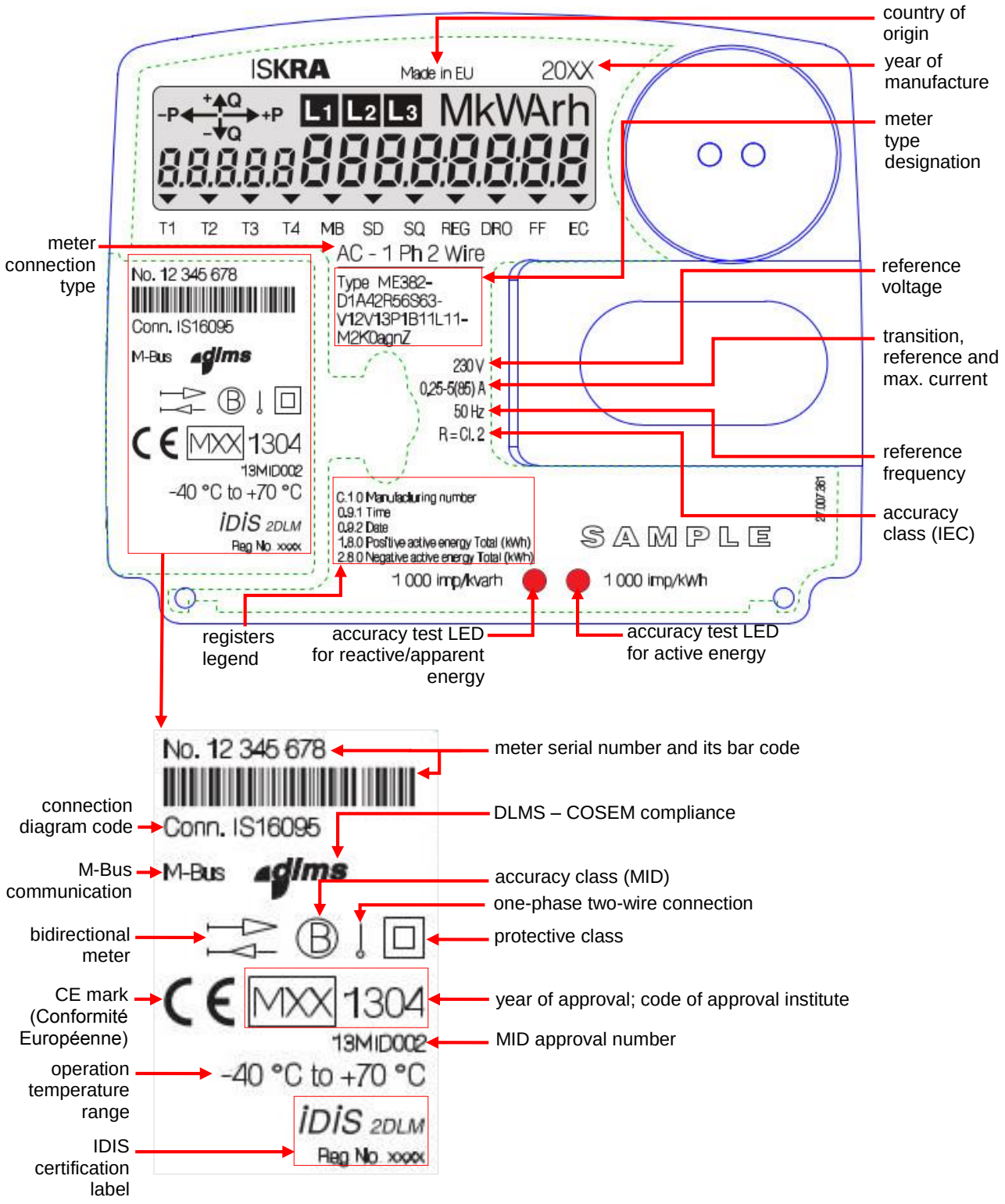


Figure 37: Name plate of the ME382 meter

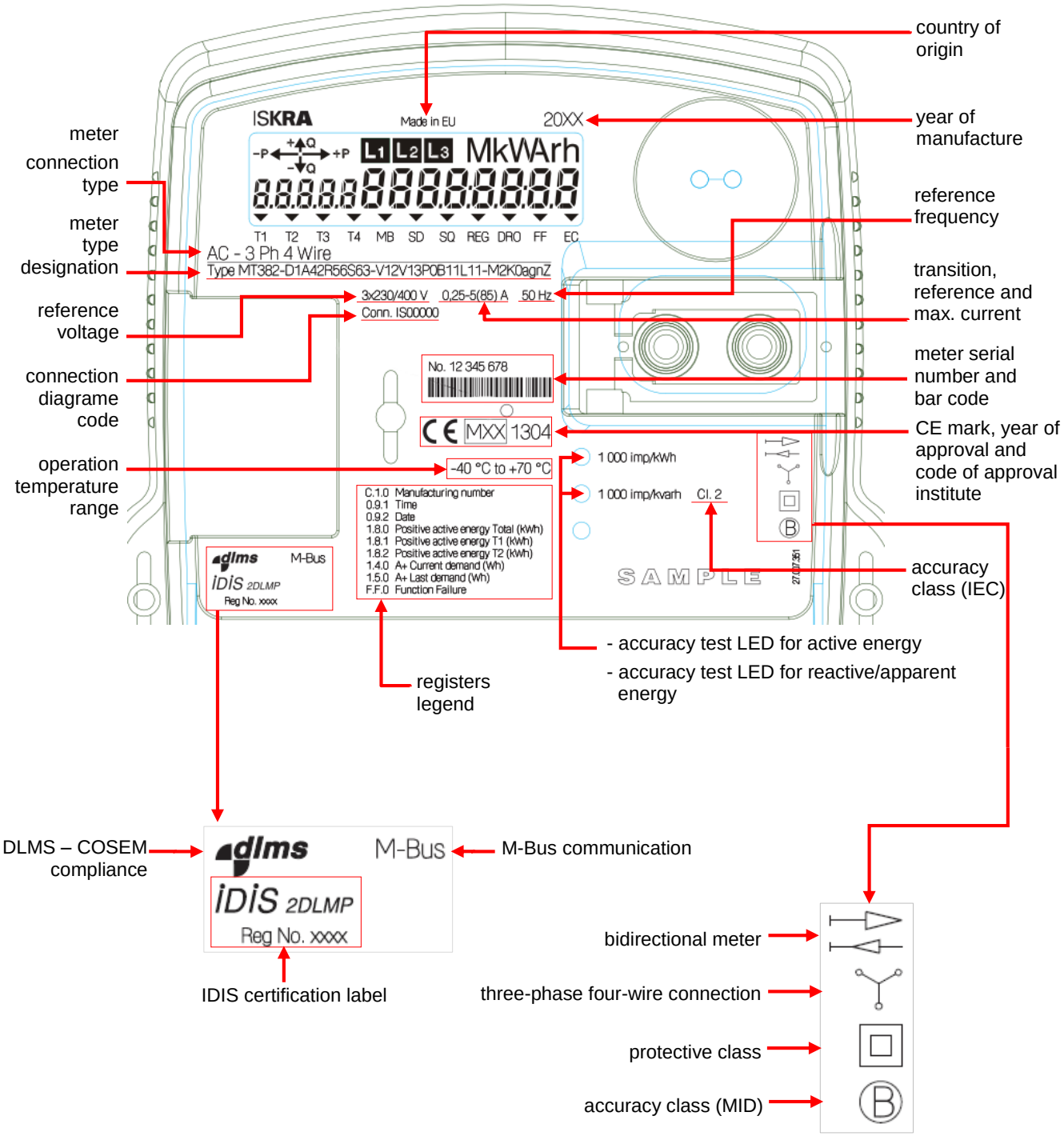


Figure 38: Name plate of the MT382 meter

4.5. Mx382 meter type designation

ME382-D3A42R52S63-V12V13P1B11L11-M2K0agnZ-Hxx																	
MT382-D1A42R52S63-V12V13P0B11L11-M2K0agnZ-Hxx																	
ME																	single-phase electronic system meter
MT																	three-phase electronic system meter
	382																meter with GSM/GPRS communication
		D1															terminal block: Imax = 85 A
		D2															terminal block: Imax = 120 A
		D3															terminal block: Imax = 100 A; BS type
		T1															terminal block up to 6 A; CT connection
			A4														accuracy class 1 (IEC), class index B (MID) for active energy measurement
			A5														accuracy class 2 (IEC), class index A (MID) for active energy measurement
				1													measurement of active energy in one direction (import only)
				2													measurement of active energy in both directions (import and export)
				4													absolute energy measurement
			R5														accuracy class 2 for reactive energy measurement,
			R6														accuracy class 3 for reactive energy measurement
				1													measurement of reactive energy in one direction (import only)
				2													measurement of reactive energy in two directions (import and export)
				6													measurement of reactive energy in 4 quadrants
			S5														apparent energy measurement, calibrated to 2%
			S6														apparent energy measurement, calibrated to 3%
				3													apparent energy calculated as SQRT (P^2+Q^2)
					V												control inputs
						1											number of inputs
							2										230 V or 120 V input
							3										No voltage (potential free) input (for external scroll button)
					P												switching device
						0											Three-phase external switching device
						1											Single-phase internal switching device
					B												high voltage output – relay type
						1											one relay contact output
							1										Make contact Relay output
					L												Solid State Relay (SSR) type output
						1											one control output
							1										Make contact Control output
								M									internal clock
									2								Super capacitor as RTC Back-up power supply
									3								Li Battery as RTC Back-up power supply
										K							communication interface
											0						optical interface (IEC62056-21)
											a						GSM/GPRS modem (2G)
											u						UMTS modem (3G)
											g						M-Bus communication interface – master
											n						P1 port
												Z					Load profile
													H				Hardware version *
														xx			versioning number defines specific version of HW (numbers go from 01 to 99)

* The type designation of first version of HW (HardWare) at specific meter type does not contain this index. Each HW that differs from the initial one gets its own index. For each new modification of HW the index rises by 1.

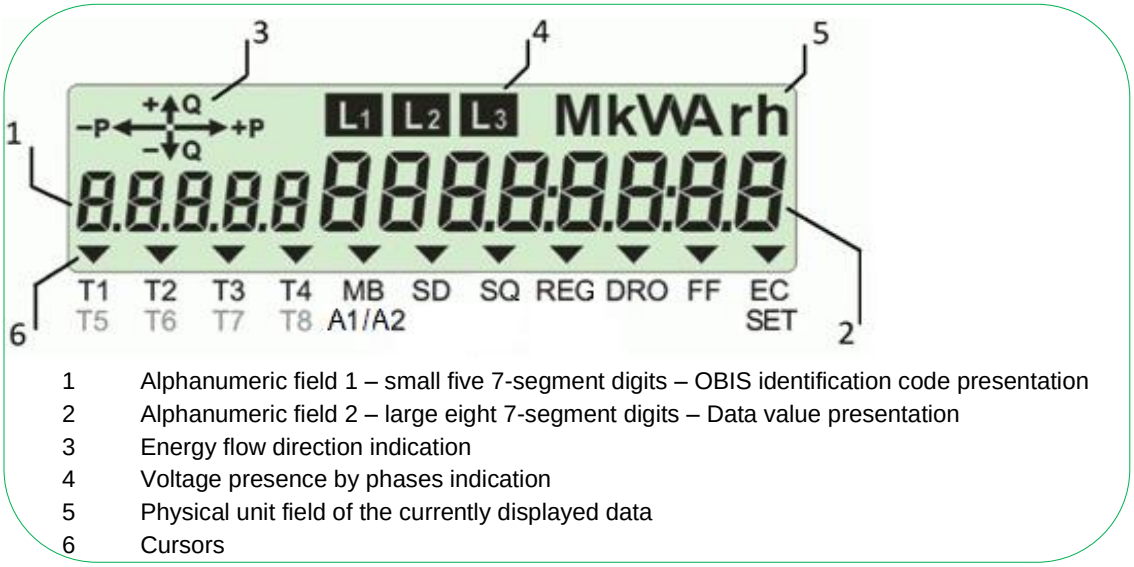
Table 19: Meter type designation

5. CONSOLE

Main features on the meter's console are LCD, two LEDs and two buttons. Every meter has them integrated.

5.1. LCD

The seven-segment liquid crystal display (LCD) with its description is shown in the Figure 39.



1 Alphanumeric field 1 – small five 7-segment digits – OBIS identification code presentation
2 Alphanumeric field 2 – large eight 7-segment digits – Data value presentation
3 Energy flow direction indication
4 Voltage presence by phases indication
5 Physical unit field of the currently displayed data
6 Cursors

Figure 39: Full Mx382 LCD – display fields

Alphanumeric field 1 is used for presentation the OBIS identification codes of the displayed data in accordance with DIN 43863-3. The hight of characters is 6 mm and width is 3 mm. In general, there are two types of OBIS name format:

- Short OBIS name format: c.d.e,
- Full OBIS name format: a-b:c.d.e.

Alphanumeric field 2 is used for presentation the data value. The height of characters is 8 mm and width is 4 mm. Up to eight digits are used to display an energy or demand value on display. Up to three of them can be used for decimal precision.

There are four **energy flow direction indication** cursors on the display. The actual type of energy is presented with the combination of the cursors:

- Positive reactive energy flow (+Q),
- Positive active energy flow (+P),
- Negative reactive energy flow (-Q),
- Negative active energy flow (-P).

Voltage presence by phases indication is indicated by segments L1, L2 and L3. Blinking segments represents wrong phase sequence connection.

Physical unit field of the currently displayed data shows units of currently displayed data. Active energy is represented in kWh, reactive energy in kvarh, apparent energy in kVAh and demand in kW.

NOTE
Prefix M (as mega) is not displayed on the LCD (in the current firmware version).

Cursors: on the front plate below the LCD display meter has laser printed markings that belong to the cursors on the LCD. The cursor shows the state of certain function that they represent e.g. tariff, registration, switching device status and meter fault (see the Table 20).

Flag	Name	Not displayed	Displayed	Blinking
1	**T1/5**		Active first tariff	Active fifth tariff
2	**T2/6**		Active second tariff	Active sixth tariff
3	**T3/7**		Active third tariff	Active seventh tariff
4	**T4/8**		Active fourth tariff	Active eighth tariff
5	**MB (A1/A2)**	No M-Bus device installed	At least one M-Bus device installed (Advanced power limitation alarm 2)	(Advanced power limitation alarm 1)
6	**SD**	Switching device OFF	Switching device ON	
7	**SQ**	No / Low signal	GSM signal present	Weak GSM signal
8	**REG**	Meter not logged in the GSM network	Meter logged in the GSM network with installation call made or not enabled	GSM/GPRS modem registered but installation call wasn't made
9	**DRO**		Meter data down-loading is in progress	Data package is present in the AMM communication network
10	**FF**	No fault	"Fatal" fault	
11	**SET**	Normal operation mode		
11	**EC**		Emergency Credit active	Emergency Credit threshold limit expired

Table 20: LCD cursors

In the display test state, all segments are displayed. The Figure 39 shows the display in the test state.

NOTE
For effective use of functionalities, the meter must be properly configured.

Display format examples (see the Figure 40 and the Figure 41).

- 60 – 6 digits, 0 decimals

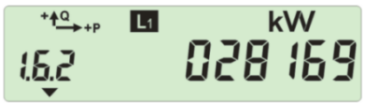


Figure 40: Displaying value with format "60"

- 82 – 8 digits, 2 decimals

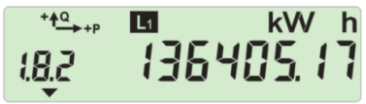


Figure 41: Displaying value with format "82"

Presentation of strings on display is performed with horizontal scroll, if the size of string is larger than the size of alphanumeric field for value on display (8 characters). Horizontal scroll shift period is one second. When the horizontal scroll is performed in General display readout mode, the General display readout scroll period (10 s) is extended until end of the string is reached.

However the display format is set, when the value on the display reaches maximum value (i.e.: 999999.99), the value on the display returns to value 000000.00 (rollover). Rollover is functionality (maximum count value), where energy registered values are reset back to zero and start accumulating up again. Maximum count value must accommodate minimum energy registration for at least 4000 operational hours at maximum current (at all applied phases) and nominal voltage according to WELMEC directive.

Then the value in the corresponding register goes to 1000000.00, so the correct value of the register is not lost, but is out of the scope of the LCD display. Maximum limit of the internal register is 999999999.

Active tariff can also be displayed with a dedicated name. For this purpose the **Currently active energy tariff** object (0-0:96.14.0) needs to be set in **General display readout** list (0-0:21.0.1) and/or in **Alternate display readout** list (0-0:21.0.2).

Two signatures can be shown on the display:

- **Active firmware module signature** (1-1:0.2.8),
- **Active firmware core signature** (1-0:0.2.8).

For both signatures, full OBIS code presentation is used. Firmware module/core signature presentation on display is performed with horizontal scroll, if the size of signature string is larger than the size of alphanumeric field for value on display (see the Figure 42).

Figure 42: Signature on the display

5.1.1. Display configuration

Display configuration is performed by the **Display configuration** (0-0:196.1.3) object. The content of this object is formatted as octet_string and consists of four octets (bits of octet 2 and octet 3 are unused yet). Each octet is bitwise organized.

Octet 0							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0x80	0x40	0x20	0x10	0x08	0x04	0x02	0x01
unused	Date format	unused	unused	Data menu configuration (Applies only to Normal console menu type!)			
/	0 → YY.MM.DD 1 → DD.MM.YY	/	/	/	P.99	P.02	P.01
				/	Certification data log	LP period 2	LP period 1
				0 → Disabled 1 → Enabled			

Table 21: Display Configuration for Octet 0 definition

Octet 1							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0x80	0x40	0x20	0x10	0x08	0x04	0x02	0x01
unused	Backlight behavior	Previous values indexing		Extended registers	Console menu type	External key	Display disable
	0 → normal behavior 1 → always ON	00 → linear indx. 01 → circular indx. 100 10 → circular indx. 12		0 → t.s off 1 → t.s on	0 → reduc. 1 → norm.	0 → scroll 1 → s.d.	0 → lcd on 1 → lcd off

Table 22: Display Configuration for Octet 1 definition

5.2. Metrological LEDs

There are two metrological LEDs on the meter. The first LED is for active energy and the second LED is either for reactive or apparent energy.

ME382

- right LED indicates active energy flow,
- left LED indicates reactive or apparent energy flow.

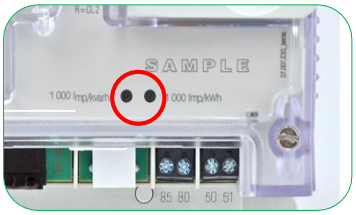


Figure 43: LEDs at the ME382 meter

MT382

- upper LED indicates active energy flow,
- middle LED indicates reactive or apparent energy flow,
- lower LED is not used.

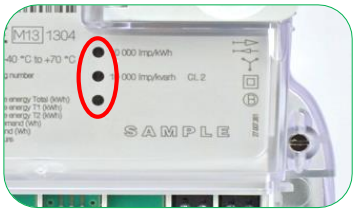


Figure 44: LEDs at the MT382 meter

According to the meter measurement type, LEDs can be enabled or disabled. When the LED is enabled, it blinks according to the constant number entered and according to the energy consumption (impulses/unit (kWh, kvarh, kVAh)). LED pulse blink duration is 30 ms and is not configurable. If load is lower than the meter starting current, the LEDs are turned-on and glow steadily.

Recommended LED constants are shown in the Table 23.

Meter type	**Full range** (Imp/unit)	**Test mode** * (Imp/unit)
ME382-D1	1000 – 4000	10000
MT382-D1	1000 – 2000	10000
MT382-D2	500 – 2000	10000
ME382-D3	1000 – 4000	10000
MT382-T1	10000 – 20000	100000

* test mode – load condition test, where current is less than 10% I_{max}

Table 23: LED constants recommendation

To avoid pulse overlapping next equitation must be valid:

phases * voltage [V] * current [A] * constant [imp/k[energy]h] * pulse_blink [ms] < 3.600.000.000 * duty-cycle

5.3. Buttons

There are two buttons on every meter's front side:

- **Scroll** button – the blue button that is always accessible. Its primary function is to scroll data from the Manual scroll sequence on the LCD.
- **Reset** button – the orange button that is placed under the lid with a hinge. It is used to execute the meter reset. The meter reset can be executed from the Reset mode (display indicates **rESEt**), that can be entered only in the first five seconds after meter start-up. See the chapter *5.3.2, Normal console menu type*.

NOTE

The meter reset is enabled only if the parameter protection button is unlocked (see the chapter *8.1.2. Parameter protection button).*

Figure 45: Scroll button (on the left) Reset and Scroll button (on the right)

Depending on the time of releasing the buttons and a combination of released buttons, the different actions can be made by the console:

- menu navigation,
- scrolling of metering results and other data,
- starting procedure to searching connected M-Bus devices (*SEArch* text on the display appears),
- testing the LCD.

Button labels

Button	Button press	Press duration	Button label
Scroll button	**S**hort press	Tp < 1 s	SS
	Medium press	1 s ≤ Tp < 2 s	SM
	Long press	2 s ≤ Tp < 5 s	SL
	Extended press	Tp ≥ 5 s < 8 s	SE
Reset button	**S**hort press	Tp < 2 s	RS
	Extended press	Tp ≥ 5 s	RE

Table 24: Button labels

The **Scroll** button is sensitive to press duration; therefore, the action is depended on release time.
The **Reset** button is not sensitive to press duration in general; therefore, the release time has no influence on its functioning.

There are also some differences in button press actions, depends on which mode in **Display configuration** object (0-0:196.1.3) is active (see the Table 25 – the Table 27):

- **Reduced** *console menu type* or
- **Normal** *console menu type*.

NOTE
For effective use of functionalities, the meter must be properly configured.

5.3.1. Reduced console menu type

For use of reduced console menu type in the **Display configuration** object (0-0:196.1.3) *Console menu type* **Reduced** need to be selected.
Use of **Scroll** button in **Reduced** *Console menu type* mode is described in the Table 25.

Button press	Press duration	Triggering event	Tip	Button label
Scroll push-button				
Short press	Tp < 1 s	Perform the display test. Enter the Alternate display readout mode from the display test mode. Scroll forward to the next item in Alternate display readout mode.	—	SS
Medium press	1 s ≤ Tp < 2 s	Scroll forward and skip the previous values in Alternate display readout mode.	—	SM
Long press	2 s ≤ Tp < 5 s	Escape from the **Consumer message code** presentation (0-0:96.13.1)	ESC	SL
Extended press	Tp ≥ 5 s < 8 s	Escape from the Alternate display readout mode to the General display readout mode	ESC	SE

Table 25: Use of Scroll button in Reduced console menu type

Scroll button extended press
Extended press on **Scroll** button is used to perform some special actions via console, as:

- switching device disconnection / reconnection or
- emergency credit activation.

See the relevant chapters for details.

Three different types of extended press on **Scroll** button are available, depending on press duration. (See the Table 26.)

Button / Press type	Press duration	Tip on display	Button label
Scroll button / **E**xtended press	Tp ≥ 5 s < 8 s	ESC / EntEr	SE
	Tp ≥ 8 s < 10 s	CrEdit	SE8
	Tp ≥ 10 s	diSconn	SE10

Table 26: Scroll button extended press

Menu navigation

When the **Reduced** *Console menu type* is active, the user interface has only two modes (see the Figure 46):

- **General display readout mode** (Auto scroll) and
- **Alternate display readout mode** (Manual scroll).

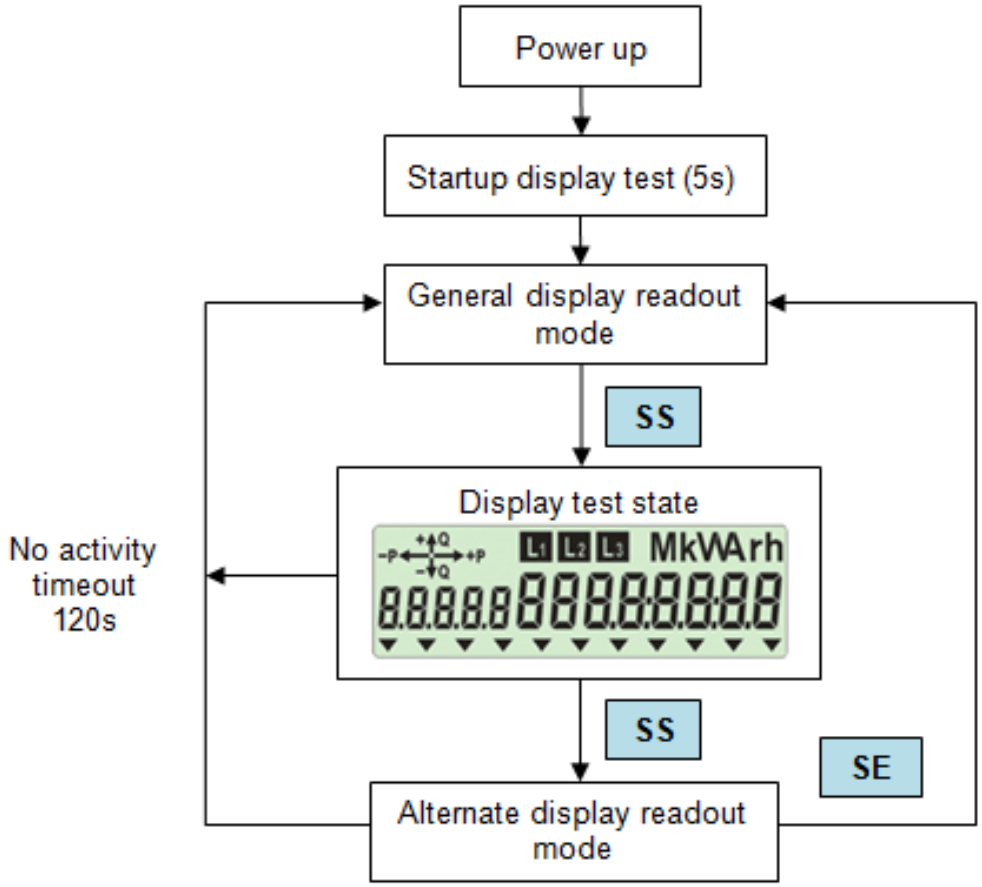


Figure 46: Menu navigation diagram – Reduced console menu type

5.3.1.1. General display readout mode

- General display readout mode is general meter mode, where the items listed in the **General display readout** object (0-0:21.0.1) are cyclically displayed on LCD.
- Transition between the displayed data is performed automatically. Scroll time is set to 10 seconds.
- By a short press on **Scroll** button in the General display readout mode, the display test is performed.
- By another short press on **Scroll** button, the Alternate display readout mode is entered.

5.3.1.2. Alternate display readout mode

- Alternate display readout mode is used for manual data review on display (see the Figure 49).
- Displayed items are listed in Alternate display readout mode sequence list, defined by **Alternate display readout** object (0-0:21.0.2).
- In **Reduced** console menu type Alternate display readout mode is accessible by a short press on **Scroll** button. When the **Scroll** button is first pressed, display test mode appears. By next short press on the **Scroll** button, first item from the sequence list is displayed.
- Transition between the displayed data is performed by successive pressing the **Scroll** button.

- In **Normal** console menu type Alternate display readout mode is accessible from the Data menu. When the **Scroll** button is first pressed, display test mode appears. By next short press on the **Scroll** button **Std dAtA** appears. Long press (> 2 s) on **Scroll** button when **Std dAtA** is on. When tip **EntEr** is shown, the first item from the sequence list is displayed. Transition between the displayed data is performed by successive pressing the **Scroll** button.
- At the end of sequence (in both console menu types), the **End** notice is displayed. Only in Normal console menu, type return to the Data menu is performed by a long press on **Scroll** button, when tip **Layer up** is shown.
- Escape in General display readout mode is performed by an extended press on **Scroll** button, when tip **ESC** is shown.

5.3.2. Normal console menu type

For use of Normal console menu type in the **Display configuration** object (0-0:196.1.3) *Console menu type* **Normal** need to be selected.

Use of **Scroll** and **Reset** button in **Normal** *Console menu type* mode is described in the Table 27.

Button press	Press duration	Triggering event	Tip on display
Scroll button			
Short press	Tp < 1 s	Scroll forward / Go to the next item	—
Medium press	1 s ≤ Tp < 2 s	Scroll forward and skip the previous values (General display readout mode, Alternate display readout mode)	—
Long press	2 s ≤ Tp < 5 s	Enter to the current item / Go to the lower layer	EntEr
		Return to the upper layer at the End of list / Return to the upper layer from the lowest layer	LAYEr UP
		Return to the General display readout mode at the End of list in Set menu / Data menu	ESC
		Escape from the **Consumer message code** presentation (0-0:96.13.1)	ESC
Extended press	Tp ≥ 5 s < 8 s	Escape to the General display readout mode from any mode	ESC
Reset button			
Short press	—	Enter to the Set menu from the Display test state	—

Table 27: Use of buttons in Normal console menu type

Scroll button extended press

Descriptions, press durations and button labels are the same as in the chapter *5.3.1.Reduced console menu type* and in the Table 26.

Menu navigation

When the **Normal** *Console menu type* is active, the user interface has two menus that are accessed from the Display test state. The Display test state is entered from the General display readout mode by a short press on **Scroll** button *(*see the Figure 47):

- **Data menu** (general use),
- **Set menu** (limited use).

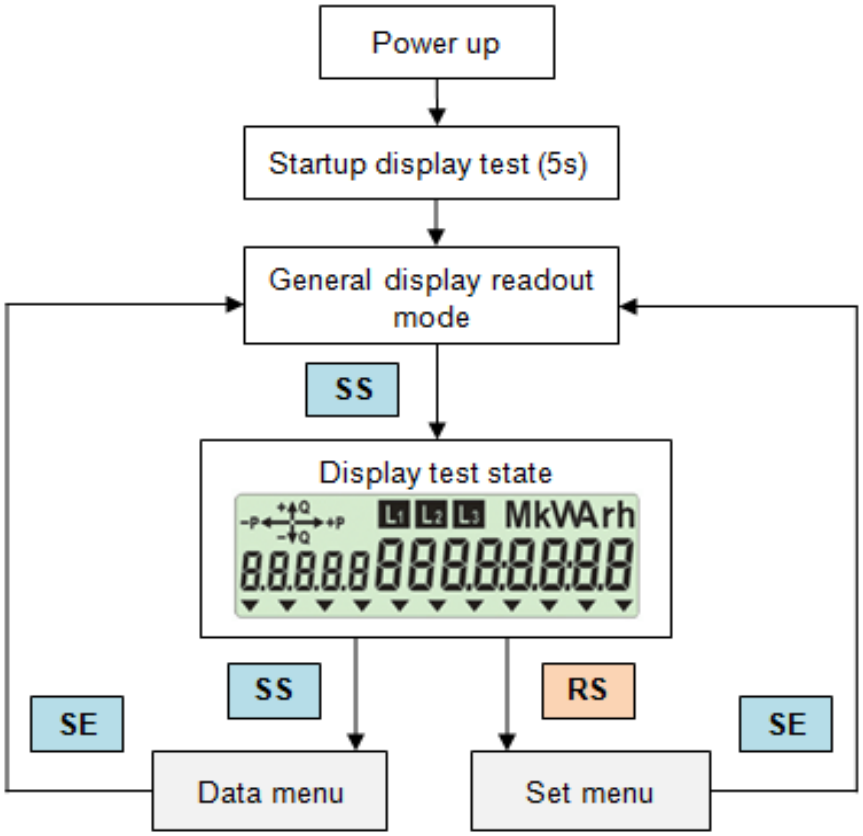


Figure 47: Entering the Data/Set menu

5.3.2.1. Data menu

Data menu is accessed from the Display test state by a short press on **Scroll** button. There are several items supported for presentation in Data menu on display. The first item is Alternate display readout mode (**Std dAtA**). It is fixed and cannot be disabled. Other items are optional and can be configured in the **Display configuration** (0-0:196.1.3) object by the *Show on display* attribute. In Data menu, the following items are listed in order:

- **Std dAtA** – Alternate display readout mode,
- **P.01** – Load profile with period 1 (optional),
- **P.02** – Load profile with period 2 (optional),
- **P.99** – Certification data log (optional),
- **End** – end of list.

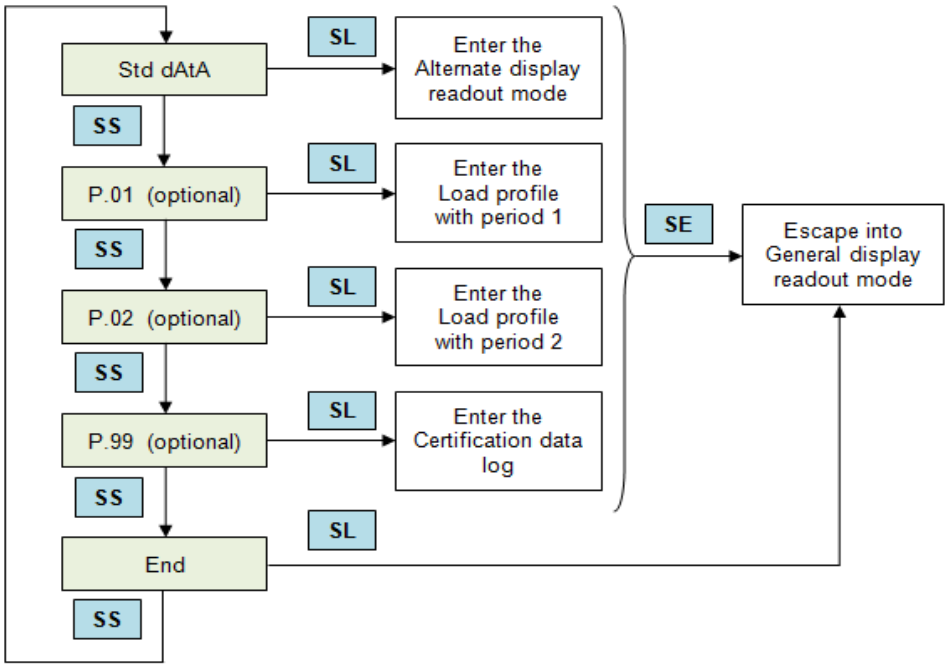


Figure 48: Data menu navigation

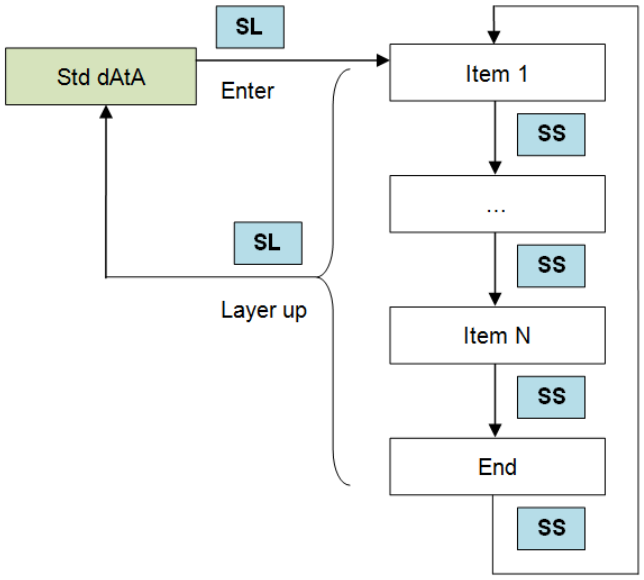


Figure 49: Alternate display readout mode navigation in Normal console menu type

Example

QUESTION: How to read the **Active firmware version** and **Active firmware core signature** value on the LCD?

ANSWER: Follow the steps described in the Table 28 or Table 29; choose the suitable one.

NOTE
If the *Console menu type* in the **Display configuration** object (0-0:196.1.3) is set as:

- ***Reduced***, follow the steps in the Table 28.
- ***Normal***, follow the steps in the Table 29.

REDUCED console menu type
1. **Active firmware version** can be found by the register **1.0.0.2.0**. **Active firmware core signature** can be found by the register **1.0.0.2.8.** 2. When the **Scroll** button is first short pressed (< 1 s), the display test mode displays. 3. Entering the manually scroll mode is enabled by next short press on the **Scroll** button; first entered register with value appears. 4. By a short pressing the **Scroll** button, you can manually list between registers. Press the button repeatedly until you can see the register **1.0.0.2.0** on the left side of the LCD. Read its value on the right side of the LCD. 5. By next short press on the **Scroll** button, the value for the register **1.0.0.2.8** appears on the left side of the LCD. Read its value on the right side of the LCD. 6. If there is no need to read a value of any other register exit the Manual scroll mode by extended press (≥ 5 s < 8 s) on the **Scroll** button until *ESC* is shown. The transition from Manual to Auto scroll mode can also be done automaticlly, the transition time is configurable.

Table 28: Register reading procedure on the LCD when the Reduced console menu type is set

NORMAL console menu type
1. **Active firmware version** can be found by the register **1.0.0.2.0**. **Active firmware core signature** can be found by the register **1.0.0.2.8.** 2. Short press the **Scroll** button (< 1 s); the display test mode displays. 3. Short press the **Scroll** button; *Std dAtA* appears. 4. To enter the *Std dAtA* menu press the **Scroll** button for 2 s until *EntEr* shows. By short pressing the **Scroll** button, manually listing between registers is now available. 5. Press the **Scroll** button repeatedly until the register **1.0.0.2.0** can be seen on the left side of the LCD. 6. Read the registers value on the right side of the LCD. 7. By next short press on the **Scroll** button, the value for the register **1.0.0.2.8** appears. Read its value. 8. If there is no need to read a value of any other register exit the Manual scroll mode by extended press (≥ 5 s < 8 s) on the **Scroll** button until *ESC* is shown. The transition from Manual to Auto scroll mode can also be done automatically, the transition time is configurable.

Table 29: Register reading procedure on the LCD when the Normal console menu type is set

NOTE

The displayed items listed in General display readout mode (Auto scroll mode) or Alternate display readout mode (Manual scroll mode) sequence list is defined in objects **General display readout** (0-0:21.0.1) and **Alternate display readout** (0-0:21.0.2).

NOTE

The object name **Active firmware core signature** has the same meaning as the object name **Checksum** in the older meter versions.

NOTE

A place number of the register in the *Std dAtA* menu is already set and it can be changed.

Load profile (P.01, P.02) on display

Presentation of Load profile on display is optional in **Normal** *Console menu type* and can be enabled by a bit-parameter in the **Display configuration** object (0-0:196.1.3). Load profile presentation is accessible from the Data menu by a long press on **Scroll** button at the P.01 / P.02 item, when tip **EntEr** is shown. There are two types of Load profile supported:

- P.01 – Load profile with period 1,
- P.02 – Load profile with period 2.

Load profile presentation on display follows VDEW specifications in general. Load profile is presented on display in layer DATE (upper layer), layer TIME (middle layer) and layer ATTR (attribute) (lower layer).

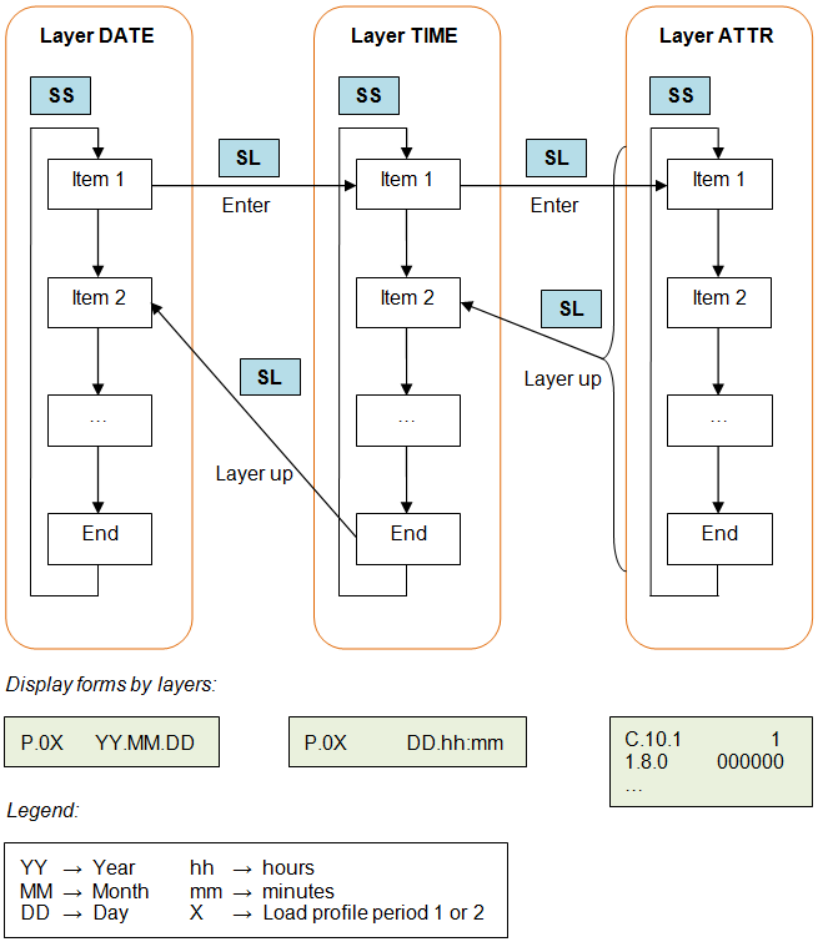


Figure 50: Load profile on display navigation

Certification data log (P.99) on display

Presentation of Certification data log on display is optional in **Normal** *Console menu type*. It can be enabled by a bit–parameter in the **Display configuration** (0-0:196.1.3). Certification data log presentation is accessible from the Data menu in **Normal** *Console menu type* by a long press on **Scroll** button at the P.99 item, when tip **EntEr** is shown (see the Figure 51).

Certification data log is presented on display in two layers:

- layer DATE (upper layer),
- layer TIME (lower layer).

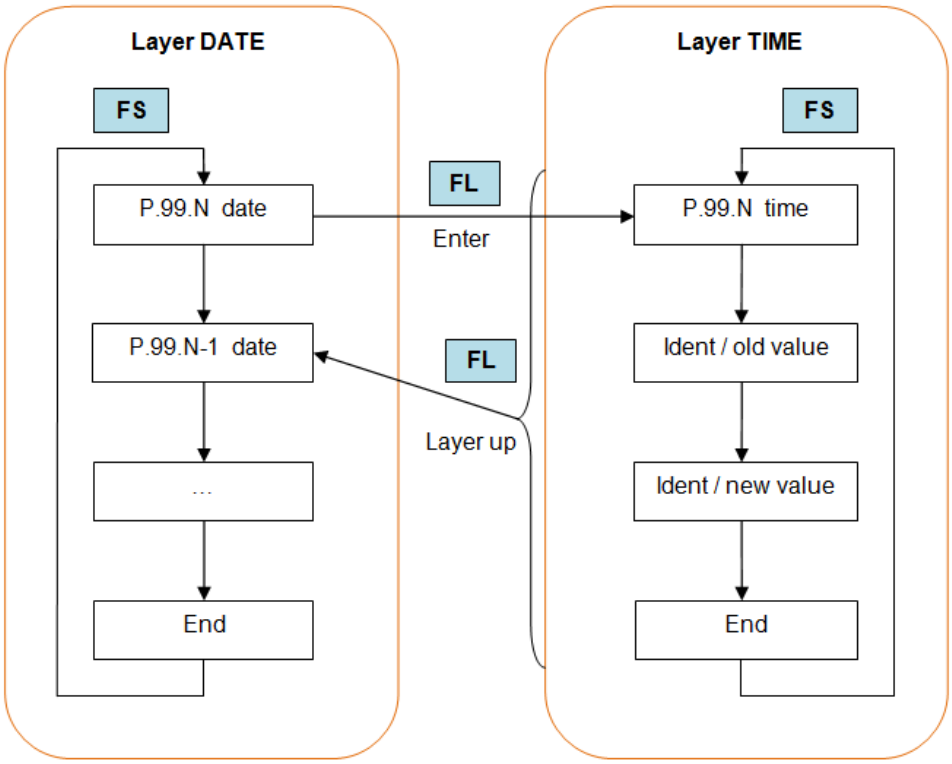


Figure 51: Certification data log on display navigation

5.3.2.2. Set menu

Set menu is accessed from the display test state by a short press on **Reset** button, which is protected with a seal. In Set menu, the following items are listed in next order:

- **rESEt** – Reset mode, meter reset execution,
- **Lcd tESt** – LCD test mode, display unit test,
- **End** – end of list.

See the Figure 52.

NOTE
Reset button is protected with a seal, therefore cannot be used unless seals are broken.

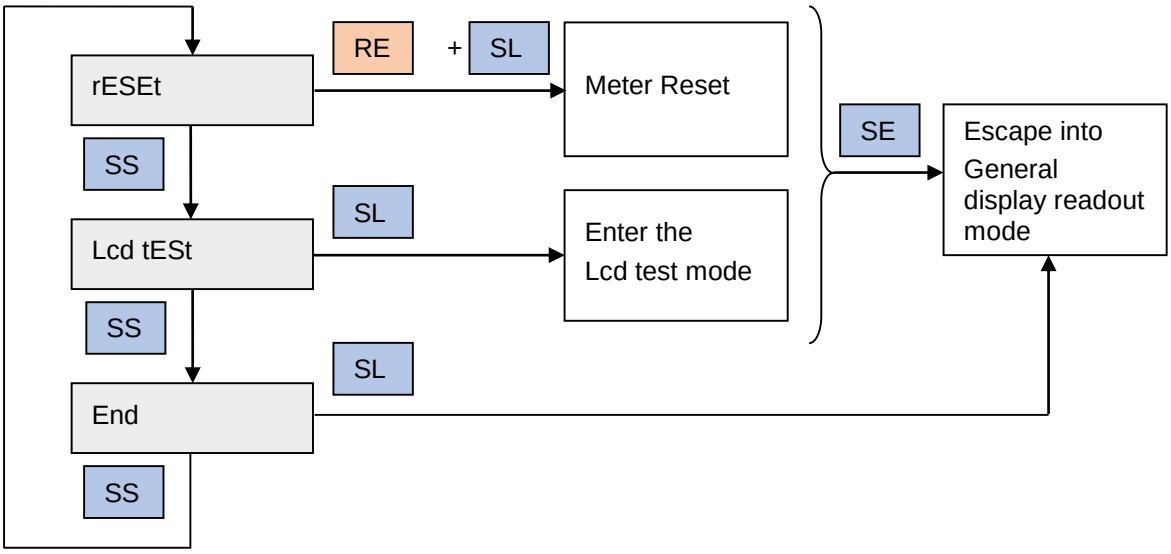


Figure 52: Set menu navigation

Reset mode

NOTE

Meter is locked (by the parameter protection button) and sealed (buttons and covers), therefore cannot be reset unless seals are broken and parameter protection button unlocked.

LCD test mode

LCD test mode is used for testing purposes to perform LCD unit test. LCD test mode is accessed from the Set menu by a long press on **Scroll** button at the LCD test item, when tip Enter is shown. There are four LCD test conditions (all, odd, even and none segments), which can be scrolled by a short press on **Scroll** button. Return to the Set menu is performed, when all LCD test conditions are scrolled. It is also possible to return to the Set menu from any LCD test condition, by a long press on **Scroll** button, when tip Layer up is shown. Escape into the General display readout mode is performed by an extended press on **Scroll** button, when tip Esc is shown.

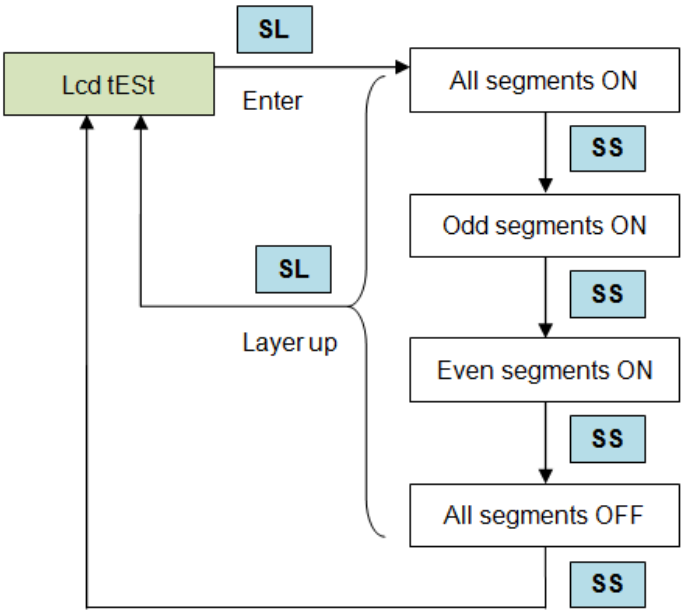


Figure 53: LCD test mode navigation

NOTE

For the proper functioning of the LCD test mode in the **Display configuration** (0-0:196.1.3) object *Console menu type* should be set to **Normal**.

5.3.3. Previous values on a display

Previous values are values of billing registers that have been captured on billing reset and stored in the billing profile – **Data of billing period 1** (0-0:98.1.0). Previous values can be presented on display in General display readout mode and Alternate display readout mode.

More about Billing profile, see the chapter *7.4.1. Billing profile.*

Registers, that are intended to be presented on display, have to be set in General and Alternate display readout list only as current values. Registers are shown on display in the same order as listed in General and Alternate display readout list. If the previous values for corresponding register exist in billing profile – **Data of billing period 1**, they will be shown on display immediately after the current value.
If no corresponding capture object, for the currently displayed register, is stored in the billing profile, the previous values for this register will not be shown. See the Figure 54.

The numbers of displayed previous values in General display readout mode and in Alternate display readout mode are defined as a parameter by the configuration **Previous values readout count** (0-0:128.11.4) object:

- Byte 1 – number of displayed previous values in General display readout mode,
- Byte 2 – number of displayed previous values in Alternate display readout mode.

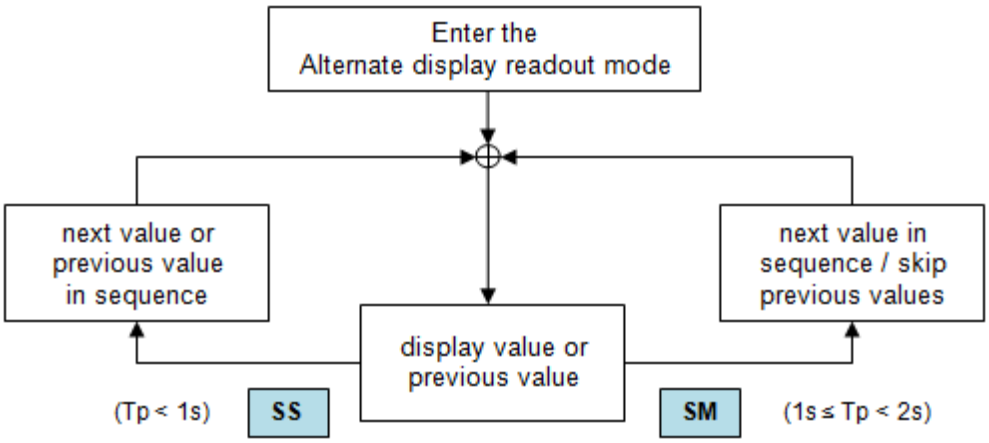


Figure 54: Previous values navigation in Alternate display readout mode

Time stamp of the most recent billing period contains the local date-time value of the internal clock at the end of the last captured billing period.

For presentation on a display, the value is formatted as a sequence of the local date and local time. After the current value, the previous values are displayed, where the first previous value is equal as the current value.

6. COMMUNICATION

6.1. Optical interface

Optical interface operates according to:

- IEC 62056-21 standard: Electricity metering: Data exchange for meter reading, tariff and load control, Part 21: Direct local data exchange (for remote data exchange see other standards of the IEC 62056 series)
- DLMS standard.

In such systems, a hand-held unit (HHU) or a unit with equivalent functions is connected to a tariff device or a group of devices. The connection can be permanent or disconnectable using an:

- optical coupling (with optical sonda, see the Figure 55) or
- electrical coupling (with RJ11 plug via P1 port, see the Figure 57).

The optical coupler is easily disconnectable to enable data collection via HHU.

Every meter has built-in optical interface. It is used for local meter data readouts and settings via PC (personal computers), laptops or PDA (Personal Digital Assistant) devices.

Figure 55: Optical interface (left); optical sonda (right)

The COSEM/DLMS communication profile is added to the meter to ensure using of the same protocol on different communication media. The implementation provides mode “E”.

The important instances in the meter for communication via optical port are:

- communication mode,
- communication speed,
- response time of the meter,
- device address,
- the entrance password for communication channel.

By **communication mode**, the protocol used by the meter on the port is defined. It can be either according to IEC 62056-21 (IEC 1107) or according to IEC 62056-46 (DLMS UA – DLMS User Association).

If protocol is not specified, the proposed baud rate is used for setting the **communication speed**. There are two communication speed values relevant in the meter:

- default baud rate defines the communication speed for the opening sequence,
- proposed baud rate defines baud rate to be proposed by the meter (relevant only for communication type 0 – (1107, modes A to E).

Communication speed from 300 baud up to 115200 baud is possible (recommended is 38400 baud).

Device address (8 digits long) is the unique number for each meter, identifies the meter in a group of meters.

At IEC 1107, the **entrance password for communication channels** needs to match the password, defined in the meter with 8 digits long number.

Important instances in the meter for IEC HDLC (High-level Data Link Control) setup are:

- the communication speed,
- window size transmit/receive,
- maximum length of the transmitted or received information,
- inter octet and inactivity timeouts,
- the device address.

Communication speed: software part of the meter enables communication speed via optical interface from 300 baud up to 115200 baud. For hardware reasons, the possible communication speeds are from 300 baud up to 57600 baud.

Window size defines the maximum number of frames that a device or system can transmit or receive before it needs to transmit or receive the acknowledgement. Inter octet timeout (ms) is the time, over which the device will treat the already received data as a complete frame. Inactivity timeout (s) defines the time over which the device will process the disconnection.

NOTE

When optical interface uses the DLMS mode, note that if the communication speed is set higher than optical interface can handle, user cannot access meter via optical channel anymore. The meter can only be set back via other communication channels. To test the speed limit of the optical interface always use IEC1107 mode E.

NOTE

For effective use of functionalities, the meter must be properly configured.

6.2. P1 interface

P1 interface is a one-way read-only communication interface and it is in compliance with DSMR V3.0 standard. Meter has one physical P1 port on which it is possible to connect more than one OSM (Other Service Module) devices via splitter.

Diagram for connecting one or more devices to the P1 port is shown in the Figure 56.

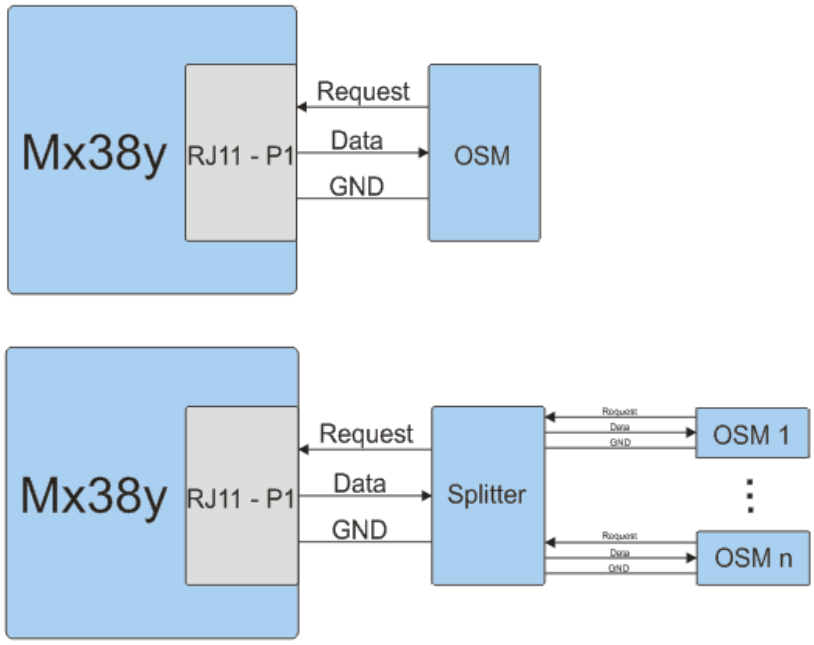


Figure 56: Diagram for connecting devices to the P1 port

P1 port connector is RJ11, where standard RJ11 plug can be inserted. Connector is not accessible at all times because it is protected by a sealed cover, unless if terminal cover with external M-Bus terminals and external P1 port connector is installed (optional, see the Figure 35).

Pin #	Signal name	Description
1		
2	Request	Input
3	GND	Ground
4		
5	Data	Output
6		

Table 30: RJ11 pins

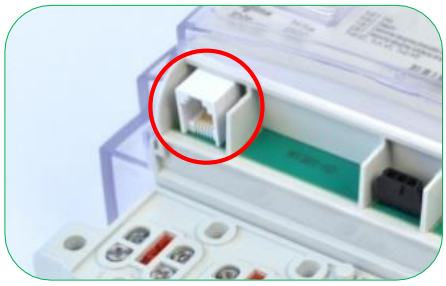


Figure 57: P1 port connection

Meter is equipped with an Opto-coupler, to protect the meter and to lower the possibility of influencing the meter through the P1 port. Physical interface is protected against reversed connection and over-voltage protection.

The port is activated by raising the request signal (~ 5 V). While receiving data, the requesting device must keep the port activated. There is no address for P1 devices and more than one OSM can be connected, activated or not. Data transfer will stop immediately after the request signal is dropped. All signals are compliant with TTL levels with max. current 30 mA and voltage 30 V. TTL signal level is +/- 5 mA and 5 V.

6.2.1. P1 functionality

IEC1107

P1 interface support two different types of data depending on the choice of communication type. With IEC 62056-21 (IEC 1107) communication type the meter can send data predefined with objects:

- **General local port readout** (0-0:21.0.0),
- **Consumer message text – Consumer information** (0-0:96.13.0),
- **Consumer message code** – **Meter display** (0-0:96.13.1).

If device is connected to the P1 port, the meter will send data configured in **General local port readout** object every 10 seconds.

Consumer message code & text:

Meter has storage capacity for one 64-character code message and one 1024 character text message. Both messages are handled independently, but in the same way. Consumer message code can be shown on P1 port and on the display. Maximum size value is 64. If more characters are written, the last ones will be cut. Message code can also be shown on general display (in visible string format) and stays there until message code is cleared (**Scroll** button pushed or empty value written). This message code has the priority above other display actions. Only supported characters can be shown on a display. Characters have to be in ASCII (American Standard Code for Information Interchange) format.

DLMS

With IEC 62056-46 (DLMS UA) communication type, the meter sends data using the Consumer Information Push (CIP) functionality:

- **Push setup – Consumer Information** (0-6:25.9.0),
- **Push script table** (0-0:10.0.108),
- **Push action scheduler – Consumer Information** (0-4:15.0.4),
- **Security Setup – Consumer Information** (0-0:43.0.1),
- **Consumer message text – Consumer information** (0-0:96.13.0).

All about Push functionalities see the chapter *6.5.Push*.

NOTE
For effective use of functionalities, the meter must be properly configured.

6.2.2. P1 parameters

Parameters for P1 interface with communication type IEC 62056-21 (IEC 1107) are:

- communication type is set to IEC 62056-21 (IEC 1107),
- communication speed is set to 9600 baud,
- response time parameter not used,
- energy format is set to 8.2 (8 digits including 2 decimals) and with units, example: 1-0:1.8.0 (000000.00*kWh),
- demand format is set to 6.3 (6 digits including 3 decimals) and with units, example: 1-0:1.4.0 (000.000*kW).

No addressing is necessary for this port, and no passwords are used for this port.

Parameters for P1 interface with communication type IEC 62056-46 (DLMS UA) are:

- communication type is set to IEC 62056-46 (DLMS UA),
- communication speed is set to default,
- response time parameter not used.

Setup configuration for P1 interface with communication type IEC 62056-46 (DLMS UA) is described in the chapter *6.5.1. Push objects*.

6.3. M-Bus

M-Bus is an interface for gas meters, gas valve, thermal (heat/cold) and water meters. It enables the communication between several types of meters and an E-meter, to which they are connected, with communication speed of 2400 baud. The communication bus is based on the M-Bus European standard EN 13757.

The E-meter functions as the communication master, the other devices connected to the M-Bus function as slaves. M-Bus is a protocol that is described for remote reading of meters. It is a two-wire system that provides power to the devices. The requirements for M-Bus are given in standard EN 13757-2. The bus interfaces of the slaves are polarity independent – the two bus lines can be interchanged without affecting the operation of the M-Bus devices. No physical access for P2 port is possible by customer. The connections to the M-Bus port are located behind a sealable lid.

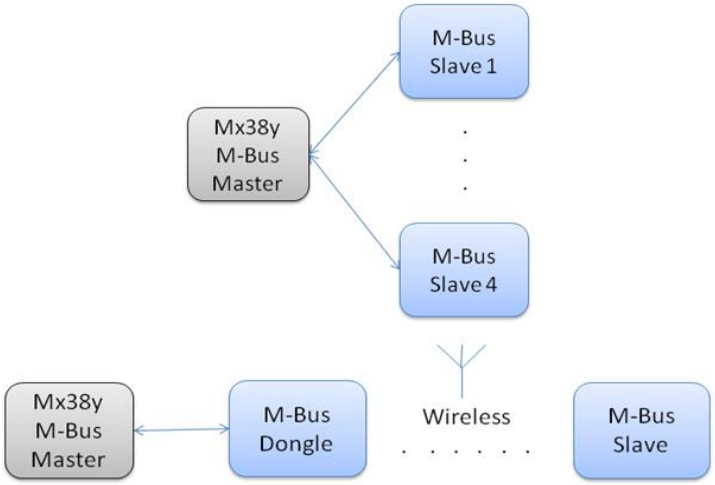
Due to uniformity reasons and independency of used communication medium all data exchange over wired connection is encrypted. E-meter gathers and stores information from all connected meters or devices and forwards this information to the Central Access System (CAS). It also controls (e.g.) the gas valve.

Also wireless M-Bus devices with dongle can be connected to the M-Bus interface of the meter. Both wired and wireless M-Bus devices can be connected to the meter at the same time. The meter allows the physical connection of maximum four M-Bus devices at the same time. But there is a limitation of the total maximum current consumption of 8 unit loads (UL) guaranteed by the meter. Typical wired M-Bus device requires a maximum mark current of 1 unit load (1 UL), which is the maximum mark state current of 1,5 mA, according to standard. Typical wireless dongle requires a maximum mark current of 4 unit loads, maximum number of wireless devices is two. Wireless meter data are exchanged according to EN 13757-4 standard. Devices are connected through the wireless (RF – Radio frequency) M-Bus connection according to the T1/T2 mode of this standard.

As alternative solution for data exchange, there is a combination of hardware or software paired meter-dongle interfaces. The dongle-master interface is confirming to the wired M-Bus specifications.

There is M-Bus communication interface integrated in all Mx382 meters according to EN 13757-2 (for physical layer) and EN 13757-3 (for application layer). When using low impedance cable (low capacity and low resistance unshielded type of cable), expected communication distance is at least 100 meters. Billing reads (data) could be retrieved daily, weekly and monthly at specified time or on request from the system.

See the Figure 58.



Mx38y: Mx381, Mx382, Mx383

Figure 58: M-Bus master-slave configuration and dongle interface

NOTE

Due to power consumption of wireless M-Bus transceivers (so-called RF dongles) one can connect only one RF dongle and one wired M-Bus sub-meter.

M-Bus display flag

MB (M-Bus) flag is present on the display as long as if at least one M-Bus device is physically connected to the bus. If none of the devices is connected to the bus, then MB flag turns off after first capture even if the devices are correctly installed in the E-meter.

In addition to the MB flag, a scroll list of different M-Bus objects and identification numbers of registered M-Bus devices, which are able to communicate will pop-up on display.

The identification numbers are listed in following format: CH x 12345678 (see the Figure 59).

The first 5 digits are used to display a number of the M-Bus channel and 8 last digits to display M-Bus device identification number. The display of the identification numbers will be exchanged with period of 10 seconds. After an interval of 120 seconds, the pop-up list will disappear and display mode will be changed to normal General display readout mode.

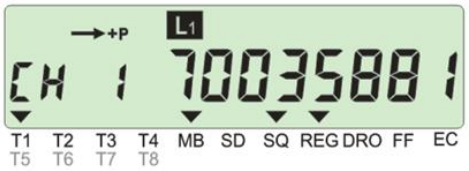


Figure 59: Example for channel

M-Bus identification numbers

Device ID1 is M-Bus equipment identifier. There are four objects, one per channel.

M-Bus equipment identifier is one of the parameters, which define uniqueness of the device. For successful reading of this identifier M-Bus device data must be unencrypted or successfully decrypted (the proper encryption key must be previously uploaded to E-meter and M-Bus device). After that, binding process is completed.

If M-Bus equipment identifier is not present in the frame of the M-Bus device, then at least Serial number of the M-Bus device must be known and the frame must be successfully decrypted for successful completion of binding process.

Device ID2 is M-Bus configurator data identifier. There are four objects, one per channel.

M-Bus result

M-Bus master value (result) holds last captured M-Bus value. There are four result objects, one per channel.

M-Bus load profile

M-Bus master load profile has hourly interval reading period of M-Bus devices (typical period is 3600 s, other periods can be selected as well).The buffer must be filled monotonously, i.e. no irregular entries are allowed. The profile is compressed type. Captured objects include clock, status and M-Bus value objects. There are four objects, one per channel.

NOTE

Whether lower interval reading period is selected, battery life of connected M-Bus device is greatly decreased if it is not powered by M-Bus.

M-Bus status

M-Bus status shows the sum of status register bits set. Each bit has a different meaning. There are four status objects, one per channel (see the Table 31).

Status		Bit	Hex	Dec	Description	Used
None			0x00	0	No event.	✓
Device disturbance	ERR	0	0x01	1	A serious error such as a hardware failure or a checksum error has occurred. If the ERR bit is set then also the DNV bit is set.	✓
Clock battery discharged	CIV	1	0x02	2	The power reserve of the calendar clock has been exhausted. The time is declared as invalid. At the same time the DNV bit is set.	✓
Measurement value disturbed	DNV	2	0x04	4	Indicates that the current entry may not be used for billing purposes without further validation because a special event has occurred.	✓
Season changed	DST	3	0x08	8	Indicates whether or not the daylight saving time is currently active. The bit is set if the daylight saving time is active (summer) and cleared in winter.	✓
Reset cumulation		4	0x10	16	Reserved: The reserved bit is always set to 0.	
Device clock changed	CAD	5	0x20	32	The bit is set when the clock has been adjusted by more than the synchronisation limit.	✓
Power up	PUP	6	0x40	64	Reserved: The reserved bit is always set to 0	
Power down	PDN	7	0x80	128	This bit is set to indicate that a total power outage has been detected during the affected capture period.	✓

Table 31: M-Bus profile status registers notifications

M-Bus event log

M-Bus event log contains errors and alarms related to M-Bus devices (e.g. changes of the clock, communication errors, fraud attempt, etc). The buffer must be filled monotonously, i.e. no irregular entries are allowed. M-Bus Event log structure consists of Timestamp and Event code.

M-Bus event log status codes

M-Bus event code object holds the code from the last event triggered. These codes along with timestamps are then used in M-Bus event log.

M-Bus disconnect control

M-Bus master disconnect control controls the opening and closing of an M-Bus disconnector (e.g. gas valve). There are four objects, one per channel.

For disconnect control modes see chapter *12.1. Annex 1: Relay, SD and M-Bus disconnect states and transitions*.

M-Bus disconnect control scheduler

M-Bus disconnect control scheduler is dedicated time point for connection or disconnection. There is one object for all four M-Bus channels used.

M-Bus disconnector script table

M-Bus disconnector script table contains 8 scripts defined to control each of four channels with remote reconnect and remote disconnect service.

M-Bus master control log

M-Bus master control log records changing of the states (opened, closed, ready for reconnection) related to the M-Bus disconnect control. There are four objects, one per channel. Contains all events related to an

M-Bus disconnector, e.g. a gas valve (open valve, close valve). M-Bus master control log structure consists of Timestamp and Event code.

M-Bus control event code

M-Bus control event code holds the code from the last event triggered. These codes along with timestamps are then used in event log. There are four objects, one per channel.

M-Bus client configuration

M-Bus client configuration object is intended for additional configuration for different kind of M-Bus functionality behaviour. There are many different scenarios of M-Bus functionality possible for some actions, for example transferring the encryption key to the M-Bus slave, handling the M-Bus value registers, profiles and logs in the case of decommissioning of the M-Bus slave, handling the capture actions in relation with M-Bus device ID, etc.

In all cases, a device should be connected one at a time and then run installation script (except for the last case). Install script is using a primary address as a parameter. Also before E-meter can read and present result values from M-Bus devices, we must manually – locally, remotely or already pre-configured – entered corresponding DIF/VIF parameters in each of the used M-Bus channels (in M-Bus client object). Parameters DIF and VIF are part of technical documentation of used M-Bus device or can be readout from the device as data frame and manually parsed.

M-Bus alarms

There are four different groups of alarms used for M-Bus events, which are directly related to devices, connected to the E-meter. Each group consists of four different alarms, one per channel (see the Table 32).

Alarm	Alarm set condition	Alarm reset condition
M-Bus communication error	After 3 unsuccessful readings of the M-Bus device (device is physically disconnected).	After first successful reading of the M-Bus device after communication error (device is physically connected again).
M-Bus fraud attempt	When the data is successfully received from the M-Bus device and bit 6 (Fraud attempt) in the Error status code of the Fixed data header is set.	When the data is successfully received from the M-Bus device and bit 6 (Fraud attempt) in the Error status code of the Fixed data header is cleared.
M-Bus device installed	After successful installation of the M-Bus device to the free channel.	After successful de-installation of the M-Bus device from the channel (when Slave de-install method or M-Bus remove method are invoked).
M-Bus client decryption failed	After unsuccessful decryption of the received frame.	After first successful decryption of the received frame or after Slave de-install. method or M-Bus remove method invocation.

Table 32: M-Bus alarms

6.4. GSM/GPRS/UMTS communication module

A GSM/GPRS/UMTS module supports communication over a cellular network using integrated modem with quad band antenna, which is controlled by the meter.
It can be connected to GSM, GPRS or UMTS services, but is using only one at a given time (during GSM service, GPRS/UMTS is suspended).

Application layer has possibility to manage GSM/GPRS network connection with objects **Auto connect** object (0-0:2.1.0.255) and **Auto answer** object (0-0:2.2.0.255). Meter registration is provided over GPRS or SMS (Short Message Service) communication and works with Push functionality interaction (see the chapter *6.5. Push*).

6.4.1. Modem initialization

During a modem initialization phase, a series of preset AT (ATtention) commands is sent to the modem to ensure properly modem configuration. An invalid response or no response to any of these commands can result in a modem reset, if no valid responses are received within a 60-second limit. **Modem configuration** object (0-0:2.0.0.255) can hold additional set of custom modem initialization commands (up to five), which are sent to the modem following normal modem initialization process (executed after each modem reset). In case of no response or an invalid response from the modem, custom command is resent but for no more than 100 times. Modem initialization service is repeated (before each diagnostic process cycle) until every initialization command is acknowledged properly or a modem reset is performed.

The attributes of the Modem configuration object are:

- **Communication speed**

  Communication speed is the speed between the meter and the modem (not the communication speed of the WAN (Wireless Area Network)). This attribute has no relevance, since the baud rate on this port is using maximum speed and is fixed to the 115200 bps.

- **Initialization string**

  The initialization string contains all necessary initialization commands to be sent to the modem in order to configure it properly. If the array contains of more than one initialization string element, requests are sent in a sequence with a defined delay time (set in ms), to allow the modem to execute the request.

- **Modem Profile**

  It defines mapping from Hayes standard commands/responses to modem specific strings.
  The attribute is not used by the meter.

6.4.2. GSM/GPRS network diagnostic

The modem initialization service is followed by the network diagnostic service. It produces a sequence of diagnostic commands, which are sent to the modem every 10 seconds. One diagnostic sequence contains the following set of commands:

- AT+CPIN? (request SIM status),
- AT+CSQ (request signal quality),
- AT+CREG? (request GSM registration status),
- AT+CGREG? (request GPRS registration status),
- AT+COPS? (request network operator name),
- AT+CGACT? (request PDP (Packet Data Protocol) context activation status),
- AT+CPMS? (request preferred message storage selected).

Each request must result in a corresponding respond. The erroneous condition is fulfilled when a valid response to at least one diagnostic command is not received within a 60 seconds limit. To provide information about modem operation and its registration to different networks, several diagnostics objects are implemented (see the Table 33).

Logical name	Object name
0-0:128.20.0	GSM signal quality
0-0:128.20.1	GSM Status
0-0:128.20.2	ID GSM ICCID
0-0:128.20.3	GSM program version
0-0:128.20.4	GSM IMEI
0-0:128.20.5	GSM network name
0-0:128.20.6	GSM WIPsoft program version
0-0:128.20.11	GSM signal strength indication limit 1
0-0:128.20.12	GSM signal strength indication limit 2

Table 33: GSM/GPRS modem diagnostics objects

GSM signal quality (0-0:128.20.0) object value presents network signal strength. The value is retrieved as an <rssi> element, as a response to the AT+CSQ command. The retrieved values (as defined in 3GPP TS 27.007) have particular meaning (see the Table 34).

Value	Signal strenght
0	-113 dBm or less
1	-111 dBm
2...30	-109... -53 dBm
31	-51 dBm or greater
99	not known or not detectable
255	no valid response to the last AT+CSQ command was received from the modem

Table 34: Network signal strength

If SIM (Subscriber Identity Module) card is not inserted in the modem, it can report value 99, especially on 3G modem. This value is consequently transferred in the **GSM signal quality** object.

GSM status (0-0:128.20.1) object contains bit organized information about modem operation (see the Table 35).

Bit	Bit description
0	Modem registered to GSM network (home or roaming)
1	Installation call done or not active
2	Modem registered in GPRS network (home or roaming)
3	Modem has active PDP context
4-7	Reserved for future use
8	SIM card not detected or giving error response
9	SIM card requires PIN (Personal Identification Number) or PUK (Personal Unblocking Key) code
10	Modem reset pending
11	Installation call failed
12-15	Reserved for future use

Table 35: GSM status object bit assignment

ID GSM ICCID (0-0:128.20.2) object contains SIM identification number which is typically 20-digit long number used for physical SIM card identification. The length can also be different regarding the response from the modem (AT+CCID? command).

GSM program version (0-0:128.20.3) object contains a special string to identify firmware of the integrated modem (version should be 7.46 or above).

GSM IMEI (0-0:128.20.4) object contains the IMEI (International Mobile Station Equipment Identity) number of the integrated modem. IMEI is a unique identification of every device that communicates in mobile networks.

GSM network name (0-0:128.20.5) object presents the name (in alphanumeric format, e.g. *Mobitel*) of the currently registered mobile network. If modem is not registered yet to the mobile network, the object's value field is empty.

GSM WIPsoft program version (0-0:128.20.6) object contains a special string to identify WIPsoft program version of integrated modem (version should be 5.42 or above).

GSM signal strength indication limit 1 (0-0:128.20.11) and **GSM signal strength indication limit 2** (0-0:128.20.12) objects are used in conjunction with console Signal Quality indicator (SQ). The GSM signal strength indication limit 2 value is the threshold, above which the network signal is considered sufficient (SQ cursor displayed). If signal strength is below the GSM signal strength indication limit 1 value, SQ cursor is not displayed. If signal strength is between the specified values, SQ cursor blinks.

At meter power up, or after every modem resets, the value attribute of ID GSM ICCID (Integrated Circuit Card Identifier), GSM IMEI and GSM network name diagnostic objects contains »Reading…« if the specific information has not yet been retrieved from the modem.

6.4.3. CSD data connection (GSM)

When modem receives a call, it sends the unsolicited ASCII +CRING*: <type of call>* string to the meter's application. Upon receiving the +CRING: *<type of call>* and the *CLIP* string, meter decides whether to accept or reject incoming call. In case of accepted call, the meter sends a confirmation command (ATA) to the modem. The confirmation command is only sent if no other call is currently in progress. After the *CONNECT* string is received, the process enters online state. The connection is considered to be established and the data transfer can begin. If the *CONNECT* string is not received within valid time (i.e. the connection timeout has elapsed) or one of the unsolicited strings *NOCARRIER*, *BUSY* or *NODIALTONE* is received instead, the corresponding process re-enters ***idle state*** during which new incoming connections are possible.

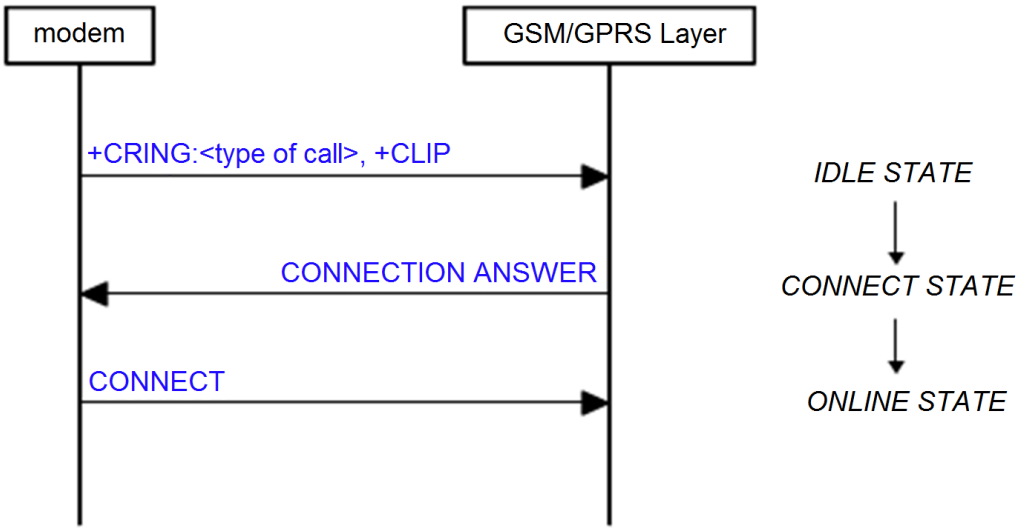


Figure 60: State transitions during a successful call establishment procedure

6.4.4. Packet data connection (GPRS)

The meter supports communication through GPRS mobile networks. In order to be visible within a GPRS network, the meters must establish connection to GPRS network first. Using special connection management functionality, meter can either be always connected to the GPRS network or connected only on request.

When meter starts the modem, it does not connect to GPRS network by default. Only when GPRS connection request is triggered, meter begins with activating GPRS connection. When modem is attached to GPRS network and confirmed, PDP context activation is requested by the meter using configured APN (Access Point Name), username and password. Dedicated object called **GPRS Modem Setup** (0-0:25.4.0) is used for APN configuration.

GPRS Modem Setup object attributes are used as:

- **APN**
  String defines the access point name of the network. The size of the APN string is limited to maximum 40 characters.
- **PIN code**
  PIN code consists of maximum 4 characters (numbers) and is intended to protect against unauthorized accesses. If the PIN code on the SIM card is disabled, the value 0 should be entered.
- **Quality of service**
  Not used by the meter.

Username and password for GPRS PDP context activation can be configured in **PPP Setup** object (0-0:25.3.0).

PPP Setup object attributes are used as:

- **PHY reference**
  Reference to another object by logical name. The object referenced contains information about the specific physical layer interface, supporting the PPP layer. **GPRS Modem Setup** object is referenced by default.
- **LCP options**
  This attribute contains the parameters for the Link Control Protocol options. From the whole set of available options, only Authentication protocol is used. Authentication protocol option must be configured for PAP (Password Authentication Protocol) protocol.

- **IPCP options**
  Not used by the meter.
- **PPP authentication**
  Contains the parameters required by the PPP authentication procedure used. PPP authentication must be configured with appropriate PAP username and password, which will be accepted by the network when PDP activation request is sent. The size of the username and password strings is limited to maximum of 32 characters.

After modem confirms PDP activation to the meter, meter activates appropriate server sockets (COSEM wrapper) in order to be able to communicate with remote peers (see the Figure 61).

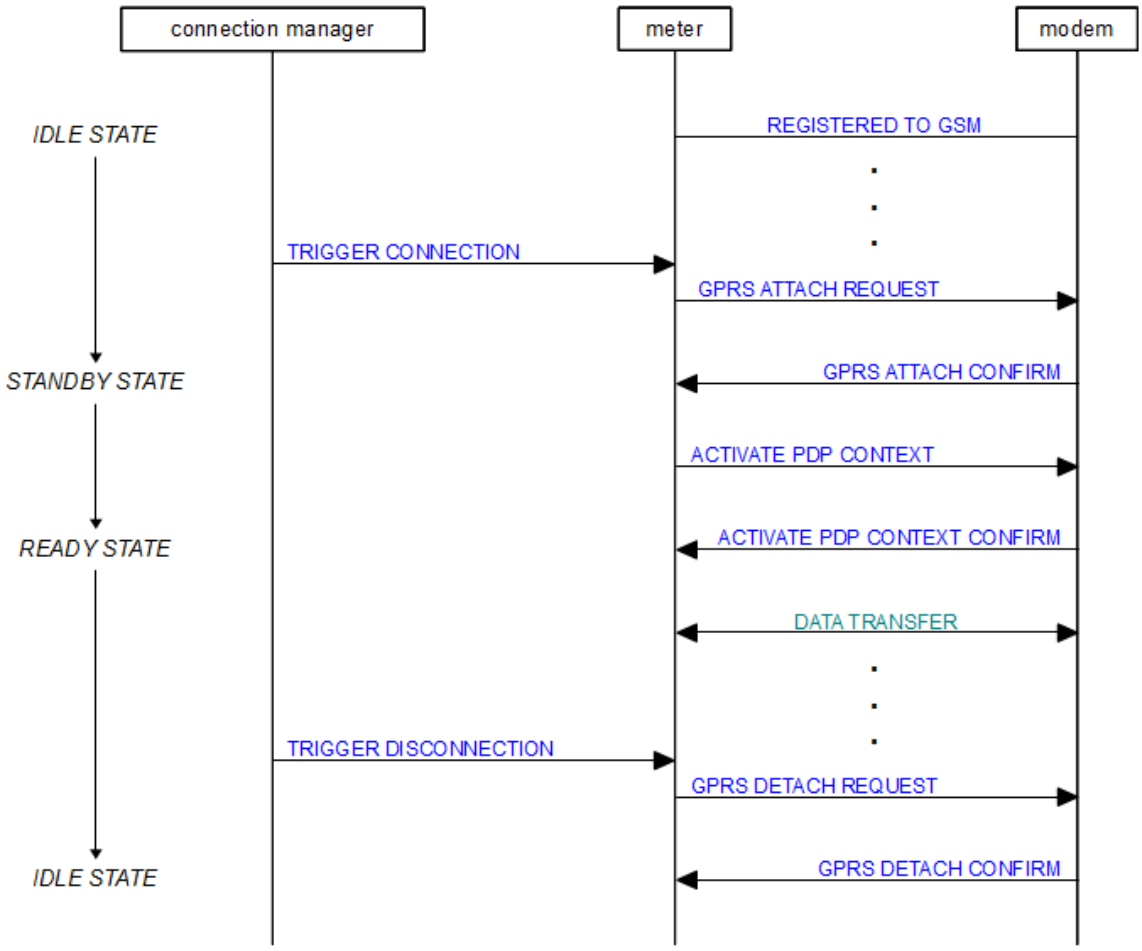


Figure 61: GPRS connection establishment process

When connection manager in the meter requests disconnection from GPRS network, the meter sends PDP deactivation request to the modem, followed by a detach request. After this, the meter is completely disconnected from GPRS network (also not attached) and being only registered to GSM network.

In the process of PDP context activation, modem connected to GPRS gets its IP address assigned by the network. The assigned IP address can be seen in **IPv4 Setup** object (0-0:25.1.0).

6.4.5. Short message service (SMS)

SMS message in the Mx382 meter can be used for meter wake-up request and push data.

SMS message can be up to 160 characters long, where each character is 7 bits long according to the 7-bit default alphabet. Eight-bit messages (max. 140 octets) are also available and are designed for data applications. The eight-bit PDU (Protocol Data Unit) mode will be used to transfer SMS messages.

SMS functionality features:

- Incoming SMS data length is limited to one SMS, 140 octets long and can be used to set some meter's parameters or to trigger some actions.
- Empty incoming SMS (data length 0) can trigger GPRS wake-up procedure (establishing PDP context).
- Outgoing SMS is used to send meter's object values to defined GSM subscriber (phone number).

SMS functionality restrictions:

- SMS is used as a one-way channel only.
- Only unconfirmed services are allowed (from client: SET, ACTION, unconfirmed; to client: Data-Notification).
- Communication is restricted to/from the Pre-established client only.

Security for SMS wake-up

If the **Auto Answer** object (0-0:2.2.0) attribute *List of callers* is defined, then only SMS which are coming from the explicitly white listed numbers are accepted by the meter. If *List of callers* is empty, there is no restriction.

Receiving unconfirmed services from HES:

- Only possible in pre-established association.
- Depending on the security policy set, global broadcast encryption and/or global authentication key may be used.
- Unconfirmed SET and unconfirmed ACTION services.

SMS: The phone number is ASCII encoded, first digit left, only numbers, no blanks.

6.4.5.1. SMS initialization

For successful usage of SMS functionality, two settings have to be performed:

- Optional setting SMS centre address (SCA): add initialization string to **Modem configuration** object, 0-0:2.0.0, *Initialization string*.

The Table 36 shows example of setting SMS centre address phone number to +3864100133 (145 = international format).

Modem configuration, 0-0:2.0.0, attribute 3 (Initialization string)	Value
1. Request	+CSCA="+38641001333", 145
2. Response	OK
3. Delay after response	3000

Table 36: SMS centre address phone number setting

- Optional setting restriction for **Auto answer** object, 0-0:2.2.0: ***Call type*** in *List of callers* should be set to ***1 – Wake-up request***.

The Table 37 shows example of phone number 040123456 (national format) or +38640123456 (international format) from which it is allowed to receive SMS. To support both national and international phone number format, it is advised to use wildcard (*) instead of explicit phone number (*40123456 instead of 040123456 or +38640123456).

Auto answer, 0-0:2.2.0, attribute 7 (List of callers)	Value
1. Caller ID	*40123456
2. Call type	1 – Wake-up request

Table 37: Phone number example

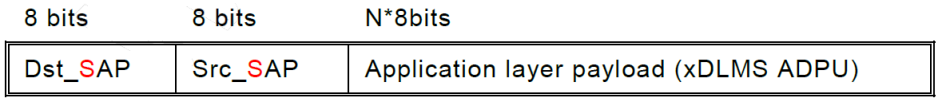
For Call type, the priority of ***1 – Wake-up request*** or ***2 – Normal CSD call*** can be defined.

6.4.5.2. SMS Application Protocol Data Unit (APDU)

The xDLMS APDUs are transported via the SMS channel by means of the SMS Short Wrapper. Length of xDLMS APDU data is 140 bytes (decreased by 2 octets used for SMS Short Wrapper Header).

SMS Short Wrapper

The payload of an SMS message is the xDLMS APDU prepended with the identifier of the Destination_SAP (Service Access Point) and the Source_SAP as shown in the Figure 62.



Dst_SAP = Destination SAP
Src_SAP = Source SAP

Figure 62: SMS short wrapper

Outgoing SMS (Meter → HES):
Destination SAP = 102
Source SAP = 001

Incoming SMS (HES → Meter):
Destination SAP = 001
Source SAP = 102

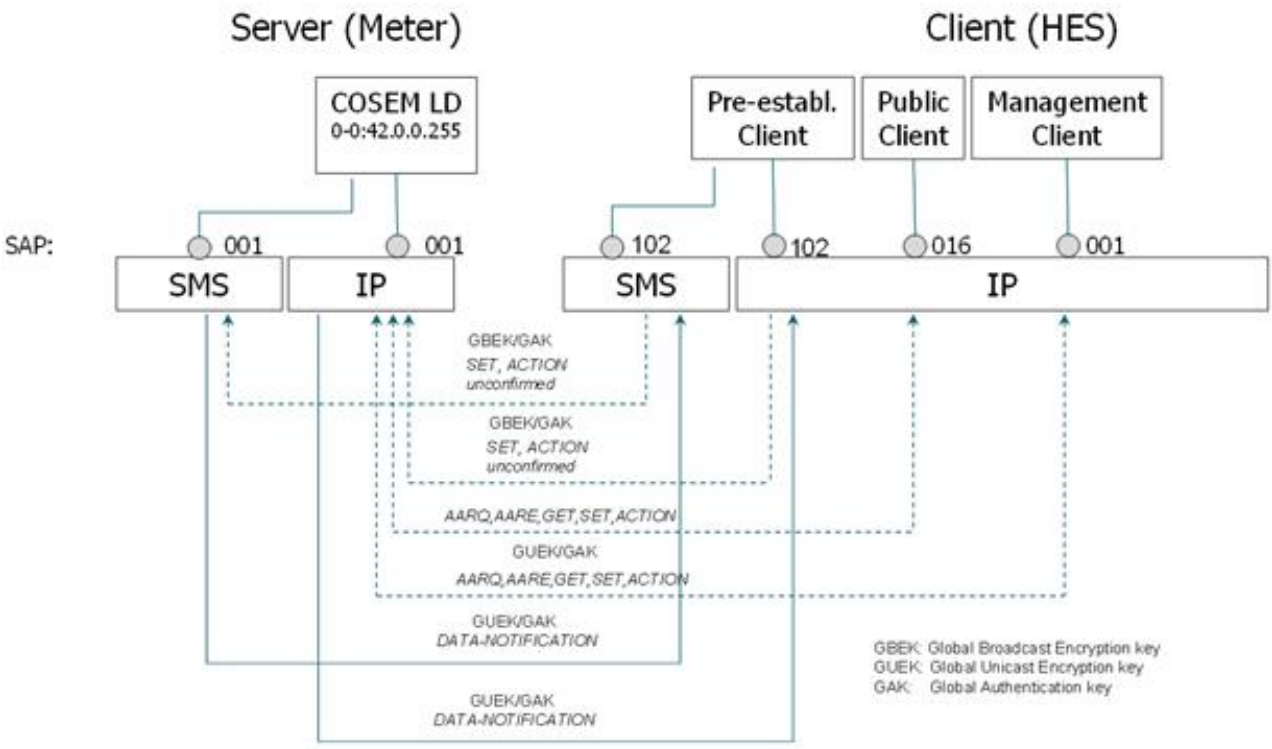


Figure 63: IDIS client and server model

6.4.5.3. Outgoing SMS

Sending SMS is triggered by the executing Push setup methods (see the Table 38).

Push setup	Logical name
1. Push setup – On connectivity	0-0:25.9.0
2. Push setup – Interval 1	0-1:25.9.0
3. Push setup – Interval 2	0-2:25.9.0
4. Push setup – Interval 3	0-3:25.9.0
5. Push setup – On alarm	0-4:25.9.0
6. Push setup – On power down	0-5:25.9.0
7. Push setup – Consumer Information (optional)	0-6:25.9.0
8. Push setup – On installation	0-7:25.9.0

Table 38: Push setup list

Push setup should be set to:

- ***Push object list*** (Filter): any COSEM object in meter with read access
- ***Send destination and method:***
  - **Service type**: 4 – SMS
  - **Destination**: phone number (e.g. 0038641123456, +38641123456, 041123456)
  - **Message type**: 0 – COSEM APDU

Service Centre Address (SCA) used for SMS sending (SMS-SUBMIT) should be set prior executing the method. Data Coding Scheme (DCS) is always set to *8-bit data coding in the User Data*.

DCS Settings	
Meter → HES	0xF4

Table 39: DCS Settings

The VP (Validity Period) is the information field that gives an SME (Short Message Entity) submitting a SMS-SUBMIT to the SMSC (Short Message Service Centre) the possibility to include a specific time period value in the short message. The VP parameter value indicates the time period for which the short message is valid, i.e. for how long the SMSC shall guarantee its existence in the SMSC memory before delivery to the recipient expires.

VP Settings	
Meter → HES	0xA7 (= 24 hours)

Table 40: VP Settings

If XDLMS APDU data length is less or equal 138 octets (140 octets maximum SMS APDU – 2 octets for SMS Short Wrapper Header), meter sends Push data in single SMS.

If data length is greater, meter sends two or more concatenated SMS (according to specifications 3GPP TS 23.040). In this case, each part includes additional 6 octets User Data Header (8 bit reference number).

Maximum data length (SMS Short Wrapper Header + Push data) is limited to 255 x (140 - 6) octets = 34.170 octets.

6.4.5.4. Incoming SMS

When incoming SMS is received, sender's phone number is compared with the *List of callers* of the object **Auto answer** (0-0:2.2.0). If phone number is whitelisted or if *List of callers* is empty and ***Wake-up request*** call type is selected, meter accepts the data.

Coding of incoming SMS is always interpreted as 8-bit, regardless of DCS of the received SMS.

NOTE

For the proper performance of Wake-up procedure, incoming SMS must be empty.

Incoming SMS Short Header is checked for correct association. Only pre-establish client association is allowed:

- Client (HES) – source – Association 102 (pre-establish client)
- Server (Meter) – destination – Association 001 (management server)

If SMS Short Header is not correct, SMS is discarded.

SMS Short Header	
0x01	Destination SAP – Server (Meter) – 001
0x66	Source SAP – Client (HES) – 102
xDLMS APDU	
0xC1	COSEM PDU (CosemSetRequest)
0x01	COSEM APDU type (Normal)
0x00	Invoke ID and Priority
0x00	Class ID
0x01	
0x00	

SMS Short Header	
0x00	Instance ID 0-0:96.13.0 (Consumer message text – Consumer information)
0x60	
0x0D	
0x00	
0xFF	
0x02	Attribute ID
0x00	AccessSelection
0x09	COSEM data: abcdef
0x06	
0x61	
0x62	
0x63	
0x64	
0x65	
0x66	

Table 41: Example of SMS PDU for setting object 0-0:96.13.0

6.4.5.5. SMS Wake-up request (Empty incoming SMS)

When empty incoming SMS is received, sender's phone number is compared with *List of callers* of the **Auto answer** object (0-0:2.2.0) and ***Wake-up request*** call type is selected. If *List of callers* is empty and ***Wake-up request*** call type is selected, meter connects to GPRS.

If sender's phone number is not on the list, or call type is incorrect, SMS is discarded.

When **Auto connect** object (0-0:2.1.0) mode is 103 or 104 (see the Table 45), GPRS connection (PDP context) is established (GPRS Wake-up request).

6.4.5.6. Concatenated SMS

If data length, that has to be transferred by SMS, is greater than 140 octets, SMS is divided to multiple SMS, according to SMS Point to Point specification, 3GPP TS 23.040: Technical realization of the Short Message Service (SMS).

In every SMS segment, UDHI (User Data Header Indicator) bit of PDU-type is set to 1. Beginning of the User Data field contains additional 6 octet (8-bit reference number) Concatenated SMS header. Therefore, every SMS segment holds 134 octets of user data.

Maximum number of SMS segments is 255. Maximum data length for the concatenated SMS is limited to 255 x (140 - 6) octets = 34.170 octets.

The Table 42 shows the concatenated SMS (User data header and User data).

User Data Header (6 octets)	
0x05	UDHL (User Data Header Length)
0x00	IEI (Identity Element Identifier): 0x00 = Concatenated message, 8 bit reference number
0x03	IEDL (Identity Element Data Length)
0xXX	Reference number of this concatenated number. Each part must have the same reference number.
0xNN	Total number of concatenated message parts (2 < 0xNN < 0xFF)
0xMM	Number of this concatenated message part (1 < 0xMM < 0xNN)
User Data (max. 134 octets)	
0xYY	User Data
...	
0xZZ	

Table 42: Concatenated SMS

6.4.6. Modem reset

Once GSM/GPRS communication modem is running, network specific errors or broken connections can cause modem to become unresponsive to subsequent communication attempts. Modem reset mechanism enables automatic restart and re-initialization of GSM/GPRS communication module, thus restoring it back to the fully operational mode.

Each time a modem reset is required, the meter attempts to perform a software reset first (using corresponding AT commands). If a software reset proves to be unsuccessful, a hardware reset is performed by triggering modem HW reset signal. The occurrence of modem reset events is recorded in the **Communication event log** (0-0:99.98.5) object under ***Modem SW reset*** (149) or ***Modem HW reset*** (150) events (see the Table 58).

The following scenarios can cause the modem reset to occur:

- error in modem initialization,
- error in modem diagnostic,
- error during a CSD/GPRS connection,
- no connection timeout has expired.

An error in initialization triggers a modem reset if the cause of the error is not resolved after 60 seconds from the time the error originated. This type of error occurs:

- when the modem does not respond properly in time to the first AT command sent by the meter,
- the modem's multiplexer mode could not be started,
- modem replies to any subsequent (followed by the start of the multiplexer mode) AT commands were invalid or not received.

Modem diagnostics process constantly runs in the meter. In case of invalid or no response to diagnostic command for the period longer than 60 seconds, meter triggers modem reset. Diagnostics process also triggers modem reset in the following conditions last for more than 600 seconds:

- modem does not return SIM ready,
- modem reports signal quality 0 or 99,
- modem is not able to register into GSM network.

Modem reset is triggered if a CSD/GPRS service cannot be established or if an error in the termination of the service occurs due to some network specific error which results in GSM/GPRS modem interface not being accessible to the connecting clients.

Each communication port has a separate timer, which records the time duration since the last successful communication over that particular port. A common timer for recording the time duration since the last successful communication over any of the available ports is also implemented. When the timer expires, the affected ports are re-initialized. If the port to be re-initialized is used as a GSM/GPRS communication interface, additionally a modem reset is performed prior to any port re-initialization.

No connection timeout (0-0:128.20.30) object is used to configure timeout parameter for the timers described above. The object is set to 30 hours by default. Each time a new value for the **No connection timeout** object is set, the individual and common port timers are reset to 0. Setting the **No connection timeout** object parameter to 0 disables the described monitoring functionality, hence no resets due to lack of communication are performed.

The actual value used by the meter to monitor communication inactivity is calculated from the *No connection timeout* parameter (NCT) and is therefore different. The actual value used is random value between NCT and NCT + NCT / 3. This is to prevent an excessive number of simultaneous GSM/GPRS de-registrations performed by different meters when common source of error occurs in the network.

The Table 43 explains how errors in various stages of modem operation lead to possible modem reset.

No.	Stage	Error result
1	**Initialization service**	
1.1	first AT command sent	no/invalid response
1.2	MUX* start-up	MUX not started
1.3	Additional AT commands sent	no/invalid response
2	**Diagnostic service**	
2.1	Signal quality status	insufficient quality, no/invalid response
2.2	SIM status	SIM not inserted, no/invalid response
2.3	GSM registration	registration failed, no/invalid response
2.4	GPRS registration	registration failed, no/invalid response
2.5	Operator selection status	no/invalid response
2.6	PDP context status	PDP deactivated, no/invalid response
3	**CSD/GPRS service**	
3.1	service establishment	error during service establishment
3.2	service termination	error during service termination
4	**no connection timeout**	
4.1		no communication on port

* Multiplexer (3GPP TS 27.010 Multiplexing protocol)

Table 43: Modem reset triggers

Whenever a request to restart the modem is issued, the meter enters a special modem restart procedure. The following actions are executed:

- IMSI (International Mobile Subscriber Identity) detach is requested,
- multiplexing mode on modem is closed,
- modem software reset is requested,
- in case of unsuccessful SW reset, modem HW reset is requested,
- reset procedure finishes and reinitializes modem communication.

Written order of the restart procedure actions is the same as the order of their execution. The *IMSI detach request* and *IMSI detach response* states are intended to detach the modem from the mobile network by sending the AT+CFUN=4 command. After that, a close-down of the multiplexer is attempted. When successful, a *software reset request* follows. The request (AT+CFUN=1,1) is only executed after an internal restart timeout (set to 180 seconds) added with a random time between 0 and 60 seconds expires. The time is measured from the moment the main GSM/GPRS process entries the restart procedure. When finished, GSM/GPRS process enters the *reset finished* state after which the communication port initialization is performed.

If any of the described states fails to execute properly/in time, the reset procedure enters *hardware reset request* state. The HW reset procedure executes actual reset (triggering dedicated HW reset signal) only after the internal restart timeout expires (see the Figure 64).

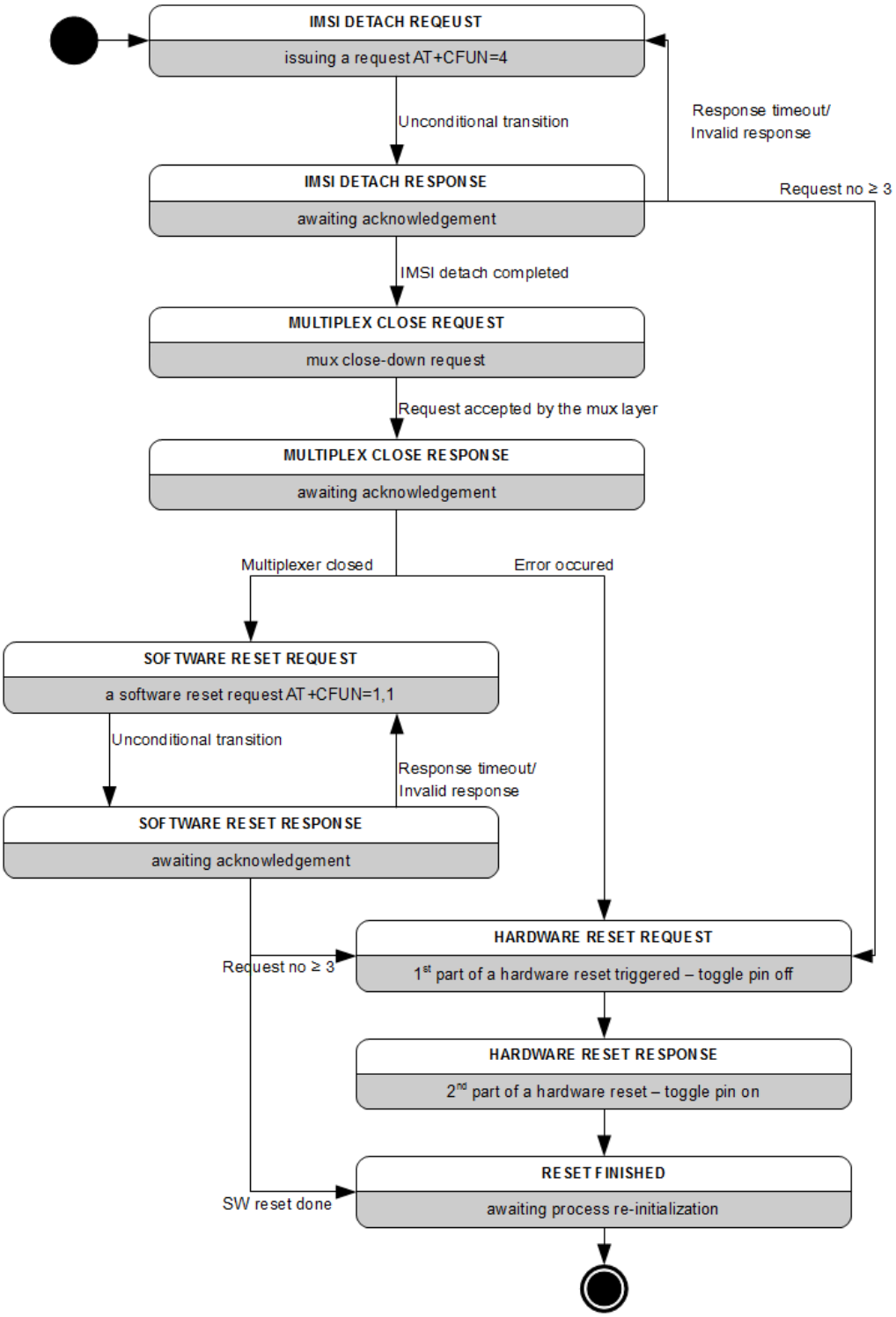


Figure 64: State diagram during modem restart procedure

The entire modem reset procedure takes approximately 3 to 4 minutes to complete. Whether or not a modem reset procedure is currently in progress it can be observed using the **GSM status** (0-0:128.20.1) object.
If the eleventh bit (B10) of the object's value attribute (*Modem reset pending*) is set to **ON**, the modem reset procedure is being executed.

6.4.7. TCP/IP based COSEM communication profile

This profile is implemented to be used in conjunction with a GPRS communication interface.

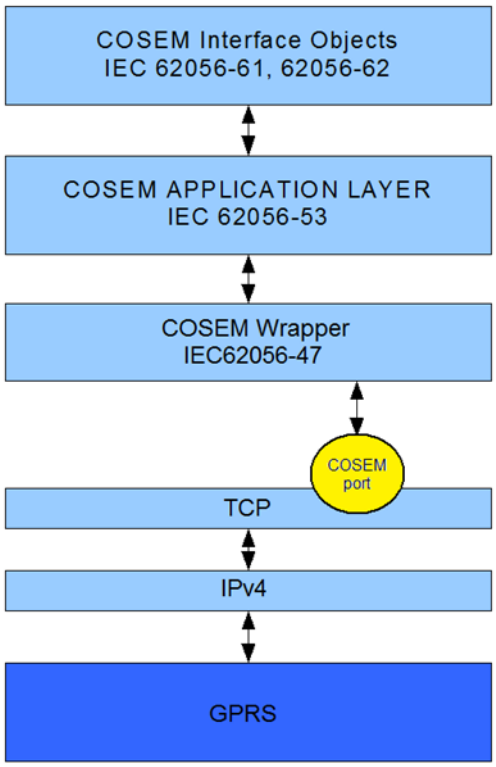


Figure 65: TCP/IP based COSEM communication profiles

COSEM Wrapper

COSEM Wrapper protocol is a part of COSEM specification used for COSEM communication over IP networks. The COSEM wrapper layer adds 8 bytes long header to the original COSEM message. The wrapper header includes information about version, source wrapper port, destination wrapper port and length (see the Table 44). COSEM Wrapper header is followed by COSEM application data (APDU).

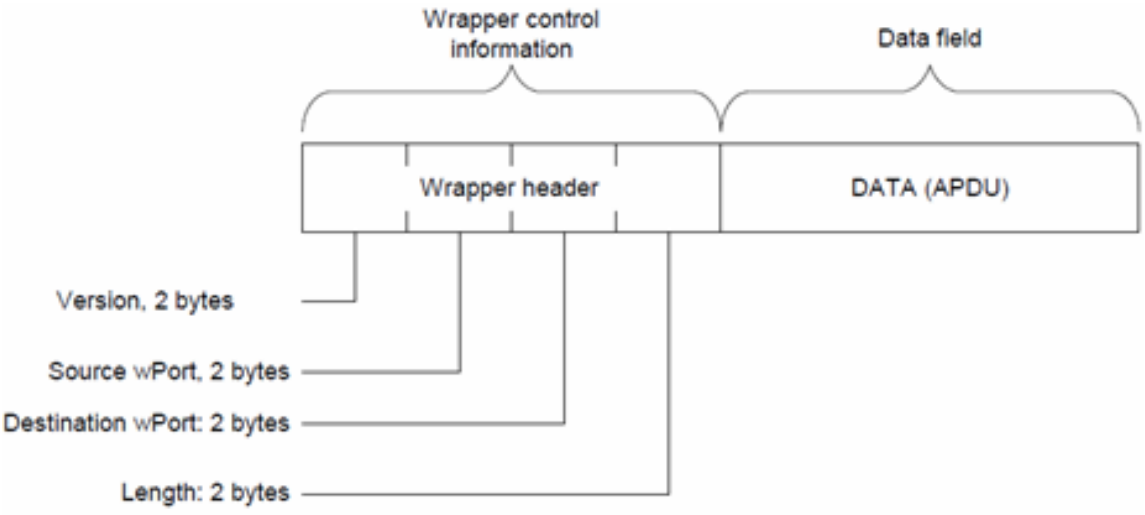


Figure 66: The COSEM wrapper protocol data unit (WPDU)

Header information	Description
Version	This 16 bit long unsigned integer value carries the version number identifying the version of the wrapper. Its value is controlled by the DLMS User Association. The current value is 0x0001.
Source wPort	16 bit long unsigned integer value carries the wPort number identifying the sender AP (Application Process).
Destination wPort	This 16 bit long unsigned integer value carries the wPort number identifying the destination AP.
Length	This 16 bit long, unsigned integer value indicates the length of the DATA field of the WPDU (the length of the APDU transported).

Table 44: COSEM Wrapper header information

When receiving COSEM Wrapper messages, the meter checks version number and length fields of the incoming TCP (Transmission Control Protocol) packet. If the version is not 1 (fixed value) or if the length of data APDU is not equal to Length field, the packet is discarded and the active connection is closed.
When the header is verified, the data APDU with additional parameters is passed to the DLMS server.

When DLMS server in the meter responds to the request, the frame is passed through the COSEM Wrapper layer, which adds the COSEM wrapper header and sends the message active socket connection to the client.

When no data is exchanged for the time out period in **TCP-UDP Setup** object (0-0:25.0.0), meter closes the incoming connection. Meter still keeps listening for new connections on configured TCP-UDP port.

COSEM wrapper operation is determined by dedicated configuration in **TCP-UDP Setup** object:

- **TCP-UDP port**

  Valid TCP-UDP (Transmission Control Protocol - User Datagram Protocol) port number values are between 1 and 65535. If the port number has been changed, the meter waits the client to close the connection. After that, the meter closes the listening socket on old port number, waits for 5 seconds and opens the listening socket on the new port number.
  If the meter is not configured, default parameters are 0, including the TCP-UDP port. In that case, TCP port number used for the listen socket is 4059 (default value defined in the Green Book).

- **IP reference**

  IP reference references an IP setup object by its logical name. The referenced object contains information about the IP address settings of the IP layer supporting the TCP-UDP layer.

- **MSS (maximum segment size option)**

  Maximum segment size (MSS) is set to fixed value of 1460 bytes. Value configured in **TCP-UDP Setup** (0-0:25.0.0) object has no effect on operation of the MSS.
  Maximum COSEM application data is 1072 bytes + 8 bytes COSEM wrapper layer header = 1080 bytes long, which is less than 1460 bytes. That assures that all requests and responses are transferred in one segment, which minimizes the transfer delays.

- **Number of simultaneous connections**

  Number of simultaneous connections is limited to 1. Value configured in **TCP-UDP Setup** (0-0:25.0.0) object has no effect on the number of simultaneous connections.

- **Inactivity time out**

  Inactivity time out expressed in seconds is timeout after the active connection will be closed if no activity is detected on the connected socket. If the value 0 is entered, timeout should not be operational. Because of the safety reasons (a client can disable further access to the meter), timeout period is limited to 3600 seconds maximum when value 0 is entered in the inactivity time out field. If value greater than 3600 is entered, inactivity timeout period is set to 3600 seconds.

6.4.8. GSM/GPRS connection management

GSM/GPRS connection management functionality is achieved through the implementation of two COSEM classes:

- **Auto Connect**,
- **Auto Answer**.

6.4.8.1. Auto connect

The meter implements **Auto connect** (0-0:2.1.0) object in order to be able to control the operation of auto connect functionality. Auto connect functionality is intended to control network connectivity and supports the following modes for GPRS operation (values are detailed described in the Table 45):

- **Always ON**: Meter is always connected to the IP (GPRS) network (value 101).
- **Always ON in time window**: Meter is connected to the IP (GPRS) network during defined time window only (value 102).
- **Always ON in time window with exception**: Meter is connected to the IP (GPRS) network during defined time window. Out of time window meter connects to network when connect method is invoked (value 103).
- **Wake-up**: Meter is usually disconnected and connects to the network when connect method is invoked (value 104).

In **Always ON** modes meter maintains permanent connection to GPRS network during the defined time period (if window is used). In case of connection failure, meter resets the modem and retries connection establishment.

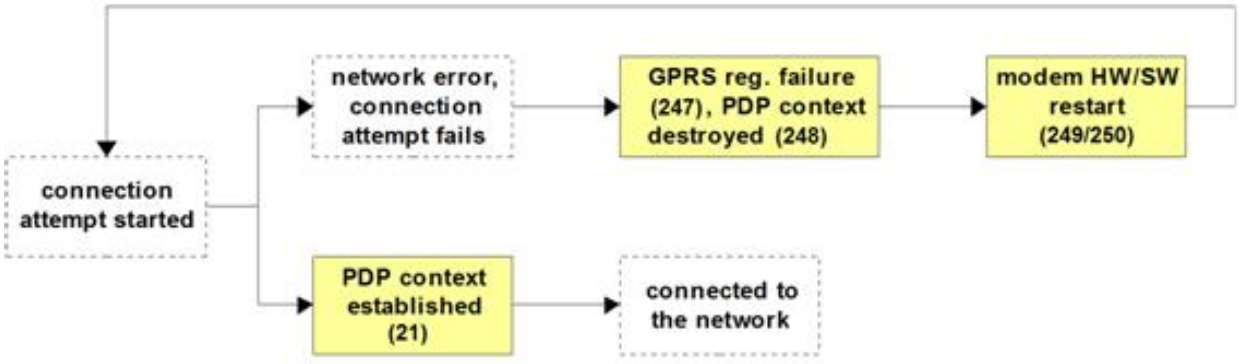


Figure 67: Auto connect operation in »Always ON« modes during defined time window

The attributes of the **Auto connect** object are used in the following way:

- ***Mode***: Controls the auto connect functionality in terms of the timing, the message type and the infrastructure to be used (see the Table 45).
- ***Repetitions***: Maximum number of retrials in case of unsuccessful connection attempts.
- ***Repetition delay***: Time delay, expressed in seconds until an unsuccessful connection attempt can be repeated. If value is 0, repetitions delay is not specified.
- ***Calling window***: Contains the time points when the window becomes active (*start time*), and inactive (*end time*). The *start time* implicitly defines the period.
- ***Destination list***: NOT used by the meter.

Value	Mode description
0…99	Reserved.
101	Always on: the device is permanently connected to the communication Network.
102	Always on within the validity time of the calling window: the device is disconnected from the communication network outside the calling window. No connection possible outside the calling window.
103	Always on within the validity time of the calling window: the device is disconnected from the communication network outside the calling window, but it connects to the communication network as soon as the connect method is invoked.
104	Wake-up mode: the device is usually disconnected. It connects to the communication network as soon as the connect method is invoked.
105…199	Reserved.
200…255	Manufacturer specific modes.

Table 45: Auto connect modes

NOTE
Meter connects to GPRS network only if one of modes (values 101 to 104) is configured.

When a connect method is invoked, the auto connect attempts to connect to the network if not already connected. When successful, the meter remains connected to the network until specific auto connect parameters change or network error occurs. If a connection attempt is unsuccessful, the auto connect re-attempts to connect to the network. The number of re-attempts is limited by the repetitions attribute.

A connect method can only be invoked if the mode attribute is set to 103 (while outside of the defined calling window) or to 104 (see the Figure 68).

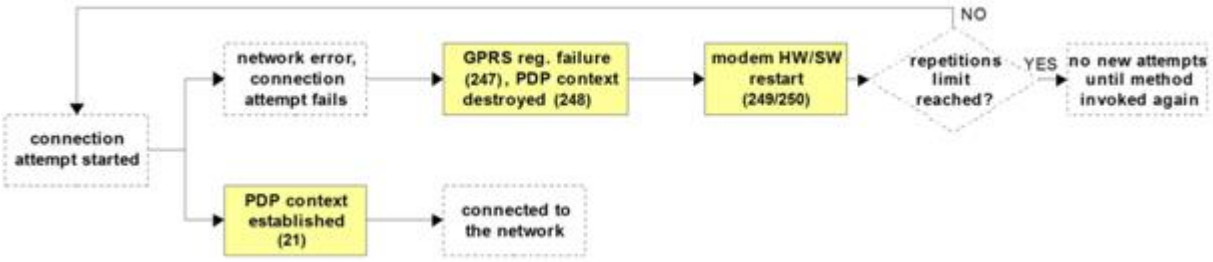


Figure 68: Auto connect operation in modes 103 and 104 when a connection method is invoked

6.4.8.2. Auto answer

The meter provides an **Auto answer** (0-0:2.2.0) object intended to manage the following functionality of the exchangeable GSM/GPRS module:

- answering to incoming calls,
- managing GPRS wake-up requests.

The attributes of the **Auto Answer** object have the following meaning:

- ***Mode***: defines the working mode of the modem line when the meter is auto answering. Parameter value is enumerated (see the Table 46).
- ***Listening window***: defines the time points when the communication window(s) become active (start_time) and inactive (end_time).
- ***Status***: status of the window is defined in the Table 47.

Value	Mode description
0	Line dedicated to the device.
1	Shared line management with a limited number of calls allowed. Once the number of calls is reached, the window status becomes inactive until the next start date, whatever the result of the call.
2	Shared line management with a limited number of successful calls allowed. Once the number of successful communications is reached, the window status becomes inactive until the next start date.
3	Currently no modem connected.
200...255	Manufacturer specific modes.

Table 46: Modem working mode

Value	Status
0	**Inactive**. The device will manage no new incoming call. This status is automatically reset to active when the next listening window starts.
1	**Active**. The device can answer to the next incoming call.
2	**Locked.** This value can be set automatically by the device or by a specific client when this client has completed its reading session and wants to give the line back to the customer before the end of the window duration. This status is automatically reset to active when the next listening window starts.

Table 47: Window status

- ***Number of calls***: this number is the reference used in modes 1 and 2. When set to 0, this means there is no limit.
- ***Number of rings***: defines the number of rings before the meter connects the modem.
  Two cases are distinguished:
  - the number of rings within the window defined by the attribute ***listening window***,
  - the number of rings outside of the ***listening window***.
- ***List of callers***: contains an optional list of calling numbers, which further limits the connectivity of the modem based on the calling number. It also controls the acceptance of wake-up requests from a calling number. Each calling number in the list is associated with caller type, defined as:
  - **0**: normal CSD call; the modem only connects if the calling number matches this entry in the list. This is tested in addition to all other attributes, e.g. *number_of_rings, listening_windows*, etc.
  - **1**: wake-up request; calls or messages from this calling number are handled as wake-up requests. The wake-up request is processed immediately regardless of *number_of_rings*.

Answering to incoming calls

The client system may initiate communication to the meter via circuit-switched-data connection using GSM network. In order to support this **Auto Answer** object in the meter it must be configured appropriately. Functionality of answering incoming calls is based on caller recognition, which is achieved by using GSM network CLIP (Caller Line Identification Presentation) service.

In order to be able to accept incoming call, the meter must have **Auto Answer** object configured in one of the following way:

- list of allowed callers is empty so meter answers incoming calls regardless of calling number.
- calling number reported with CLIP matches one of the calling numbers in list of allowed callers, which is associated with caller type for normal CSD call.

In addition to calling number checking, meter also answers incoming calls according to other parameters (listening window, number of rings, etc.).

Auto answer functionality answers only incoming data type of call. If incoming call is voice type, it is only possible to perform wake-up.

Because the implemented GSM/GPRS communication module is a class B modem (communication over GPRS and CSD at the same time is not possible), any incoming CSD call is rejected if there is any TCP session (over GPRS) active.

When CSD connection is established specific application checks activity on meter modem channel. If there is no activity time more than Inactivity time out, 8th attribute of appropriate channel IEC HDLC setup object (0-b:22.0.0), then meter makes hang up and destroys connection.

Managing GPRS wake-up requests (via CSD or SMS)

In addition to **Always ON** modes, where GPRS connection is permanently activated during defined time period, the meter also supports GPRS connection establishment on request, so called wake-up. Wake-up is based on receiving CSD call notification (+CRING: <type of call>, +CLIP) or SMS. Upon receiving the wake-up call or SMS from the HES, the meter verifies the calling number according to configuration of the **Auto Answer** object. If the caller type of the calling number is set to (1) ***Wake-up request*** in the *list of callers* the meter rejects incoming CSD call and immediately triggers GPRS connection request to the modem or in SMS case is depend of if incoming SMS is empty or not. The GPRS connection request is only triggered if appropriate mode (103 or 104) is configured in **Auto Connect** object. If mode 103 is configured in **Auto Connect**, also *calling window* is checked.

When **Auto Answer** mode is set to 0, meter does not check any other parameters of **Auto Answer** object, except *list of* callers when managing wake-up request. When **Auto Answer** mode is set to 1 or 2, meter also takes *listening window*, and *number of calls* into account when managing wake-up request.

When Wake-up GPRS connection is established specific application checks activity on this attachment. If there is no activity time more than Inactivity time out, 6th attribute of **TCP-UDP setup** object (0-0:25.0.0), then meter destroys connection.

Otherwise if there is activity on this attachment then PDP context becomes inactive as soon as reading/writing via GPRS is finished only when no **Push Setup** objects that need PDP context. In this case, PDP context stay active till push process is finished.

Meter registration

By meter registration meter sends its IP address and its system title over GPRS or SMS communication to the HES using Data-Notification service. Mx382 meter triggers push method on object **Push setup – On Installation** (0-7:25.9.0). The execution of the push method results in transmission of the Data-Notification message to the set IP address or phone number.

Push method is triggered by the GSM status object and is depended of relation state of bits B1 and B11.

All relation states of bits and its meaning or action are shown in the Table 48.

B1	B11	f
0	0	Trigger Push method (Installation On)
0	1	Trigger Push method (Installation On)
1	0	Installation call done or not active
1	1	Installation call failed

Table 48: GSM status object bits B1 and B11 relation states and meaning

6.4.9. Selecting the cellular network (2G/3G)

For the 3G modem (Sierra Wireless SL8082) user can select the cellular network (Wireless Data Service) to operate with the Mobile Terminal/Terminal Adaptor. This can be done with the Sierra Wireless proprietary command +WWSM. The selected cellular network will be taken into account after power-down and power-up the meter (modem reset is required). By default, the modem automatically uses the best available network.

The following procedure describes selecting the cellular network:

1. Disable the PDP context setting (destroy PDP context, if it is established).
2. Enter the WWSM command in the **Modem configuration** object, then wait for 20 seconds.
3. Power-down and Power-up the meter (wait for approximately 1 minute after meter Power-up).
4. Re-enable the PDP context setting (if it was set).
5. Optional: remove the WWSM command from the **Modem configuration** object.

Detailed procedure description:

1. Disable the PDP context setting:
    a. Remember the settings of the Auto connect object (0-0:2.1.0*255) “Mode” attribute
    b. Set the Auto connect object (0-0:2.1.0*255) “Mode” attribute to 104 (The device is usually disconnected)
    c. Check GSM status object (0-0:128.20.1*255).Bit B3 (Modem has active PDP context) should not be checked.
2. Enter the WWSM command in the Modem configuration object (0-0:2.0.0*255), »Initialization string« attribute:
    a. In the »Response« field enter »OK«
    b. In the »Delay after response« enter »5000«
    c. In the »Request« field:
        i. for 2G mode only: enter »+WWSM=0«
        ii. for 3G mode only: enter »+WWSM=1«
        iii. automatic selection of the network (default): enter »+WWSM=2«
    d. Wait for 20 seconds
3. Power-Down and Power-Up the meter:
    a. Power-Down the meter
    b. Wait for 1-2 seconds
    c. Power-Up the meter
    d. Wait 1 minute
4. Re-enable the PDP context setting
    a. Set the Auto connect object (0-0:2.1.0*255) Mode to the value that was set previous the change in step 1.
5. Optional: remove the WWSM command from the Modem configuration object. The command can be removed because the WWSM setting is permanently saved in the modem).

To check the current cellular network in use by the modem, read the **GSM network name** object (0-0:128.20.5). The object may have two different values depending the cellular network, which is currently in use. The values are represented in the Table 49.

Object 0-0:128.20.5	Example	Current cellular network in use
network_name, 0	Mobitel, 0	2G NETWORK – GETRAN (GSM/EDGE)
network_name, 2	Mobitel, 2	3G NETWORK – UTRAN (UMTS)

Table 49: GSM network name

6.5. Push

Generally, communications runs from the central system (client) to the meter (server).

On the contrary, in Push operation communication runs from the meter (server) to the central system (client), where the meter initiates the communication and pushes information to the central system without any request. In some cases, Push can also be requested by the central system (client).

Push method activates the push process leading to the elaboration and the sending of the push data taking into account the values of the attributes. Push process is implemented through the data notification process, which takes care of processing of the requested push object, checking for successful communication and preparing data to build proper COSEM_APDU (Application Protocol Data Unit) message.

6.5.1. Push objects

Push setup objects

- **Push setup – On connectivity** (0-0:25.9.0) is used when PDP context is established. Meter sends its IP address and system title using *data_notification* service to the HES.
- **Push setup – Interval 1, 2, 3** (0-1:25.9.0; 0-2:25.9.0; 0-3:25.9.0) can be used for various periodical data reporting (profiles, billing, etc.).
- **Push setup – On alarm** (0-4:25.9.0) is called from alarm monitor objects to report alarm registers.
- **Push setup – On power down** (0-5:25.9.0) is used to report power fail event (usually over SMS). Push is sent only if meter is powered-up for at least 20 minutes.
- **Push setup – Consumer information** (0-6:25.9.0) is used to transmit information to local P1 port (i.e. IHD) serving as Consumer Information Interface (CII) to support the optional Consumer Information Push (CIP) functionality. Field *Send destination and method* need to be properly set. Depending on the market request, this local port may be connected to a suitable home gateway.
- **Push setup – On installation** (0-7:25.9.0) is used to inform HES that meter is installed to the system (e.g. meter sends its IP address and its system title to the HES using *data_notification* service).

NOTE

When power down occurs, only **Push setup – On Power Down** is allowed. Any other active push is stopped and becomes active again when power returns.

Push action scheduler

- **Push action scheduler interval 1, 2, 3** (0-1:15.0.4; 0-2:15.0.4; 0-3:15.0.4) are used to periodically invoke **Push script table** (0-0:10.0.108) with a predefined selector to trigger push method on dedicated **Push setup** object.
- **Push action scheduler – Consumer information** (0-4:15.0.4) is used for dedicated CIP functionality.

Push script table

- **Push script table** (0-0:10.0.108) contain scripts which are used to trigger push method on configured **Push setup** objects.

6.5.2. Data notification service

Data_notification to the Consumer Information Interface can be pushed:

- periodically with triggering push operation by the meter's **Push action scheduler – Consumer information**. It is optional and is used to periodically invoke of **Push script table** (0-0:10.0.108) with predefined selector to trigger push method on object **Push setup - Consumer Information**. Scheduler defines the time instances when the meter is pushing information to the CII,
- immediately after HES changed value of object **Consumer Message Text – Consumer Information** (0-0:96.13.0). Setting attribute 2 (value) for object **Consumer message text – Consumer information** (0-0:96.13.0) trigger push method on object **Push setup - Consumer Information** (0-6:25.9.0).

6.5.3. Push process

Only one **Push setup** object is processed at once. Multiple Push requests are resolved through executing one by one according to the COSEM logical name until at least one object is active.

In case of a delay (*randomisation_start_interval*, *repetition_delay*) another **Push** object is treated, if it is triggered. If triggered **Push** object has no delay at first attempt or the delay expires and communication window is active, then Push process continues to establish connection. If communication window is not active then first attempt is started in next active Window element and another **Push** object is treated if it is triggered. If communication window reaches end, Push process is finished. If there is no destination set, then Push process is finished as well.

When using TCP as service type registration in GPRS, network must be established in maximum delay of 330 seconds. If error occurs or delay expires new push attempt is started. When registration in GPRS network is established, then connection to the destination is started. If error occurred or connection is not established in 58 seconds, new push attempt is started. If **Push** object list is empty, then process is finished. At the end of sending *data_notification* waiting for server to close socket is made. If server does not close socket in 58 seconds and connection to the same destination is no more active, push is treated as failed and new push attempt is started. If power down occurred at end of sending *data_notification*, waiting for server to close socket is not made and push is always treated as successful.

When using SMS as service type the check if previous SMS was sent is made. If error occurred or previous SMS was not sent in 50 seconds, new push attempt is started, otherwise the phone number is checked if it is in proper format. If object list is empty then Push process is finished at this point. After last block is prepared, wait and check if it was sent is made. If SMS is not sent in 50 seconds, new push attempt is started, otherwise push is finished successfully. If power down occurred, check if SMS was sent is not made.

When using HDLC as service type **Push** object is set to active on any channel that use HDLC and *data_notification* activity. If no destination is set, then only CIP (Consumer Information Push) association (103, 1) is allowed. Each channel make check if communication has no association restrictions and if communication mode is set to DLMS. If any check failed, then Push process on that channel is finished with treatment of currently working **Push setup** object and next channel in a row start with treatment this **Push setup** object. To successfully send *data_notificaton*, restriction and communication mode on all channels using HDLC must be properly set. At the end of sending *data_notification* no check if *data_notification* was successfully sent is made and push is always treated as successful.

When power down occurs, **Push setup – On Power Down** is triggered. At power down only **Push setup – On Power Down** is allowed. Any other **Push setup** is finished and remains active to be processed after power good. To send *data_notification* at power down, power good elapsed time must be at least 20 minutes to provide enough power supply for 40 seconds to send data notification. After 40 seconds meter starts to disconnect from GPRS network procedure. If power good elapsed time is less than 20 minutes then at power down disconnect from GPRS network procedure is started. Additional time (fixed delay) represented with object **Power failure alarm filtering limit** (1-0:96.239.0) is used to suspend sending of *data_notification* if power down elapsed time is less than this time.

6.5.4. Push related functionalities

- **Security setup** (0-0:43.0.0) object is used to secure *data_notification* when pushing data using pre-established association. The Management Client association and the Pre-established Client association share the same security context. Therefore, there is only one security setup object through which this security context is configured.
- **Security setup – Consumer Information** (0-0:43.0.1) object is used to secure *data_notification* when pushing data (with HLS security) using CIP association (CIP functionality).
- **IEC local port setup channel 1**

  With setting *Communication mode* in object **IEC local port setup channel 1** (0-1:20.0.0) to value 1, CIP functionality on local port is allowed to send *data_notification*.
- **Consumer message text – Consumer information**

  Setting attribute 2 (value) for object **Consumer message text – Consumer information** (0-0:96.13.0) triggers push method on object **Push setup - Consumer Information** (0-6:25.9.0).
- **Alarm monitor 1** (0-0:16.1.0) is used to monitor predefined monitored value and execute action on predefined script.
- **Alarm monitor 2** (0-0:16.1.1) is used to monitor predefined monitored value and execute action on predefined script.
- **Alarm descriptor 1** (0-0:97.98.20) is used for monitored value in object **Alarm monitor 1**.
- **Alarm descriptor 2** (0-0:97.98.21) is used for monitored value in object **Alarm monitor 2**.
- **Power failure alarm filtering limit** (1-0:96.239.0) object is used to delay sending of *data_notification* at power down.

7. DESCRIPTION OF MAIN METER FUNCTIONALITIES

7.1. Measurements

Beside energy and power measurement and registration and instantaneous values measurement and registration (power, voltage, current, power factor, frequency) the following meter functions are available:

- power quality measurements (partly according to EN 50160*),
- power quality measurements data available as instantaneous or average data,
- voltage sags and swells,
- undervoltages, overvoltages,
- measurement of minimum, maximum - daily voltage,
- measurement of instantaneous power factor; per phase, three-phase registers,
- measurement of last average power factor,
- registration of three phase and phase power-downs, and the power-down duration (long and short).

* for the following items: voltage sags and swells, voltage asymmetry, undervoltages, and overvoltages.

7.2. Sequences

These objects are used to configure data for quick readout, either from display or from P1 communication interface. Each register can accept maximum of 32 visible entries. They are usually used for most needed meter information such as energy and demand values or date and time. The meters have P1 **General local port readout** sequence, **General display readout** sequence and **Alternate display readout** sequence.

With **General local port readout** list (0-0:21.0.0) data readout information can be set.

With **General display readout** (0-0:21.0.1) the information visible on meter's display can be set. This information automatically scrolls on display every 10 seconds without pressing any button.

With **Alternate display readout** (0-0:21.0.2) the information visible on meter's display can be set. Each press on **Scroll** button scrolls to next information in the register. This information is visible after **Scroll** button has been pressed. Full display test appears after first **Scroll** button is pressed. After last pressed button, sequence returns after 2 minutes to General display readout mode.

NOTE
For effective use of functionalities, the meter must be properly configured.

7.3. Main load profiles

General-purpose load profiles are available in Mx382 meter. Each can capture any of the basic type object value present in the meter.

The meter has two Load profiles (LP with period 1 and LP with period 2), four M-Bus load profiles and Billing profiles. A profile has an internal memory space to store captured data, therefore each profile has a limit of stored data. More capture objects we select, less total captured data is possible to store. After a call of reset method, the buffer does not contain any entries, and this value is zero. Profile entries attribute specifies how many entries could be retained in the buffer. Entries in use attribute counts the number of entries stored in the buffer.
In each profile up to 32 objects can be registered. Maximum profile capacity mainly depends on the number of capture objects set.

Data in a load-profile recorder are accompanied with a timestamp and with the meter status in the last saving period as well as with a check sum. The timestamp indicates the end of a registration period.
Both profiles (LP1, LP2) are compressed type – only one (first) timestamp is shown. Compressed type allows more data to be store.
Profiles are implemented as FIFO (First In First Out) buffers. Each record has associated a unique record number. Within one load profile, more records can have same timestamp (in case time is shifted back) but all have different record numbers. When reading load profiles records are being put out according to their record number in increasing order.

Load profile capture period

Capture period is variable which defines the time distance between two captured data in seconds.
The capture period of the profile can be specified by capture period attribute. Recommended recording periods for period 1 are 5 min (300), 10 min (600), 15 min (900), 30 min (1800) and 1 hour (3600), for period 2 recommended recording period is 1 day (86400). Load profile with period 2 has same functionality as profile with period 1, only difference is in less reserved space for records in the meter (otherwise the period 2 can also be set as period 1).
The period is synchronized with the hour; it always begins at completed hour. Value 0 of capture period means no registration. The profile buffer can be cleared by invocation of the Profile generic, method reset. The data in the load profiles can be erased with the reset method.

Profile status

The two status registers in the meter are **Profile status** – **Load profile with period 1** (0-0:96.10.1) and **Profile status** – **Load profile with period 2** (0-0:96.10.2). The AMM profile status code has a size of 1 byte and is shown in decimal form. The following table describes the state and the function of all bits. If one of the events defined below has occurred during capture period, corresponding event code is added to the profile status register. By adding event codes to the profile status register all events occurred during capture period are stored to the profile buffer at the end of capture period. After storing a value of profile status register together with the meter stands in the profile internal memory space, the meter resets profile status register to the value 0.

Status		Bit	Hex	Dec	Description
None			0x00	0	No event
Device disturbance	ERR	0	0x01	1	A serious error such as a hardware failure or a checksum error has occurred.
Clock battery discharged	CIV	1	0x02	2	The power reserve of the clock has been exhausted. The time is declared as invalid.
Measurement value disturbed	DNV	2	0x04	4	Indicates that the current entry may not be used for billing purposes without further validation because a special event has occurred. e.g. due to time shift or if no values have been recorded during the capture period.
Season changed	DST	3	0x08	8	Indicates that daylight savings is enabled.
Reset cumulation		4	0x10	16	Reserved: The reserved bit is always set to 0
Device clock changed	CAD	5	0x20	32	The bit is set when clock has been adjusted more than the synchronization limit.
Power up	PUP	6	0x40	64	This bit is set to 0. Power up bit can be enable by LP options.
Power down	PDN	7	0x80	128	This bit is set to indicate that an all-phase power failure occurred.

Table 50: Profile status register

M-Bus load profile

For detailed information about the M-Bus load profile, see the chapter *6.3. M-Bus*.

7.3.1. Load profiles options

Access rights for Profile Generic class objects Load Profile 1, Load Profile 2, Data of Billing period 1 and Data of Billing Period 2 can be modified in runtime with dedicated parameter in **Profile access options** (0-0:128.90.0) object. Writing this parameter is only allowed with Password level 3 or higher.

The parameter is implemented as bit organized value (see the Table 51).

Bit	Bit description
0	Load profile attribute access restricted
1	Load profile status enable power up flag
2-7	Reserved for future use

Table 51: Load profile options bit values

7.4. Billing

Billing functionality provides process and storage for managing billing data. There are two billing profile objects implemented in the meter - **Data of billing period 1** (0-0:98.1.0) and **Data of billing period 2** (0-0:98.2.0). Each billing profile has its own set of capture objects defined. When capture method is executed, capture objects values are stored in the billing profile. **MDI reset** / **End of billing period** (0-0:10.0.1) can be executed by invoking via communication channel or internally through the **End of billing period 1 scheduler** (0-0:15.0.0) and **End of billing period 2 scheduler** (0-0:15.1.0).

The following actions for Billing profile 1 are carried out by the meter when script 1 of **MDI reset / End of billing period** (0-0:10.0.1) is executed:

- execute capture method for Billing profile 1,
- reset maximum demand registers,
- reset minimum power factor (value is set to 1),
- increment counter in the **Billing period counter** (1-0:0.1.0) object,
- create event in event log-to-log execution of billing reset.

The following actions for Billing profile 2 are carried out by the meter when script 2 of **MDI reset / End of billing period** (0-0:10.0.1) is executed:

- execute capture method for Billing profile 2.

Two single action schedule objects are dedicated to billing process. Each single action schedule can have up to four time definitions that trigger execution of its associated script. Time definitions can be set as periodic (e.g. every day, every month …) or exact specified date-time.

If clock is set forward or backward over n periodic billing execution times, then only one entry will be generated in billing profile, marked with first time of periodic definition appearing after old time. The event in event log will be generated with the new set time.

If the clock is set forward over **n** exactly specified billing execution date-times, then only one will be generated in billing profile, marked with the nearest time appearing after old time. If billing reset is set to occur while the meter is powered down, billing reset will occur immediately on meter power up. Event in event log will be generated with the timestamp when the meter is powered up. Object **Time stamp of the most recent billing period** (1-0:0.1.2) holds the value of the most recent billing date.

Data of the past billing periods are stored in profile buffer and can be displayed on LCD (normal console type configuration) or can be read out via communication channels, i.e. via optical port or dedicated communication.

Billing profile 1 buffer is source for the previous values, which can be shown on the display. The numbers of displayed previous values are defined as a parameter by the configuration **Previous values readout count** (0-0:128.11.4) object. See the chapter *5.3.3. Previous values on a display*.

NOTE

If more than one execution time is set on the same time/date, then only one billing execution will be registered in the event log and billing counter.

7.4.1. Billing profile

Billing profile is the storage for billing data, captured by execution of billing actions. Billing profile buffer is organized as an array of entries. Each entry is a snapshot of capture object values at the moment of capture time. By default, the first data in billing profile entries time mark in object **Clock** (0-0:1.0.0). Capture time is triggered from single action scheduler.

There are two objects of billing profiles:

- **Data of billing period 1** (0-0:98.1.0)*,
- **Data of billing period 2** (0-0:98.2.0).

* used for previous values on display, see the chapter *5.3.25.3.3. Previous values on a display*

Each billing profile has the capacity of:

- 35 entries with default number of capture objects (5; clock + 4 objects of size 4 bytes);
- 88 entries with minimum number of captured objects (2; clock + 1 object of size 4 bytes);
- 5 entries with maximum number of capture objects (32; clock + 31 objects of size 4 bytes).

The attributes of the **Data of billing period** objects are used in the following way:

Capture objects: up to 32 objects can be set to be captured according to capture period. By default, capture objects are set to:

- 0-0:1.0.0.255, Clock
- 1-0:1.8.1.255, Active energy import, tariff 1
- 1-0:1.8.2.255, Active energy import, tariff 2
- 1-0:1.6.1.255, Maximum demand register – Active energy import, tariff 1
- 1-0:1.6.2.255, Maximum demand register – Active energy import, tariff 2

Capture period: this attribute is set to 0 because records are recorded according to end of billing period. This attribute has also write access rights in unlocked mode.

Sort method: attribute for sorting captured data. It is fixed to FIFO (First in First Out).

Sort object: clock object is used as sort object.

Entries in use: this attribute shows how many recordings have been made and are recorded (captured).

Profile entries: this attribute shows how many recordings are possible in the meter. This number depends on the number of capture objects set and meter type used (ME or MT).

Execute Method *(accessible with the right mouse click on the object name)*

Billing profile has two methods implemented:

- Reset (erases captured values)
- Capture (new records are stored)

NOTE
Billing profile is erased when attribute *capture objects* or *capture period* are set.

7.5. Prepayment

Prepayment functionality allows consumption of up to a remotely preset amount of energy or credits paid in advance. Once no more credits are available, the meter will eventually disconnect the customer from the grid.

A specified pre-paid register counts at a rate equal to the amount of a consumed energy. Customer can revalue the prepay meter remotely. If the total amount of pre-paid cost of the energy is consumed, the meter will activate emergency credit for a certain amount of energy before disconnecting. Customer will be informed if the prepaid amount limit is reached. The meter needs to be revaluated remotely (tokenless).

Emergency credit gives customer possibility to transfer credit also in negative range. When consumption achieves Emergency credit limit, the meter disconnects from the grid until new credit transfer is done.

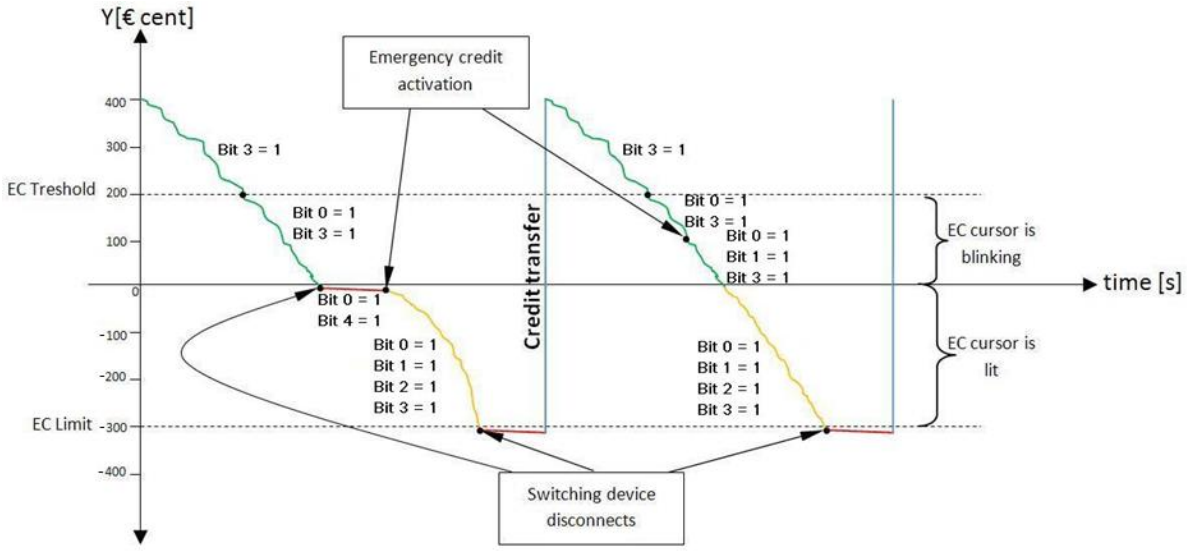


Figure 69: Prepayment function with statuses

Payment mode

The complete prepayment functionality in the meter is activated via **Payment mode** object (0-0:128.60.0). Payment modes are:

- **0** – **Disable prepayment**: credit mode where prepayment function is deactivated
- **1** – **Enable prepayment**: debit mode where prepayment function is activated

Credit transfer

The credit is transferred via virtual token. Virtual token carrier does not require a person to transport credit between the point where the token is loaded onto the token carrier and the point where it is retrieved from the token carrier by the payment meter.

Credit token transfer part of prepayment functionality provides the possibility to transfer new credits into the meter. For this purpose, the virtual token carrier type is used. This means that credits can be transferred over any type of communication interfaces available in the meter by using appropriate communication protocols.

Additional credit can be transferred to the meter by writing an appropriate token protocol data unit into the **Credit transfer** register (0-0:128.60.30).

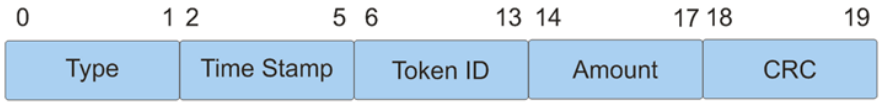


Figure 70: Credit transfer data structure

The meter processes the received token protocol data unit through the phases (see the Figure 71).

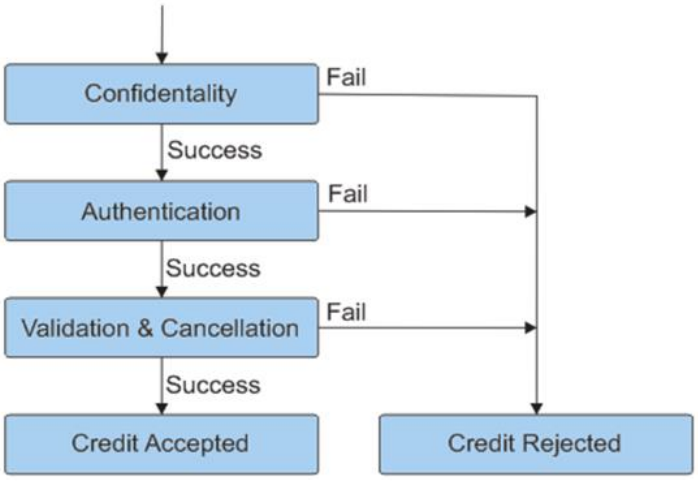


Figure 71: Token protocol data unit processing phases

In the confidentiality phase, the meter decrypts the message by using appropriate encryption/decryption algorithm selected for communication over specific communication interface.

In validation phase, the meter rejects the credit in following cases:

- if credit acceptance could result in Available credit register overflow,
- if timestamp of token is outside the valid time window,
- if token with same ID already exists in internal token buffer.

The valid time window for accepting the credit token is determined by the following margins:

- time window high = current meter time,
- time window low = max (current meter time – 1 year, oldest token time).

When validation phase ends successfully, the meter executes cancellation phase in which the transferred token is stored internally for later validation of future credit token transfers. When all the phases of token protocol data unit processing end successfully, the transferred credit is accepted, resulting in increase of **Available credit** register (0-0:128.60.1) and **Total purchase value** register (0-0:128.60.4) values for the value of amount field in token protocol data unit. Also an event 239 (Prepay Token Enter Success) is logged in standard event log, signalling successful credit transfer (see the Table 53).

When authentication phase fails, the meter responds with error on protocol used for accessing Credit transfer register. When validation phase fails, the meter does not report protocol error but logs an event 240 (Prepay Token Enter Fail) in standard event log (see the Table 53). The transferred token protocol data unit rejected in validation phase can be read back from Credit transfer register for verification. Also an accepted token protocol data unit can be read back the same way.

The amount field in token credit protocol data unit contains the transferred credit. This is the currency value, which is added to the available credit value when credit is accepted. The scaler of the transferred credit is the same as for all the data containing currency values related to prepayment functionality.

Prepayment accounting

The implementation of prepayment accounting functions can be separated on credit and charge functions. The credit functions include:

- token credit function,
- emergency credit function.

Two types of charge functions are implemented:

- consumption-based tariff charges,
- time-based auxiliary charges.

Token credit

Token credit function deals with managing credit registers according to credit token transfer. When credit transfer is accepted the values of Available credit register and Total purchase register are increased for the amount credit transferred.

Emergency credit

The Emergency credit (EC) function is used in situations when Available credit register value approaches or goes under zero. For this purpose, three parameter objects are implemented:

- Emergency credit initial limit is used once after meter installation for the purpose of enabling the customer to make the first buy (or transferring the first credit from the management centre).
- Emergency credit limit defines the credit value, which is available after the value of Available credit register reaches zero and the customer selects the emergency credit.
- Emergency credit threshold defines the positive value of Available credit register at which the meter begins to notify the customer that the credit will expire.

Emergency credit must always be selected by the customer, otherwise the meter disconnects the customer from the grid when Available credit register reaches zero.

7.6. Event logs

Basic principle is shown in a diagram in the Figure 72.

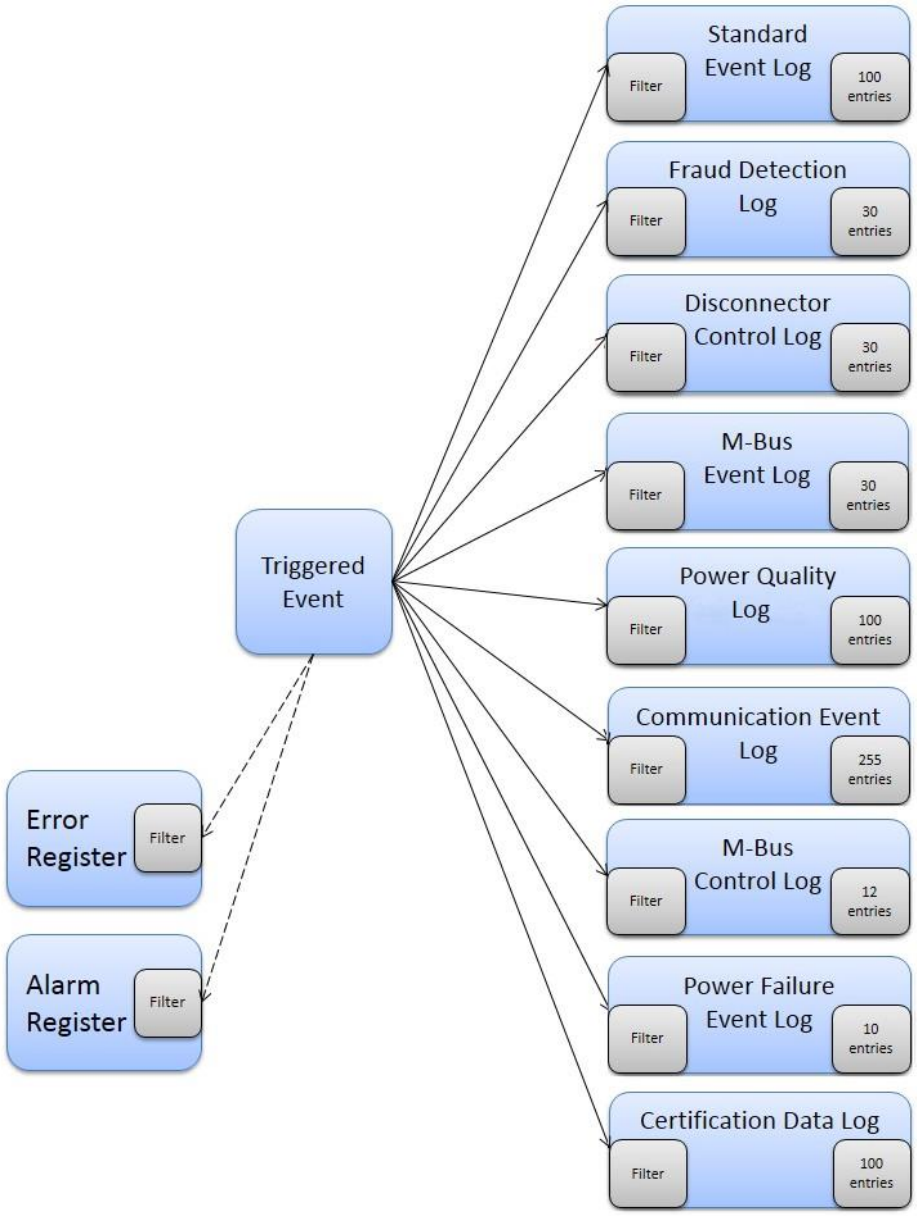


Figure 72: Event handling

Events are generated by the meter itself or by its environment. All these events are logged in several event logs. Every event has a unique code to identify the action, which has triggered it. Every event is assigned to one event log (event filter) and it is only stored there. The Mx382 meter features nine different event logs as described in the Table 52. All logs except the Power failure event log have the same basic structure (timestamp - time of the occurrence of the event and event code).

Event codes are stored in corresponding Event code objects. Each event object holds only the most recent event. The event code object has the value of 0 until the first event is detected/generated by the meter or every time a power-up is performed.

Instances of event code objects are captured in corresponding event logs. Event log objects (except the Certification event log) are organized as FIFO buffers where records are sorted by time. Once the buffer is full, the oldest entry in the buffer is the first to be replaced. The capacity (maximum number of records in a buffer) of the event log objects varies from object to object. Records in the buffer are captured asynchronously, as the events occur.

The meter features the following event log objects (see the Table 52).

Event log object	Logical name	Capacity	Captured objects
Standard event log	0-0:99.98.0	100	0-0:1.0.0 0-0:96.11.0
Fraud detection log	0-0:99.98.1	30	0-0:1.0.0 0-0:96.11.1
Disconnector control log	0-0:99.98.2	30	0-0:1.0.0 0-0:96.11.2
M-Bus event log	0-0:99.98.3	30	0-0:1.0.0 0-0:96.11.3
Power quality log	0-0:99.98.4	100	0-0:1.0.0 0-0:96.11.4
Communication event log	0-0:99.98.5	255	0-0:1.0.0 0-0:96.11.5
M-Bus master control log	0-x:24.5.0 *	12	0-0:1.0.0 0-x:96.11.4 *
Power failure event log	1-0:99.97.0	10	0-0:1.0.0 0-0:96.7.19
Certification data log	1-0:99.99.0	100	0-0:1.0.0 0-0:96.128.0 0-0:96.128.1 0-0:96.128.2

* x =1 to 4

Table 52: Event log objects

7.6.1. Standard event log

Standard event log (0-0:99.98.0) contains all events not recorded in other special event logs, e.g. changes of the clock, changes of the configuration, clearing of profiles, all kind of self-check errors, activation of new parameters, activation of new time of use, etc. **Standard event log** structure consists of timestamp and event code.
The **Event object – Standard event log** object (0-0:96.11.0) holds the code from the last event triggered.
See the Table 53.

IDIS event code	Event name	Event description
1	Power Down	Indicates a complete power down of the device. Please note that this is related to the device and not necessarily to the network.
2	Power Up	Indicates that the device is powered again after a complete power down.
3	DST enabled or disabled	Indicates the regular change from and to daylight saving time. The timestamp shows the time after the change. This event is not set in case of manual clock changes and in case of power failures.
4	Clock adjusted (old date/time)	Indicates that the clock has been adjusted. The date/time that is stored in the event log is the old date/time before adjusting the clock.
5	Clock adjusted (new date/time)	Indicates that the clock has been adjusted. The date/time that is stored in the event log is the new date/time after adjusting the clock.
6	Clock invalid	Indicates that clock may be invalid, i.e. if the power reserve of the clock has exhausted. It is set at power up.
7	Replace Battery	Indicates that the battery must be exchanged due to the expected end of life time (only in meters with battery).
8	Battery voltage low	Indicates that the current battery voltage is low (only in meters with battery).
9	TOU activated	Indicates that the passive TOU has been activated.
10	Error register cleared	Indicates that the error register was cleared.
11	Alarm register cleared	Indicates that the alarm register was cleared.
12	Program memory error	Indicates a physical or a logical error in the program memory.

IDIS event code	Event name	Event description
13	RAM error	Indicates a physical or a logical error in the RAM (Random Access Memory)
14	NV memory error	Indicates a physical or a logical error in the non-volatile memory
15	Watchdog error	Indicates a watch dog reset or a hardware reset of the microcontroller.
16	Measurement system error	Indicates a logical or physical error in the measurement system
17	Firmware ready for activation	Indicates that the new firmware has been successfully downloaded and verified, i.e. it is ready for activation
18	Firmware activated	Indicates that a new firmware has been activated
19	Passive TOU programmed	The passive structures of TOU or a new activation date/time were programmed
47	One or more parameters changed	
48	Global key(s) changed	One or more global keys changed
51	FW verification failed	Indicates the transferred firmware verification failed i.e. cannot be activated.
88	Phase sequence reversal	Indicates wrong mains connection. Usually indicates fraud or wrong installation. For poly phase connection only!
89	Missing neutral	Indicates that the neutral connection from the supplier to the meter is interrupted (but the neutral connection to the load prevails). The phase voltages measured by the meter may differ from their nominal values.
230	Fatal error	Indicates any fatal error length
231	Billing reset	Indicates billing reset
232	Power down phase L1	Indicates power loss / power disconnected on phase L1
233	Power down phase L2	Indicates power loss / power disconnected on phase L2
234	Power down phase L3	Indicates power loss / power disconnected on phase L3
235	Power restored phase L1	Indicates power restored / power connected to phase L1
236	Power restored phase L2	Indicates power restored / power connected to phase L2
237	Power restored phase L3	Indicates power restored / power connected to phase L3
238	No connection timeout	Indicates No connection timeout when there is no communication for 30h
239	Prepay Token Enter Success	Indicates Successful Prepay Token Enter
240	Prepay Token Enter Fail	Indicates Failed Prepay Token Enter
241	Prepay Credit Expired	Indicates Prepay Credit Expiration
242	Prepay Emergency Credit Expired	Indicates Emergency Credit Expiration
243	Prepay Emergency Credit Activated	Indicates Emergency Credit Activation
254	Load profile cleared	Any of the profiles cleared. **NOTE**: If it appears in **Standard Event Log** then any of the E-load profiles was cleared. If the event appears in the **M-Bus Event log** then one of the M-Bus load profiles was cleared.
255	Event log cleared	Indicates that the event log was cleared. This is always the first entry in an event log. It is only stored in the affected event log.

Table 53: List of events in the Standard event log

7.6.2. Fraud detection log

Fraud detection log object (0-0:99.98.1) contains all events related to the detection of fraud attempts, e.g. removal of terminal cover, removal of meter cover, strong DC field detection, access with wrong password, etc. There is a parameter in the **Fraud detection hold-off period** (1-0:96.245.10) object with default 15 minutes (900 s) period between two events (only events detected after 15 min of latest one are recorded). Hold-off period is started at fraud event, which disables another logging of same fraud event for its duration. This prevents filling the fraud detection log too quickly with repeating the same fraud events. The code from the last event triggered holds the **Event object – Fraud detection log** object (0-0:96.11.1). See the Table 54.

IDIS event code	Event name	Event description
40	Terminal cover removed	Indicates that the terminal cover has been removed
42	Strong DC field detected	Indicates that a strong magnetic DC field has been detected.
43	No strong DC field anymore	Indicates that the strong magnetic DC field has disappeared.
44	Meter cover removed	Indicates that the meter cover has been removed.
46	Association authentication failure (n time failed authentication)	Indicates that a user tried to gain LLS access with wrong password (intrusion detect) or HLS access challenge processing failed n-times
49	Decryption or authentication failure (n time failure)	Decryption with currently valid key (global or dedicated) failed to generate a valid APDU or authentication tag
50	Replay attack	Receive frame counter value less or equal to the last successfully received frame counter in the received APDU. Event signalizes as well the situation when the DC has lost the frame counter synchronization.
91	Current reversal *	Indicates unexpected energy export (for devices, which are configured for energy import measurement only).
255	Event log cleared	Indicates that the event log was cleared. This is always the first entry in an event log. It is only stored in the affected event log.

* Event included in IDIS Package 2

Table 54: List of events in the Fraud detection event log

7.6.3. Disconnector control log

Disconnector control log (0-0:99.98.2) contains all events related to the switching device, e.g. connect, disconnect, changing of the switching device threshold. **Disconnect control log** structure contains timestamp and event code. The **Event object – Disconnector control log** object (0-0:96.11.2) holds the code from the last event triggered. These codes along with timestamps are then used in event log.
See the Table 55.

IDIS event code	Event name	Event description
59	Switching device (SD) ready for manual reconnection	Indicates that the SD has been set into the Ready for reconnection state and can be manually reconnected
60	Manual disconnection	Indicates that the SD has been manually disconnected.
61	Manual connection	Indicates that the SD has been manually connected.
62	Remote disconnection	Indicates that the SD has been remotely disconnected.
63	Remote connection	Indicates that the SD has been remotely connected.
64	Local disconnection	Indicates that the SD has been locally disconnected
65	Limiter threshold exceeded	Indicates that the limiter threshold has been exceeded.
66	Limiter threshold OK	Indicates that the monitored value of the limiter dropped below the threshold.
67	Limiter threshold changed	Indicates that the limiter threshold has been changed
68	Disconnect/Reconnect failure	Indicates that the failure of disconnection or reconnection has happened.
69	Local reconnection	Indicates that the SD has been locally re-connected (i.e. via the limiter or current supervision monitors).
70	Supervision monitor 1 threshold exceeded	Indicates that the supervision monitor threshold has been exceeded.
71	Supervision monitor 1 threshold OK	Indicates that the monitored value dropped below the threshold.
72	Supervision monitor 2 threshold exceeded	Indicates that the supervision monitor threshold has been exceeded.
73	Supervision monitor 2 threshold OK	Indicates that the monitored value dropped below the threshold.
74	Supervision monitor 3 threshold exceeded	Indicates that the supervision monitor threshold has been exceeded.
75	Supervision monitor 3 threshold OK	Indicates that the monitored value dropped below the threshold.
255	Event log cleared	Indicates that the event log was cleared. This is always the first entry in an event log. It is only stored in the affected event log.

Table 55: List of events in the Disconnector control log

7.6.4. M-Bus event log

M-Bus event log (0-0:99.98.3) contains errors and alarms related to M-Bus devices (e.g. changes of the clock, communication errors, fraud attempt, etc). The buffer must be filled monotonously, i.e. no irregular entries are allowed. **M-Bus Event Log** structure consists of Timestamp and Event Code. See the Table 56.

IDIS event code	Event name	Event description
100	Comm. error M-Bus Ch. 1	Indicates comm. malfunction when reading the meter connected to Ch.1 of the M-Bus
101	Comm. ok M-Bus Ch.1	Indicates that the communication with the M-Bus meter connected to Ch.1 of the M-Bus is ok again.
102	Replace Battery M-Bus Ch. 1	Indicates that the battery must be exchanged due to the expected end of lifetime.
103	Fraud attempt M-Bus Ch.1	Indicates that a fraud attempt has been registered.
104	Clock adjusted M-Bus Ch. 1	Indicates that the clock has been adjusted.
105	New M-Bus device installed Ch. 1 *	Indicated the meter (M-Bus master) has registered a M-Bus device connected to channel 1 with a new serial number
106	Permanent Error M-Bus channel 1 *	Indicated the meter (M-Bus master) has registered a M-Bus device connected to channel 1 with a new serial number
110	Communication Error M-Bus Ch. 2	Indicates comm. malfunction when reading the meter connected to Ch.2 of the M-Bus
111	Comm. ok M-Bus Ch. 2	Indicates that the communication with the M-Bus meter connected to channel 2 of the M-Bus is ok again.
112	Replace Battery M-Bus Ch. 2	Indicates that the battery must be exchanged due to the expected end of life time.
113	Fraud attempt M-Bus Ch. 2	Indicates that a fraud attempt has been registered.
114	Clock adjusted M-Bus Ch. 2	Indicates that the clock has been adjusted.
115	New M-Bus device installed Ch. 2 *	Indicated the meter (M-Bus master) has registered a M-Bus device connected to channel 2 with a new serial number
116	Permanent Error M-Bus Ch. 2 *	Severe error reported by M-Bus device
120	Comm. Error M-Bus Ch. 3	Indicates comm. malfunction when reading the meter connected to Ch.3 of the M-Bus
121	Comm. ok M-Bus Ch. 3	Indicates that the communication with the M-Bus meter connected to Ch.3 of the M-Bus is ok again.
122	Replace Battery M-Bus Ch. 3	Indicates that the battery must be exchanged due to the expected end of life time.
123	Fraud attempt M-Bus Ch. 3	Indicates that a fraud attempt has been registered.
124	Clock adjusted M-Bus Ch. 3	Indicates that the clock has been adjusted.
125	New M-Bus device installed Ch. 3 *	Indicated the meter (M-Bus master) has registered a M-Bus device connected to channel 3 with a new serial number
126	Permanent Error M-Bus Ch. 3 *	Severe error reported by M-Bus device
130	Comm. Error M-Bus Ch. 4	Indicates comm. malfunction when reading the meter connected to Ch.4 of the M-Bus
131	Comm. ok M-Bus Ch. 4	Indicates that the communication with the M-Bus meter connected to ch.4 of the M-Bus is ok again.
132	Replace Battery M-Bus Ch. 4	Indicates that the battery must be exchanged due to the expected end of lifetime.
133	Fraud attempt M-Bus Ch. 4	Indicates that a fraud attempt has been registered.
134	Clock adjusted M-Bus Ch. 4	Indicates that the clock has been adjusted.
135	New M-Bus device installed Ch. 4 *	Indicated the meter (M-Bus master) has registered a M-Bus device connected to channel 4 with a new serial number
136	Permanent Error M-Bus Ch. 4 *	Severe error reported by M-Bus device
254	Load profile cleared	Any of the profiles cleared. **NOTE**: If it appears in Standard Event Log then any of the E-load profiles was cleared. If the event appears in the M-Bus Event log then one of the M-Bus load profiles was cleared.
255	Event log cleared	Indicates that the event log was cleared. This is always the first entry in an event log. It is only stored in the affected event log.

* Events included in IDIS Package 2

Table 56: List of events in the M-Bus event log

7.6.5. Power quality log

Power quality log object (0-0:99.98.4) contains all events related to power quality. **Power quality event log** structure consists of timestamp and event code. The **Event object – Power quality log** object (0-0:96.11.4) holds the code from the last event triggered. See the Table 57.

IDIS event code	Event name	Event description
76	Undervoltage L1	Indicates undervoltage on at least L1 phase was detected.
77	Undervoltage L2	Indicates undervoltage on at least L2 phase was detected.
78	Undervoltage L3	Indicates undervoltage on at least L3 phase was detected.
79	Overvoltage L1	Indicates overvoltage on at least L1 phase was detected.
80	Overvoltage L2	Indicates overvoltage on at least L2 phase was detected.
81	Overvoltage L3	Indicates overvoltage on at least L3 phase was detected.
82	Missing voltage L1	Indicates that the voltage on at least L1 phase has fallen below the U_{min} threshold for longer than the time delay.
83	Missing voltage L2	Indicates that the voltage on at least L1 phase has fallen below the U_{min} threshold for longer than the time delay.
84	Missing voltage L3	Indicates that the voltage on at least L1 phase has fallen below the U_{min} threshold for longer than the time delay.
85	Voltage L1 normal	Indicates that the mains voltage is in normal limits again, e.g. after overvoltage.
86	Voltage L2 normal	Indicates that the mains voltage is in normal limits again, e.g. after overvoltage.
87	Voltage L3 normal	Indicates that the mains voltage is in normal limits again, e.g. after overvoltage.
90	Phase Asymmetry *	Indicates phase asymmetry due to large unbalance of loads connected
92	Bad Voltage Quality L1 *	Indicates that during each period of one week 95 % of the 10 min mean r.m.s, values of the supply voltage are within the range of Un+/- 10 % and all 10 mín mean r.m.s. values of the supply voltage shall be within the range of Un + 10%/-15%. (acc. EN50160:2010, section 4.2.2)
93	Bad Voltage Quality L2 *	Indicates that during each period of one week 95 % of the 10 min mean r.m.s, values of the supply voltage are within the range of Un+/- 10 % and all 10 mín mean r.m.s. values of the supply voltage shall be within the range of Un + 10%/-15%. (acc. EN50160:2010, section 4.2.2)
94	Bad Voltage Quality L3 *	Indicates that during each period of one week 95 % of the 10 min mean r.m.s, values of the supply voltage are within the range of Un+/- 10 % and all 10 mín mean r.m.s. values of the supply voltage shall be within the range of Un + 10%/-15%. (acc. EN50160:2010, section 4.2.2)
255	Event log cleared	Indicates that the event log was cleared. This is always the first entry in an event log. It is only stored in the affected event log.

* Events included in IDIS Package 2

Table 57: List of events in the Power quality event log

7.6.6. Communication event log

Communication event log (0-0:99.98.5) object contains all events related to communication, e.g. no connection timeout, modem related events (modem reset, initialization failure, SIM failure, GSM/GPRS registration failure…), auto answer. **Communication event log** structure consists of timestamp and event code.

Description of the attributes and methods for this object is the same as for standard **Event object – Communication event log** object (0-0:96.11.5). It holds the code from the last event triggered. These codes along with timestamps are then used in event log. See the Table 58.

IDIS event code	Event name	Event description
140	No connection timeout	Indicates No connection timeout when there is no communication for 30h
141	Modem initialization failure	Modem's response to initialization AT commands(s) is invalid or ERROR or no response received
142	SIM card failure	SIM card is not inserted or is not recognized
143	SIM card ok	SIM card has been correctly detected
144	GSM registration failure	Modem's registration on GSM network is not successful
145	GPRS registration failure	Modem's registration on GPRS network is not successful

IDIS event code	Event name	Event description
146	PDP context established	PDP context is established
147	PDP context destroyed	PDP context is destroyed
148	PDP context failure	No valid PDP context(s) retrieved
149	Modem SW reset	Modem software restart
150	Modem HW reset	Modem hardware restart
151	GSM outgoing connection	Modem is successfully connected, initiated by an outgoing call
152	GSM incoming connection	Modem is successfully connected, initiated by an incoming call
153	GSM hang-up	Modem is disconnected
154	Diagnostic failure	Modem's response to diagnostic AT command(s) ("+CPIN?", "+CSQ", "+CREG?", "+CGREG?", "+COPS?", "+CGACT?", "+CPMS?") is invalid or ERROR or no response received
155	User initialization failure	Modem's initialization AT command(s) – specified in attribute 3 of the modem configuration object – is invalid. Error message or no response from the modem
156	Signal quality low	Signal strength to low, not known or not detectable
157	Auto Answer number of calls exceeded	Number of calls has exceeded
158	Local communication attempt	Indicates a successful communication on any local port has been initiated

Table 58: List of events in the Communication event log

7.6.7. M-Bus master control logs

The **M-Bus master control log** (0-x:24.5.0), where x represent M-Bus channel from 1 to 4, indicates both states (connected, disconnected) of disconnector and valve alarm registrations. See the Table 59.

IDIS event code	Event name	Event description
160	Manual disconnection M-Bus Ch.1	Indicates that the disconnector has been manually disconnected
161	Manual connection M-Bus Ch.1	Indicates that the disconnector has been manually connected
162	Remote disconnection M-Bus Ch.1	Indicates that the disconnector has been remotely disconnected
163	Remote connection M-Bus Ch.1	Indicates that the disconnector has been remotely connected
164	Valve alarm M-Bus Ch. 1	Indicates that a valve alarm has been registered
165	Local disconnection M-Bus Ch. 1*	Indicates that the disconnector has been locally disconnected
166	Local connection M-Bus Ch. 1 *	Indicates that the disconnector has been locally connected
170	Manual disconnection M-Bus Ch.2	Indicates that the disconnector has been manually disconnected
171	Manual connection M-Bus Ch.2	Indicates that the disconnector has been manually connected
172	Remote disconnection M-Bus Ch.2	Indicates that the disconnector has been remotely disconnected
173	Remote connection M-Bus Ch.2	Indicates that the disconnector has been remotely connected
174	Valve alarm M-Bus Ch. 2	Indicates that a valve alarm has been registered
175	Local disconnection M-Bus Ch. 2 *	Indicates that the disconnector has been locally disconnected
176	Local connection M-Bus Ch. 2 *	Indicates that the disconnector has been locally connected
180	Manual disconnection M-Bus Ch.3	Indicates that the disconnector has been manually disconnected
181	Manual connection M-Bus Ch.3	Indicates that the disconnector has been manually connected
182	Remote disconnection M-Bus Ch.3	Indicates that the disconnector has been remotely disconnected
183	Remote connection M-Bus Ch.3	Indicates that the disconnector has been remotely connected
184	Valve alarm M-Bus Ch.3	Indicates that a valve alarm has been registered
185	Local disconnection M-Bus Ch. 3 *	Indicates that the disconnector has been locally disconnected
186	Local connection M-Bus Ch. 3 *	Indicates that the disconnector has been locally connected
190	Manual disconnection M-Bus Ch.4	Indicates that the disconnector has been manually disconnected
191	Manual connection M-Bus Ch.4	Indicates that the disconnector has been manually connected
192	Remote disconnection M-Bus Ch.4	Indicates that the disconnector has been remotely disconnected
193	Remote connection M-Bus Ch.4	Indicates that the disconnector has been remotely connected
194	Valve alarm M-Bus Ch.4	Indicates that a valve alarm has been registered
195	Local disconnection M-Bus Ch. 4 *	Indicates that the disconnector has been locally disconnected
196	Local connection M-Bus Ch. 4 *	Indicates that the disconnector has been locally connected
255	Event log cleared	Indicates that the event log was cleared. This is always the first entry in an event log. It is only stored in the affected event log.

* Events included in IDIS Package 2

Table 59: List of events in the M-Bus control log

7.6.8. Power failure event log

Power failure event log (1-0:99.97.0) contains all events related to long power outages, i.e. start and end of a long power outage.

Attributes	Data type	Class ID	Code	Access	Min.	Max.	Default
1. Logical name	Octet_string	7	1-0:99.97.0	R			
3. Capture Objects	Array			R	2	2	2
4. Capture Period	Unsigned32			R/(W)	0	86400	0
5. Sort Method	Enum			R	1	1	1-FIFO
6. Sort Object	Structure			R			clock
7. Entries in use	Unsigned32			R	0	10	0
8. Profile Entries	Unsigned32			R	0	10	10
Specific Methods							
1. Reset							
2. Capture							

Table 60: Power Failure Event Log

It is a simplified version of the full power quality event log storing just the timestamp and the duration of last long power failure in any phase. Timestamp represents the end of power failure. Object “Duration of last long power failure in any phase” stores only the duration of the most recent power outage. Time thresholds for long power failure is defined with **Time threshold for long power failure** object.

7.6.9. Certification data log

Certification data log (1-0:99.99.0) is special log, used to log modifications of critical parameters which influence measurement values. The basic structure of the data log contains the timestamp and three additional objects:

- **Last modified secure parameter identifier** (0-0:96.128.0),
- **Last modified secure parameter old value** (0-0:96.128.1)
- **Last modified secure parameter new value** (0-0:96.128.2).

Last modified secure parameter identifier contains the logical name of the most recently modified critical measurement parameter object. **Last modified secure parameter old value** and the **Last modified secure parameter new value** contain the last modified object’s previous and newly set values.

Attributes	Data type	Class ID	Code	Access	Min.	Max.	Default
1. logical_name	octet_string	1	0-0:96.128.0	R			
2. value	octet_string			R			

Table 61: Last Modified Secure Parameter Identifier

Attributes	Data type	Class ID	Code	Access	Min.	Max.	Default
1. logical_name	octet_string	1	0-0:96.128.1	R			
2. value	DoubleLongUnsigned			R			

Table 62: Last Modified Secure Parameter Old Value

Attributes	Data type	Class ID	Code	Access	Min.	Max.	Default
1. logical_name	octet_string	1	0-0:96.128.2	R			
2. value	DoubleLongUnsigned			R			

Table 63: Last Modified Secure Parameter New Value

Capture to this log is done when one of the critical measurement parameters changes. In this case, all the needed information (logical name, old value and new value) are stored in dedicated objects first and then captured into certification data log.

The following critical parameters (captured in objects) are being monitored (see the Table 64).

Object	OBIS code
Active energy, metrological LED	(1-0:0.3.0)
Reactive energy, metrological LED	(1-0:0.3.1)
Apparent energy, metrological LED	(1-0:0.3.2)
Transformer ratio – current (numerator)	(1-0:0.4.2)
Transformer ratio – current denominator)	(1-0:0.4.5)
Measurement period 1, for average value 1	(1-0:0.8.0)
Active energy, output pulse meter constant [Imp/kWh]	(1-0:0.3.3)
Reactive energy, output pulse meter constant [Imp/kvarh]	(1-0:0.3.4)
Apparent energy, output pulse meter constant [Imp/kVAh]	(1-0:0.3.5)
Nominal voltage	(1-0:0.6.0)

Table 64: Monitored critical parameters

The capacity of the Certification data log is set to 100 entries.

NOTE

When **Certification data log** is full, the critical measurement objects can no longer be changed! All further changes to critical parameters are rejected. The **Certification data log** cannot be erased.

7.7. Alarms

When some special events occur in the meter, internal alarm is generated in the meter, which can be sent to the central access system. The alarm parameters are predefined. The priority levels of alarms are adjustable. Alarms are then registered and handled by the utility head end system (HES).

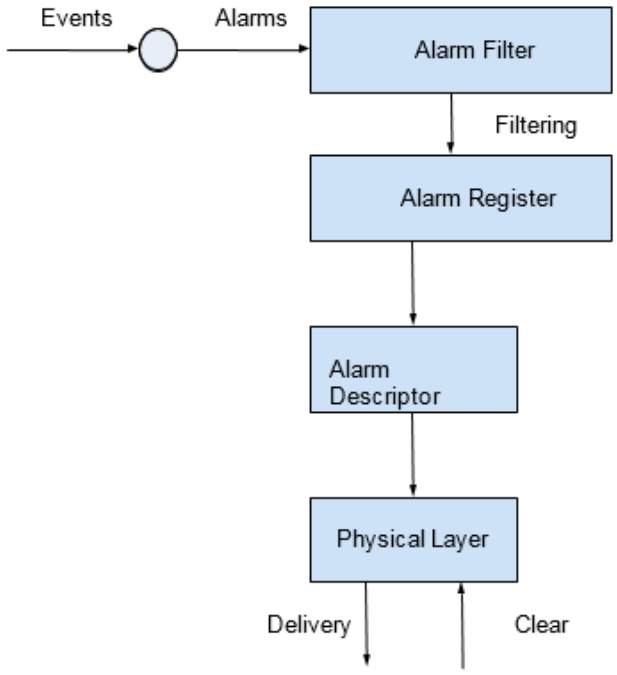


Figure 73: Alarm reporting process

Each bit in the alarm register represents a different alarm. If any bit is set, corresponding alarm was recorded. Value of the alarm register is a 32-bit value of all active and inactive alarms. Depending on the capabilities of the HES and the utility policy, it is possible to mask unwanted alarms through the alarm filter.

The Table 65 and the Table 66 represents two sets of alarm codes.

Bit	Alarm	Description
0	Clock invalid	Current clock is compared with internal clock structure and if there is any deviation the bit is set.
1	Replace battery	Clock battery (only meters with battery) or backup capacitor is discharged.
2	Unused	
3	Unused	
4	Unused	
5	Unused	
6	Unused	
7	Unused	
8	Program memory error	Set whenever a program memory error bit in error register is set.
9	RAM error	Set whenever a RAM error bit in error register is set.
10	NV memory error	Set whenever a NV memory error bit in error register is set.
11	Measurement system error	Set whenever a measurement system error bit in error register is set.
12	Watchdog error	Set whenever a watchdog error bit in error register is set.
13	Fraud attempt	Set when fraud attempt is detected.
14	Unused	
15	Unused	
16	Comm. error M-Bus Ch1	M-Bus device connected to the channel 1 does not respond.
17	Comm. error M-Bus Ch2	M-Bus device connected to the channel 2 does not respond.
18	Comm. error M-Bus Ch3	M-Bus device connected to the channel 3 does not respond.
19	Comm. error M-Bus Ch4	M-Bus device connected to the channel 4 does not respond.
20	Fraud attempt M-Bus Ch1	Alarm is set when M-Bus device connected to the Ch. 1 reports a fraud attempt.
21	Fraud attempt M-Bus Ch2	Alarm is set when M-Bus device connected to the Ch. 2 reports a fraud attempt.
22	Fraud attempt M-Bus Ch3	Alarm is set when M-Bus device connected to the Ch. 3 reports a fraud attempt.
23	Fraud attempt M-Bus Ch4	Alarm is set when M-Bus device connected to the Ch. 4 reports a fraud attempt.
24	Permanent error M-Bus Ch1	Alarm is set when M-Bus device connected to the Ch. 1 reports a permanent error.
25	Permanent error M-Bus Ch2	Alarm is set when M-Bus device connected to the Ch. 2 reports a permanent error.
26	Permanent error M-Bus Ch3	Alarm is set when M-Bus device connected to the Ch. 3 reports a permanent error.
27	Permanent error M-Bus Ch4	Alarm is set when M-Bus device connected to the Ch. 4 reports a permanent error.
28	Battery low on M-Bus Ch1	Alarm is set when M-Bus device connected to the Ch. 1 reports a battery low on device.
29	Battery low on M-Bus Ch2	Alarm is set when M-Bus device connected to the Ch. 2 reports a battery low on device.
30	Battery low on M-Bus Ch3	Alarm is set when M-Bus device connected to the Ch. 3 reports a battery low on device.
31	Battery low on M-Bus Ch4	Alarm is set when M-Bus device connected to the Ch. 4 reports a battery low on device.

Table 65: Alarm 1 codes

NOTE

When the error *Replace battery* occurs in the meter, equipped with the Lithium battery, the meter must be replaced with new one. In case when the meter is equipped with the SuperCap, it must be connected to the power and the time in the meter must be properly set.

Bit	Alarm	Description
0	Total Power Failure	Set when power-down on meter occurs.
1	Power Resume	Set when meter power returns.
2	Voltage Phase Failure L1	Set when voltage on at least L1 phase has fallen below the Umin threshold for longer than time delay.
3	Voltage Phase Failure L2	Set when voltage on at least L2 phase has fallen below the Umin threshold for longer than time delay.
4	Voltage Phase Failure L3	Set when voltage on at least L3 phase has fallen below the Umin threshold for longer than time delay.
5	Voltage Phase Resume L1	Set when the mains voltage on L1 is in normal limits again.

Bit	Alarm	Description
6	Voltage Phase Resume L2	Set when the mains voltage on L2 is in normal limits again.
7	Voltage Phase Resume L3	Set when the mains voltage on L3 is in normal limits again.
8	Missing Neutral	Set when the neutral connection from the supplier to the meter is interrupted.
9	Phase Asymmetry	Set when large unbalance loads is present
10	Current Reversal	Set when unexpected energy export is present (for energy import configured devices only).
11	Wrong Phase Sequence	Set when wrong mains connection or fraud (three-phase meters only).
12	Unexpected Consumption	Set when consumption is detected on at least one phase when disconnector has been disconnected.
13	Key Exchanged	Set when one or more global keys changed.
14	Bad Voltage Quality L1	Set when L1 voltage is not within ranges for defined period of time (see EN50160:2010, section 4.2.2).
15	Bad Voltage Quality L2	Set when L2 voltage is not within ranges for defined period of time (see EN50160:2010, section 4.2.2).
16	Bad Voltage Quality L3	Set when L3 voltage is not within ranges for defined period of time (see EN50160:2010, section 4.2.2).
17	External Alert	Set when signal is detected on meter's INPUT terminal.
18	Local Communication Attempt	Set when communication on any local port is detected (i.e. unauthorized access)
19	New M-Bus Device Installed Ch1	Set when new M-Bus device is registered on the Ch1 with new serial number.
20	New M-Bus Device Installed Ch2	Set when new M-Bus device is registered on the Ch2 with new serial number.
21	New M-Bus Device Installed Ch3	Set when new M-Bus device is registered on the Ch3 with new serial number.
22	New M-Bus Device Installed Ch4	Set when new M-Bus device is registered on the Ch4 with new serial number.
23	Missing Neutral OFF*	Set after condition for Missing Neutral alarm is OFF.
24	Phase Asymmetry OFF*	Set after condition for Phase Asymmetry alarm is OFF.
25	Unused	
26	Unused	
27	M-Bus Valve Alarm Ch1	Set when ALARM STATUS bit is received from device on Ch1.
28	M-Bus Valve Alarm Ch2	Set when ALARM STATUS bit is received from device on Ch2.
29	M-Bus Valve Alarm Ch3	Set when ALARM STATUS bit is received from device on Ch3.
30	M-Bus Valve Alarm Ch4	Set when ALARM STATUS bit is received from device on Ch4.
31	Disconnect/Reconnect Failure	Set when disconnector failed to connect/disconnect.

* valid only when for the asymmetrical voltage and the neutral fault the optional methods are selected (see the chapters 0 and 7.16.1.7)

Table 66: Alarm 2 codes (IDIS P2)

7.8. RTC backup

Depending on customer needs meters have one option of power storage devices:

- SuperCap or
- Lithium battery

Power storage device guaranty operation of Real Time Clock and Tamper functionality during power loss.

The SuperCap (super capacitor) enables operation for 7 days, if meter is previously charged for 24 h continuously at the nominal voltage.

The Lithium battery has 20 years lifetime and provides enough energy to enable 10 years operation.

The attribute in the **Battery use time counter** (0-0:96.6.0) object shows battery use time, which is present in hours on the LCD. The value is a sum of meter power down and power up time.

The attribute in the **Battery estimated remaining use time counter** (0-0:96.6.6) object shows remaining battery use time. It measures power time length and subtracts it from battery default lifetime (determined according to datasheets and tests – approx. 20 years).

NOTE
When the battery is not implemented in the meter (SuperCap use), this object shows 0 value.

NOTE
Data referred to the SuperCap and the Lithium battery is valid for the ambient temperature 25 °C.
When the temperature is higher or lower than the ambient temperature, the SuperCap or the Lithium battery capacity is lowered. Therefore, 7 days of the SuperCap or 10 years of the Lithium battery operation is not guaranteed.

7.8.1. Time

Time in the meter is defined with local time/date, time zone and daylight savings time (DST). Time and date data format contains the meter's local date and time, its deviation to UTC (Coordinated Universal Time) in minutes and the status, which shows if DST is active or not. For providing the local date and time information (year, month, day, day in a week, hour, minute, second and lap year) the Real Time Clock (RTC) integrated circuit is built into the meter.

OCTET1	OCTET2	OCTET3	OCTET4	OCTET5	OCTET6	OCTET7	OCTET8	OCTET9	OCTET10	OCTET11	OCTET12
YYYY		MM	DD	WD	hh	mm	ss	hd	dddd		CS
Year		Month	Day	Week Day	Hour	Minute	Second	Hund-redths	Deviation		Clock Status

Figure 74: Time and Date Data Format

Daylight saving begin/end defines the local switch date and time when the local time has to be deviated from the normal time. Daylight savings deviation contains the number of minutes by which the deviation in generalized time must be corrected when daylight savings begin. Deviation (in minutes) shows the difference from GMT (Greenwich Mean Time) and clock status active / inactive DST.

Local date and time are represented on the meter display like this:

- Time: hh:mm:ss (hours:minutes:seconds).
- Date: yy.mm.dd (year.month.day),
  dd.mm.yy (day.month.year).

The easiest way and also, the most common way to set local time and date is via MeterView application.
If the time in the meter deviates from the system time, it causes the synchronisation of the time in the meter. Clock shifting is not registered in the meter as time shift event, if the deviation is shorter than the parameter Clock time shift limit (s). Otherwise, the meter records the synchronisation as time setting.

RTC in the meter can operate either in normal or in test mode. Test mode operation is intended mostly for digital calibration process.

7.8.1.1. Time management

Whenever the time in the meter is changed, it comes to one of two possible events – time change or time synchronization. Time threshold is defined by **Clock time shift limit** object (1-0:0.9.11).

Time synchronization occurs whenever the difference between new and old time does not exceed certain threshold. For demand registers, one threshold is time set threshold. The time shift occurs when the time difference is smaller than 1% of respective measurement period, but not longer than 9 seconds (VDEW).

Time synchronization event has no effect on demand registers, because time change is too small. Nevertheless, if more than one time synchronization per measurement period occurs, every second synchronization is treated as appropriate time change (second time synchronization forward/backward is treated as time change forward/backward). If the above-mentioned thresholds are exceeded, time change is treated by the meter.

7.9. Errors

The meter uses its automatic supervision mechanism to detect and log different types of events related to meter operation. These events can be a part of meter's internal functionality or can occur due to changes in the meter's environment. When an event, which indicates a malfunction in the meter operation, is triggered, the appropriate flag in the error register is set.

Once a flag in the **Error register** (0-0:97.97.0) is set, it remains active even after the corresponding error condition has disappeared. The error register has to be cleared manually (using supported communication interfaces). If, after the flag in the error register has been cleared, the corresponding error condition still remains, the flag in the error register is reset by the meter.

During operation, the meter performs tests of individual functions. In case of an error, it is represented with corresponding error bit in the error object register and FF flag on the LCD display is set. The error object value register is 32 bits long and is organized in 4 groups of errors: Memory errors, Communication errors, Clock errors and Control errors.

Mx382 meters contain two sets of error registers. See the Table 67 and the Table 68.

Bit	Error	Description
0	Clock invalid	Clock is invalid.
1	Replace battery	Clock battery (only meters with battery) or backup capacitor is discharged
2-7	Unused	/
8	Program memory error	Indicates error in the meters program space (internal flash memory) when the behaviour of meter is unpredictable and the meter should be replaced. The results stored in the meter should be inspected and validated.
9	RAM error	Error detected in RAM (data) memory. The meter can operate irregularly.
10	NV memory error	Error detected in non-volatile memory. The meter can operate irregularly.
11	Measurement system error	Error detected in measurement system. The measurement could be inaccurate.
12	Watchdog error *	Meter has been restarted by watchdog circuitry.
13-15	Unused	/
16	Communication error M-Bus channel 1	Communication with M-Bus device on channel 1 failed.
17	Communication error M-Bus channel 2	Communication with M-Bus device on channel 2 failed.
18	Communication error M-Bus channel 3	Communication with M-Bus device on channel 3 failed.
19	Communication error M-Bus channel 4	Communication with M-Bus device on channel 4 failed.
20-31	Unused	/

* At least 10 resets need to occur, before Watchdog error bit is set.

Table 67: IDIS error codes register

NOTE

When the error *Replace battery* occurs in the meter, equipped with the Lithium battery, the meter must be replaced with new one. In case of the meter, equipped with the SuperCap, the meter must be connected to the power and the time in the meter must be properly set.

Bit	Error	Description
0-7	Unused	/
8	ROM checksum error	Error in the meter program space detected.
9	Backup data checksum	Checksum error in backup data.
10	Parameters checksum	Checksum error in parameter storage.
11	Profile checksum	Checksum error in profile.
12	Event log checksum	Checksum error in event log.
13	RAM checksum	Checksum error in RAM memory.
14-15	Unused	/
16	RAM error	Error detected in RAM (data) memory. The meter can operate irregularly.
17	FRAM (Ferroelectric Random Access Memory) memory error	Error detected in non-volatile memory. The meter can operate irregularly
18	Measurement error	Measurement error detected.

19	RTC error	RTC error detected.
20-21	Unused	/
22	Communication error	Communication error detected.
23	Display error	Display error detected.
24	Battery discharged	Clock battery or backup capacitor is discharged.
25	Invalid time	Clock is invalid.
26-31	Unused	/

Table 68: IE error codes register

7.9.1. Error filter

Depending on the capabilities of the system and the policy of the utility, not all possible errors are desired. Therefore, the error filter object can be programmed to mask out unwanted errors in **Error register** (0-0:97.97.0). To mask out unwanted errors the corresponding bit in the error filter should be set to logical 1.

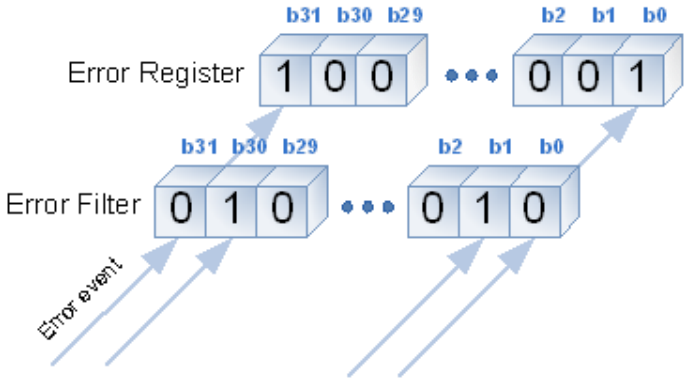


Figure 75: Error filtering

With error display, filter errors can be filtered out on display **FF** flag. In order to filter out the right error the corresponding bit in the error display filter should be set to logical 1.

7.9.2. Error types

Errors recorded in the **Error register** (0-0:97.97.0) can be grouped into following categories:

Clock errors

- RTC value is compared with the internal clock structure and checks for any deviation and possible errors (*Clock invalid*).
- The state of a battery (if meter is equipped with battery) or backup super capacitor is continuously monitored for a valid voltage level (*Replace battery*).

Memory errors

- Program memory is checked by integrity of program code stored, which is signed by the MD5 algorithm during build time (*Program memory error*).
- During initialization process of the RAM, memory space check is performed (*RAM error*).
- Non-volatile memory is checked on meter power-up initialization and then periodically monitored for valid data consistency on stored data (internal parameters, profile data, etc.) (*NV memory error*).

Measurement system error

- Checking of undisturbed operation and accuracy of the meter, to certain extend, performs a meter by itself. If any error is detected, meter reports it by setting Measurement System Error flag (*Measurement system error*).

Control errors

- The main processor is monitored by an external watchdog circuit. If there is no signal within short time period from main processor, external circuit resets the main processor (*Watchdog error*).

Communication errors

- Communication between meter and M-Bus slave device is checked for a valid respond and a valid data structure on data link layer (*Communication error M-bus channel 1-4*).

7.10. Activity calendar and TOU registration

Tariff program is implemented with set of objects that are used to configure different seasons or weekly and daily programs, to define which tariff should be active. Also, different actions can be performed with tariff switching like for example registering energy values in different tariffs or switching on/off bi-stable relay. Graphical tariff program illustration can be seen in the Figure 76.

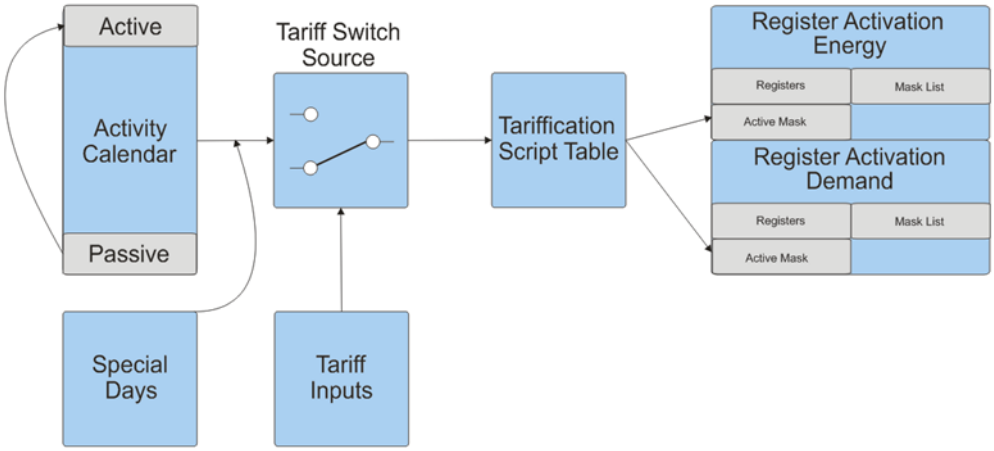


Figure 76: Graphical tariff program

TOU (time of use) capabilities:

- Up to 8 tariffs,
- Up to 16 masks for configuring different combinations of tariff registers,
- Up to 12 seasons tariff programs,
- Up to 12 week tariff programs,
- Up to 12 day tariff programs,
- Up to 16 actions per day tariff program,
- Up to 64 special day date definitions.

Possible ways of tariff switching are:

- separate energy and demand tariff switching and
- tariff switching via internal RTC (by IEC 61038).

7.10.1. Activity calendar

Activity calendar is time of use (TOU) object for tariff control. It allows modelling and handling of various tariff structures in the meter. It is used to store energy and demand according to tariff rate schedule. Scheduled actions are defined inside the meter. They follow the classical way of calendar-based schedules by defining seasons, weeks and days. After a power failure, only the last action missed from Activity calendar is executed (delayed). This is to ensure proper tariff after power up.

Activity calendar consists of two calendars, active and passive, and an attribute for activation of passive calendar. Changes can be made only to passive calendar, which has to be activated to become active calendar. Each calendar has the following attributes:

- Calendar name is an identifier, which describes calendar parameter set.
- Season profile can be divided into 12 periods (seasons), during which different week tables are applicable.
- Week profile table determines the day profile table applicable for particular weekday. 12 week tables are available – one week profile per season. Since weekday tables are only divided into days, Monday to Sunday without time data, they are repeated every week while they are valid according to season profile.
- Day profile table - up to 12-day profile tables are available in the meter to cover weekdays and special days. Day profile tables are divided into day actions, which define individual tariff for energy and power. Each of these day actions is defined by the entry of start time. Up to 16 daily actions (switching points) can be defined per one-day profile table.

New tariff program structure have to be entered to passive calendar and changeover time and date are to be entered to attribute activate passive calendar time. On entered time and date content of active calendar will be replaced by tariff structure stored in the passive calendar. Immediate activation can be done by setting the activation date to the current date or with invoking the method Activate passive calendar.

Special day object is used for defining dates with special tariff programs. Each entry in special days object contains date on which special day is used and the ID of the day. ID is a reference to one-day definition in day profile table of activity calendar. In the meter, one activity calendar object and one special days object are implemented. With these objects, all the tariff rules (for energy and demand) must be defined. Up to 64 special days can be defined in the meter as fixed dates, which occur only once or as periodic days.

The registers, of which values should be recorded and stored, are defined in the register activation object. Selection of registers depends on meter type and configuration. It is defined in the meter which registers are available in the meter. Each register has its own index number, which identifies the register to be selected. There are separate energy and maximum demand objects where data to register can be set. Energy or demand objects can therefore be set separately with 16 different masks.

Energy register assignment includes all 88 rated energy objects from the meter, while maximum demand register assignment includes all 56 rated maximum demand objects from the meter.

7.10.2. Tariff program

Tariff program configures different seasons or weekly and daily programs to define, which certain tariffs should be active. Different actions can be performed with tariff switching like registering energy values in different tariffs or switching on and off the bi-stable relay.

NOTE

For effective use of functionalities, the meter must be properly configured.

7.10.3. Tariff synchronization

Tariff changeover in the meter can be synchronized with measurement period or not. If not, the tariff change is asynchronous by the internal tariffication scheme via activity calendar. If tariff switching must be synchronous with the measuring period, activity calendar must be set up in such a way that this is achieved.

NOTE
For effective use of functionalities, the meter must be properly configured.

7.10.4. Tariffication script table

Tariffication script table (0-0:10.0.100) object is used to provide a way for activating different masks of register activation objects (energy or demand). Tariffication script table in meter supports up to 16 scripts to be defined. Each script can execute up to four actions.

7.10.5. Tariff switch source

Tariff triggering is determined by the **Tariff switch source** (0-0:128.10.0) object with next modes:

- on tariff inputs (mode 0),
- on internal tariff program (mode 1),
- on internal tariff program and manual request (mode 4).

7.10.6. Manual tariffication script activation

Manual tariffication script activation (0-0:96.14.11) activate script from tariffication script table.

By setting the object (manual tariffication script activation) attribute to value x, script x is executed immediately and value of attribute is cleared. Active tariffs changed as defined in executed script.

Active tariffs remain unchanged until next script is executed by internal tariff program (activity calendar) or another manual request.

To enable manual tariffication, set **Tariff switch source** (0-0:128.10.0) object to mode 4 – Internal tariff program and manual request. However, tariff program (activity calendar) must be defined.

7.11. Switching device

Plug-in (only for direct connected MT382 meters) switching device is used for remote disconnection and reconnection of electric network to individual customers (see the Figure 77). Control can be performed:

- locally (from the meter) or
- from a remote control centre.

Switching device options, selected by the **Switching device type** (0-0:128.30.20) object, are:

- 0 – none (disabled actions on switching device),
- 1 – circuit breaker OM31,
- 4 – Relay driven (external disconnect unit driven with relay) or
- 5 – Relay pulse driven (external disconnect unit driven with pulse generated by relay).

For the MT382-D1 meter the switching device has one screw per terminal, at the MT382-D2 meter it has two screws per terminal.

At transformer connected MT382 meters the relay can be configured as a disconnector functionality, which can drive external transformer switching device (option 4).

ME382 meters have built-in switching device.

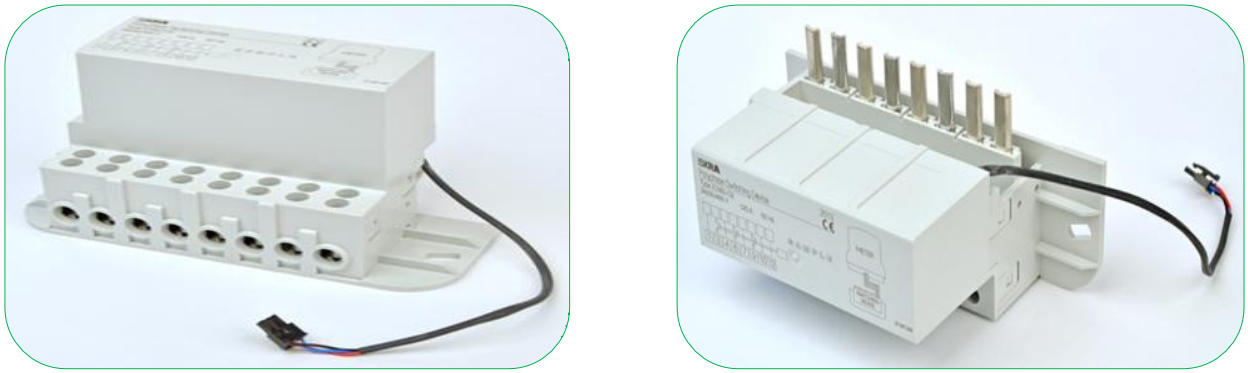


Figure 77: Example of switching device for MT382 (left: top view; right: front view)

NOTE

If switching device type is set to 0 (none), transitions on **Disconnect control object** (0-0:96.3.10) are not possible and the switching device is in a connected state.

7.11.1. Switching device type designation

Z	O										Switching device
		3									Three-phase switching device
			5								Direct control from the meter
				0							Type of housing
					—						
						D					For direct connected meter
							1				Terminal block 85 A
							2				Terminal block 100 A

Table 69: Type designation for ZO350-D1/D2

Figure 78: MT382 meter with switching device

Disconnect and reconnect can be requested:

- remotely via communication channel (remote disconnect, remote reconnect),
- manually using a **Scroll** button (manual disconnect, manual reconnect) or
- locally by a function of the meter such as limiter, register monitor or prepayment (local disconnect, local reconnect).

For state diagram and the possible state transitions, see chapter *12.1. Annex 1: Relay, SD and M-Bus disconnect states and transitions*.

NOTE
The switching device cannot be in use as main network switch or fuse.

7.11.2. Disconnect control

Connection and disconnection of switching device on the customer location is defined in **Disconnect control** object (0-0:96.3.10). There are 3 possible states of the switching device:

- *disconnected* (customer is disconnected from the network),
- *connected* (customer is connected to the network) or
- *ready for reconnection* (customer is disconnected from the network).

Depending on the *Control mode* selected in **Disconnect control** object (0-0:96.3.10), **manual** or **remote** option of reconnection/disconnection is possible. (For detailed information, see the chapter *12.1. Annex 1: Relay, SD and M-Bus disconnect states and transitions.*)

Manual change of the switching device state can be performed via the **Scroll button** (on the meter) or the **external button** (see *Inputs* in the chapter *4.3.1.1.*).

7.11.2.1. Manual option

7.11.2.1.1. Manual reconnection

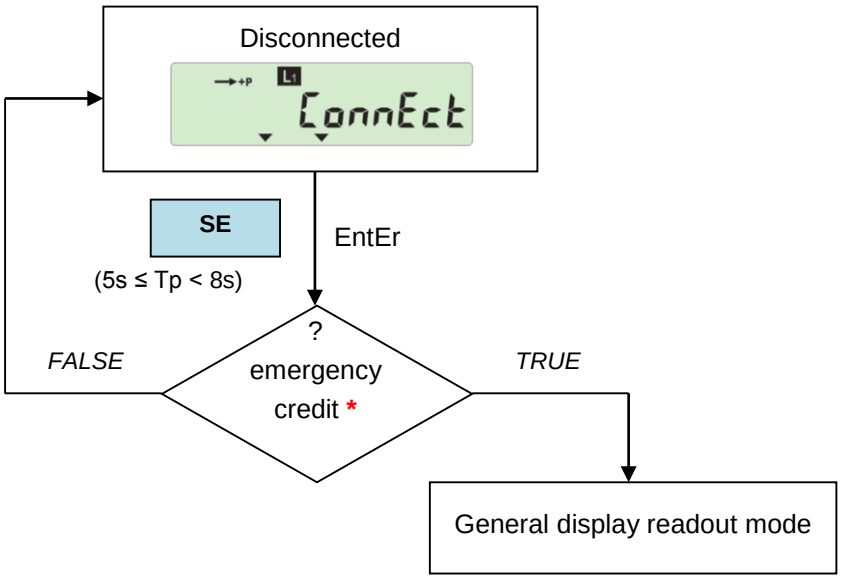
When the meter is disconnected (state Ready_for_reconnection), the ***ConnEct*** notice is permanently displayed on display (see the Figure 79). Manual reconnection of switching device is enabled in all modes of **Disconnect control** object (0-0:96.3.10).

Figure 79: The "ConnEct" notice on the LCD

To perform the manual reconnection of the switching device:

1. press the **Scroll** button for 5 seconds until ***EntEr*** tip is displayed (see the Figure 80),
2. release the button.

Figure 80: The "EntEr" notice on the LCD



* Emergency credit condition – Pre-payment (condition is valid when emergency credit is enabled):

- emergency credit limit not expired or
- emergency credit selected.

Figure 81: Switching device manual reconnection diagram

7.11.2.1.2. Manual disconnection

To perform manual disconnection of the switching device (in the **Disconnect control** object 0-0:96.3.10 *Control mode* should be set to: 1, 2, 5):

1. press the **Scroll** button for 10 seconds until ***dISconn*** appears on the display (see the following **NOTE** and the Figure 82),
2. release the button.

NOTE
Within pressing the **Scroll** button for 10 seconds, ***CrEdit*** shows on display;
in the meantime, do not release the button.

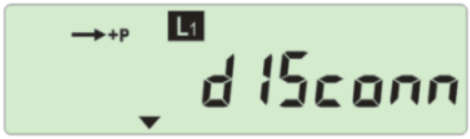


Figure 82: The "dISconn" notice on LCD

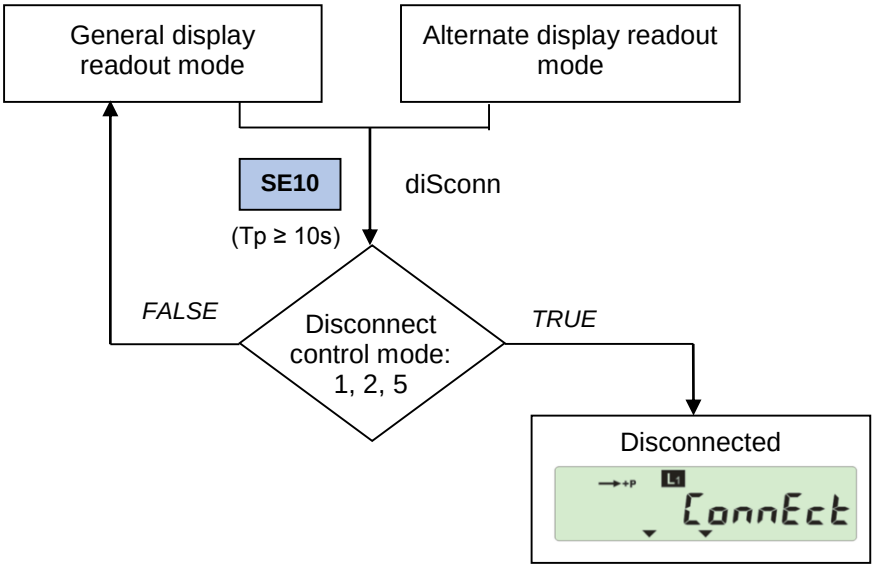


Figure 83: Switching device manual disconnection diagram

For detailed information about Control mode see the chapter *12.1. Annex 1: Relay, SD and M-Bus disconnect states and transitions*.

7.11.2.1.3. By the external button

Meter is also supported with a non-potential external button. For manual reconnection of the meter, which is placed in the meter cabinet, the non-potential external button on the door of the cabinet can be used for:

- **manual reconnection** of the switching device.
  In this case external button has the same function as the **Scroll** button on the meter (see the chapter *7.11.2.1.1., Manual reconnection*). The external button has to be pressed for 5 seconds until ***EntEr*** tip is displayed, and then released.
- **manual disconnection** or **reconnection** of the switching device.
  To perform disconnection or reconnection of the switching device, press the external button for 5 seconds, then release the button.

NOTE

Before performing manual disconnection/reconnection of switching device via external button, both objects 0-0:196.1.3 and 0-0:196.3.0 should be set as follows:

- in **Display configuration** object (0-0:196.1.3) option *External key* has to be set on *Disconnect / reconnect switching device* mode;
- in **Configurable I/O settings** object (0-0:196.3.0) option *Alarm2 & External key & Disconnector* has to be selected.

7.11.2.2. Remote option

The switchover can also be made remotely by executing remote disconnect or remote reconnect method. Transition change is described in Disconnect control IC state diagram (COSEM, Identification System and Interface Classes, excerpt from DLMS UA 1000-1, ed.9, p.36, Disconnect control).

7.11.2.2.1. Remote disconnection

Remote disconnect forces the switching device into *disconnected state* if remote disconnection in the **Disconnect control** object (0-0:96.3.10) is enabled (control mode > 0).
For detailed information about Control mode see the chapter *12.1. Annex 1: Relay, SD and M-Bus disconnect states and transitions.*

7.11.2.2.2. Remote reconnection

Remote reconnect forces the switching device into the *ready for reconnection* state if a direct remote reconnection is disabled (control mode = 1, 3, 5, 6) or into *connected' state* if a direct remote reconnection is enabled (control mode = 2, 4).
For detailed information about Control mode see the chapter *12.1. Annex 1: Relay, SD and M-Bus disconnect states and transitions.*

All events related to the disconnector, e.g. connect, disconnect, etc. are stored in the Disconnect control log. Several different internal functions like limiter, register monitor or prepayment can manipulate the disconnector. Therefore different kind of functionalities cannot take actions on the same disconnect control device at the same time. For example, if the disconnector is disconnected by a limiter, it cannot be manually reconnected until the condition of the limiter function is fulfilled.

7.12. Limitation

Beside collecting and processing energy consumption data, AMM system offers load balancing and control. To achieve this current and demand limitation is implemented in the meter. During short time period when power consumption excides contractual value for a specified time interval, customer is disconnected from the grid until normal conditions are achieved or when penalty time is over.

To handle consumption monitoring and disconnection of customer premises the important principles are:

- phase current measurement,
- disconnection separation between switching device and main fuse and
- threshold level settings in accordance with customer contract and local regulator rules.

A switching device is only disconnection element. All measurements and supervision of measured quantities is handled by AMM meter.

The meter supports two different limitation types: **Limiter** and **Supervision monitor**. Supervision monitor supports IDIS (average phase current monitoring) and GIZ – Gesellschaft für Internationale Zusammenarbeit / Society for International Cooperation (instantaneous phase current monitoring with penalty times) definition implementation.

7.12.1.Limiter

Limiter functions are used to monitor electrical network for exceeding maximum energy (power) in predefined period of time. Limiter object handles normal current and instantaneous power monitoring as well as the emergency settings. Meter supports two limiter objects. The customer can (after correcting the exceeding level) reconnect network manually (by pressing the **Scroll** button on the meter) or with remote connection (depending on the switching device mode used).

The threshold value can be normal or emergency threshold. The emergency threshold is activated via the emergency profile.

The limitation or disconnection functionality can be activated in the meter itself or by remote action.
The meter disconnects the network if a maximum current or power limit has exceeded during a predefined period of time. The current or power levels with the allowed exceeding periods are set in the meter.
See the Figure 84.

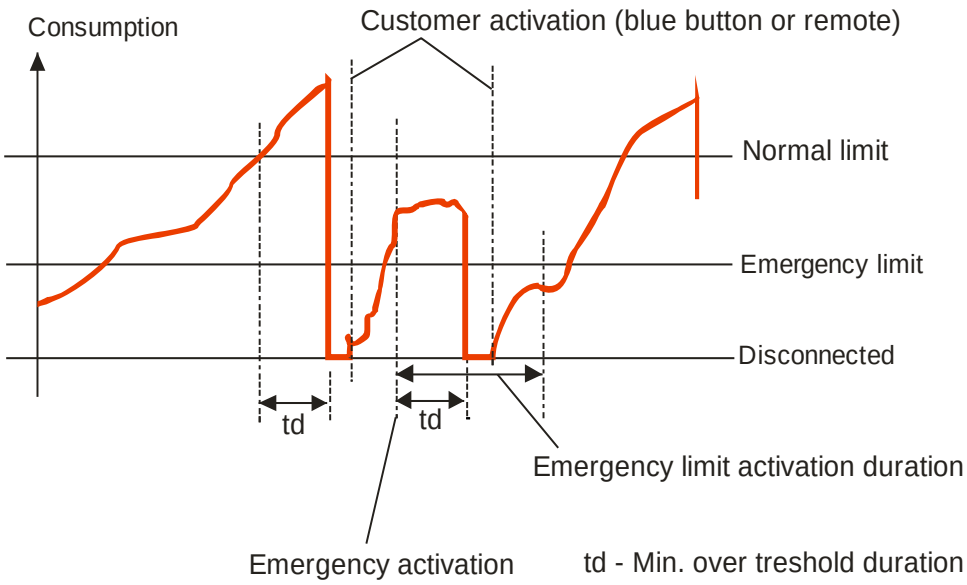


Figure 84: Limiter diagram

IDIS defines only one limiter object instance. Iskraemeco meters have two limiter instances, **Limiter 1** object (0-0:17.0.0) and **Limiter 2** object (0-0:17.0.1).

Actions defines the script to be executed when the monitored value crosses the threshold for minimal duration time:

- Action *over threshold* defines the action when the value of the attribute monitored crosses the threshold in upwards direction and remains over threshold for minimal over threshold duration time (**Disconector script table** objects 0-0:10.0.106, 1; 0-0:10.0.106, 2),
- Action *under threshold* defines the action when the value of the attribute monitored crosses the threshold in the downwards direction and remains under threshold for minimal under threshold duration time (**Disconector script table** objects 0-0:10.0.106, 0; 0-0:10.0.106, 1).

7.12.2. Advanced power limitation

Meter Mx382 provides advanced power limitation solution where three power (current) levels are available:

- (Available Power (AP),
- Max. Available Power (MAP) and
- Limited Power (LP).

When current power demand (current) is in 1st level, between the **Available Power** (object 0-0:128.61.11) and the **Max. Available Power** (object 0-0:128.61.12), longer than set in the **Max. Available Power Exceeding Time** (MAPET, object 0-0:128.61.15), alarm indicator on the meter display starts to blink.
If power demand is still in this level after time set in the **Available Power Exceeding Time** (APET, object 0-0:128.61.14) is exceeded the alarm indicator on meter display is permanently lit. By double value, set in the **Available Power Exceeding Time**, the meter disconnects.

In case power demand (current) is in 2nd level, between the **Max. Available Power** and **Limited Power** (object 0-0:128.61.13), longer than half value defined in the **Max. Available Power Exceeding Time** the meter will disconnects.

If current power demand (current) is in 3rd level, higher than the **Limited Power** is set, the meter disconnects in less than 10 seconds. See the Figure 85.

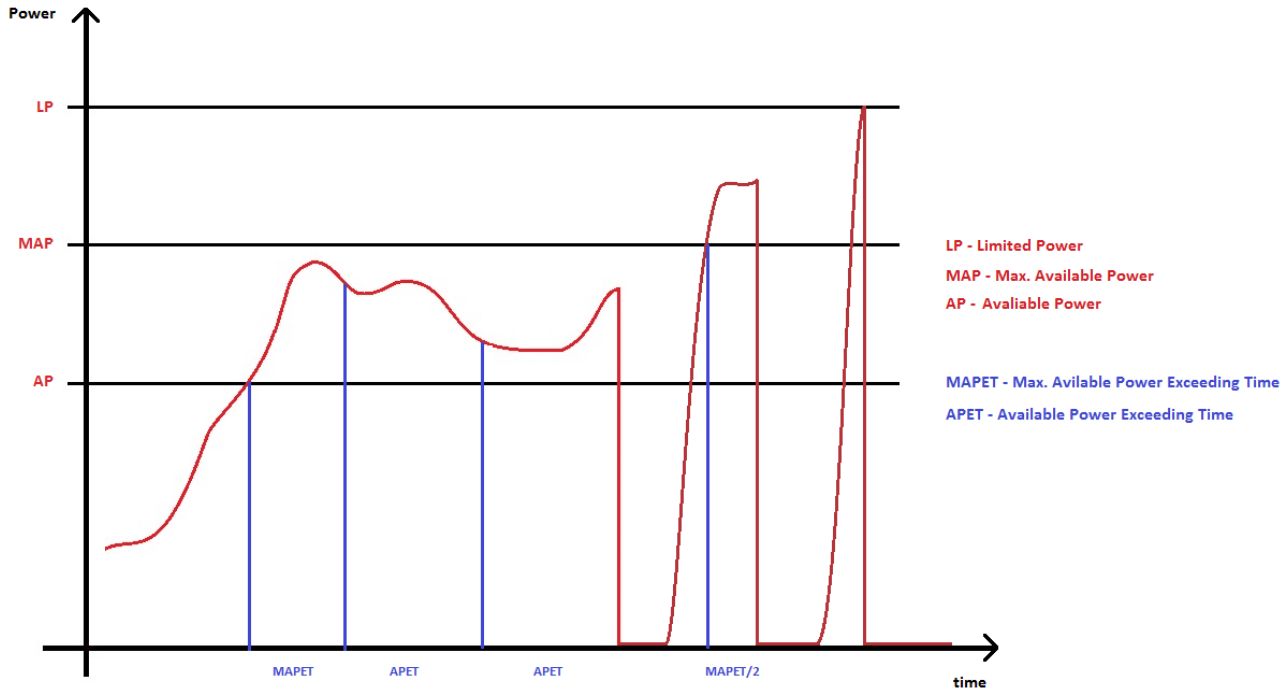


Figure 85: Advanced power limitation diagram

NOTE

The **Available power exceeding time** and the **Maximal available power exceeding time** time limitations attributes are reset internally on billing event (1st day every month) or by writting new values of objects: the **Power limit mode** (object 0-0:128.61.11), the **Available power exceeding time** and the **Maximal available power exceeding time**.

7.12.3. Supervision monitor – IDIS

Mx382 meter features phase current limitation with three register monitor (RM) objects. Every register monitor (RM) monitors the corresponding phase demand register. Actions that need to be taken are defined via the **Disconnector script table** object, where the action on the **Disconnect control** object is defined.

When monitored value passes threshold upwards or downwards, action up or action down is taken.
For Mx382 meters, there is only one threshold allowed to be set, because of the limitation functionality.

IDIS specifies **Supervision monitor** objects 1-0:31.4.0 (SM1), 1-0:51.4.0 (SM2) and 1-0:71.4.0 (SM3) for a monitored value. This is not directly measured phase current RMS (root mean square), but the averaged value over the number of periods. Phase RMS current is averaged with period (1 s) and number of periods (90) values. Value has a 1 A resolution rounded down.

An action defines scripts to be executed when the monitored value of the reference object crosses the corresponding threshold:

- action up defines the action when the attribute value of the monitored register crosses the threshold in the upwards direction (**Disconector script table** objects 0-0:10.0.106, 1 and 0-0:10.0.106, 2),
- action down defines the action when the attribute value of the monitored register crosses the threshold in the downwards direction (**Disconector script table** objects 0-0:10.0.106, 1 and 0-0:10.0.106, 0).

7.12.4. Supervision monitor – GIZ

Mx382 meter features phase current limitation with three RM objects. Every RM monitors the corresponding phase current instantaneous values. Actions that need to be taken are defined via the **Disconnector script table** object, where the action on **Disconnect control** object is defined.

The functionality of the register monitor is affected with two manufacturer specific objects, **Over current duration** object (0-0:128.62.10) and **Manual reconnect period** object (0-0:128.30.24).

Action defines scripts to be executed when the monitored attribute of the referenced object crosses the corresponding threshold:

- action up defines the action when the attribute value of the monitored register crosses the threshold in the upwards direction (**Disconector script table** objects 0-0:10.0.106, 1 and 0-0:10.0.106, 2),
- action down defines the action when the attribute value of the monitored register crosses the threshold in the downwards direction (**Disconector script table** objects 0-0:10.0.106, 1 and 0-0:10.0.106, 0).

7.13. Overvoltage monitor and load disconnection

Overvoltage monitor and load disconnection functionality is used for detection if average instantaneous voltage over the specified time interval is above the defined upper limit. If the conditions are met, load disconnection is performed. Load reconnect is performed, if average instantaneous voltage over the specified time interval is below the defined lower limit. The functionality can be disabled or enabled.

Overvoltage monitor and load disconnection functionality always disconnects electricity disconnector device.

When disconnection is active, bit 0 of the octet 0 in the **Disconnection Control Status 2** (0-0:128.30.26) object is set.
For reconnection of the disconnector, all bits in octet 0 of the **Disconnection Control Status** (0-0:128.30.25) object and the **Disconnection Control Status 2** object have to be 0 (all different source functions are released).

Reconnection depends on the setting of the Control mode of the **Disconnect control** (0-0:96.3.10) object.

The parameters of the Overvoltage monitor and load disconnection functionality can be set with following objects:

- enabling the functionality (enabled, disabled, default: disabled) with the **Over voltage monitor and load disconnection - Enabled** (0-0:128.9.1) object,
- disconnect voltage level (nominal voltage to 320 V, default: 285 V) with the **Over voltage monitor and load disconnection - Disconnect voltage level** (0-0:128.9.2) object,
- reconnect voltage level (nominal voltage to 320 V, default: 265 V) with the **Over voltage monitor and load disconnection - Reconnect voltage level** (0-0:128.9.3) object,
- disconnect time (1 to 60 s, default: 60 s) with the **Over voltage monitor and load disconnection - Disconnect time** (0-0:128.9.4) object,
- reconnect time (1 to 20 s, default: 10 s) with the **Over voltage monitor and load disconnection - Reconnect time** (0-0:128.9.5) object.

Limitations of the parameters:

- the disconnect voltage level must be higher than the reconnect voltage level,
- the reconnect voltage level must be higher than the nominal voltage,
- there is a 10 seconds retention time for the circuit breaker (if time between conditions for disconnect and reconnect is below 10 seconds, disconnect/reconnect is performed after 10 seconds of last reconnect/disconnect).

Functionality:

- voltage samples are averaged over the disconnection/reconnection time interval.
- conditions for disconnection/reconnecting are checked at the end of disconnection/reconnection time intervals.
- on the three phase meter average voltage over disconnect time interval on at least one phase has to be over the disconnect voltage level to perform the disconnect of the load.
- on the three phase meter average voltages over disconnect time interval on all phases has to be below the reconnect voltage level to perform the reconnect of the load.
- when any of the parameters are written, averaging is reset (disconnection/reconnection interval).

7.14. Fraud detection

7.14.1.Meter cover open and terminal cover open

These detectors (switches) trigger an event and alarm that lets the user know if and when the terminal block cover or the meter cover were opened. When a certain event and alarm is triggered, the next alarm of the same type can be triggered after 15 minutes.

Figure 86: Terminal cover opening switch

7.14.2.Magnetic field detection

This detector (reed relay) triggers a Magnetic field detected event (Fraud detection log, event 42) and No more magnetic field detection event (Fraud detection log, event 43) that is recorded in Fraud detection event log if and when there was an external magnetic field near the meter. This is used for security reasons as some public might try to influence the meters accuracy.

See List of events in the Fraud detection event log in the Table 54.

7.15. Identification numbers

To be able to manage E-meter configurations every E-meter handles configuration identifiers, which contain all the information necessary to manage the E-meters' settings. Every location in the identifier presents the setting of the specified parameter. The E-meter compiles a configuration identifier by its internal configuration information. The E-meter configuration identifier is handled throughout the AMM system.

Additionally firmware identification is also considered. It provides the information to the customer which firmware is currently active in the E-meter. To the authority bodies it provides the means of validating the firmware under security.

7.15.1.COSEM logical device name

The COSEM logical device can be identified by its unique **COSEM logical device name** (object 0-0:42.0.0). The name can be up to 16 octets long. The following Figure 87 presents the division of the COSEM logical device name according to the IDIS association.

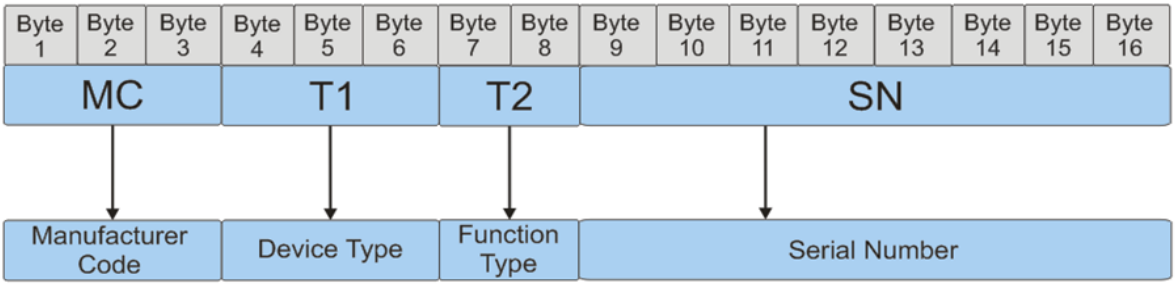


Figure 87: COSEM Logical Device Name Structure

The first three octets (MC – Manufacturer Code) are ASCII encoded and uniquely identify the manufacturer of the device. The next three octets (T1) present ASCII encoded IDIS device type.

The IDIS device types have the following meanings (see the Table 70).

Device Type	Meaning
000 … 098	reserved for non-IDIS meters; system title is considered as manufacturer specific
099	reserved system title for the DC
100	IDIS package 1 PLC single phase meter
101	IDIS package 1 PLC poly phase meter
102	IDIS package 2 IP single phase meter
103	IDIS package 2 IP poly phase meter
104 … 255	Reserved for future use

Table 70: The IDIS Device Type Meaning

The next two octets (T2) present ASCII encoded IDIS function type. Meanings of IDIS function types are described in the Table 71.

Function Type	Bit Meaning
Bit0 = 1	Disconnector extension
Bit1 = 1	Load Management extension
Bit2 = 1	Multi Utility extension
Bit3 = 1	Reserved for future use by IDIS

Table 71: The IDIS Function Type Meaning

Last eight octets (SN – serial number) present ASCII encoded E-meter serial number as specified in Device ID.

Example of the COSEM logical device name for Iskraemeco's ME382 meter with switching device, multi-utility and load management functionality with the Device ID 00000001 is presented in the Table 72.

MC			T1			T2		SN							
Octet 01	Octet 02	Octet 03	Octet 04	Octet 05	Octet 06	Octet 07	Octet 08	Octet 09	Octet 10	Octet 11	Octet 12	Octet 13	Octet 14	Octet 15	Octet 16
I	S	K	1	0	2	0	7	0	0	0	0	0	0	0	1

Table 72: COSEM logical device name example

7.15.2. System title

System title is tightly coupled with the COSEM logical device name. System title is eight (8) octets long while the COSEM logical device name is sixteen (16) octets long. Thus the transformation is:

- MC is three (3) octets long,
- T1 is one (1) octet long and HEX encoded,
- T2 is half octet long (four MSB – Most Significant Bits) and HEX encoded,
- SN is three and a half octets long and HEX encoded.

7.15.3. Device number

Device number is unique meter number in certain group of meters. The number is ASCII encoded.
The length of the ID must be eight (8) octets.

The number is copied into IEC local port setup and is used when accessing the meter through IEC 61056-21 (former 1107) protocol.

7.15.4. Device ID

The meter has nine different device IDs (0-0:96.1.e).

Device ID 1	E-meter serial number (e=0)
Device ID 2	E-meter equipment ID (e=1)
Device ID 3	function location (e=2)
Device ID 4	location information (e=3)
Device ID 5	general purpose (e=4)
Device ID 6	IDIS certification number (e=5)
Device ID 7	(e=6)
Device ID 8	(e=7)
Device ID 9	meter ID (e=8)

Table 73: Meter device IDs

Device ID1 is E-meter factory serial number (also reflected in a COSEM logical device name). The number is ASCII encoded. The length of the ID must be eight (8) digits.

Device ID2 is customer ID. The number is ASCII encoded. The length of the ID must not exceed forty eight (48) digits.

Device ID3 represents function location. The number is ASCII encoded. The length of the ID must not exceed forty eight (48) digits.

Device ID4 includes location information. The number is ASCII encoded. The length of the ID must not exceed forty eight (48) digits.

Device ID5 has no special meaning defined. It is general purpose ID for any identification purposes. The number is ASCII encoded. The length of the ID must not exceed forty eight (48) digits.

Device ID6 is IDIS certification number. The number is ASCII encoded. The length of the ID must not exceed forty eight (48) digits.

The length of the device ID 7, 8 and 9 must not exceed forty eight (48) digits.

Medium specific IDs called M-Bus device IDs are described under M-Bus section.

NOTE

For effective use of functionalities, the meter must be properly configured.

7.15.5. Meter software identification

This chapter describes metering application FW identification for electric energy meters of type Mx382.

7.15.5.1. Software architecture

The main parts of the basic modular division of software for the Mx382 meters are: the platform, core interface and the module. The platform and core interface constitute a concluded entity called core, while application module represents module. Each of two entities has its own parameters that can be configured at build time (adjustable in time of code translation) or at configuration time in the factory. Nevertheless only module has specific parameters that are variable during operation.

Due to legal constraints, meter's firmware is divided into two modules. The first is application core and the second is application module. Both entities have their own identification string and signature.

Meter's identification strings are divided into two subsets of sixteen (16) characters. The first subset represents application core while second represents application module identification. The structure of identification for both entities consists of manufacturer tag – ISK stands for Iskraemeco (3 characters), SW tag – (2 characters), device type – (5 characters), and revision of application core or application module (6 characters). (See the Figure 88.)

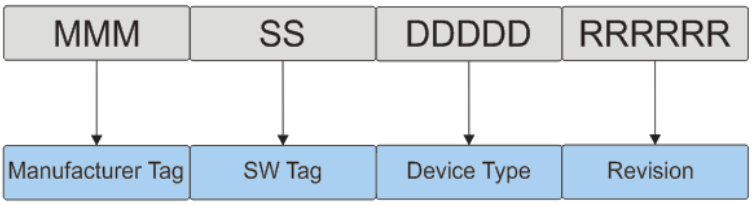


Figure 88: Identification Structure

The revision number field is organized as it is seen in the Figure 89. Meaning of the revision number characters is described in the Table 74.

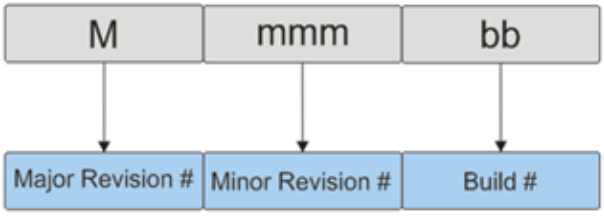


Figure 89: Revision Number Structure

Mark	Size (in characters)	Meaning
M	1	Major revision number
mmm	3	Minor revision number
bb	2	Build number

Table 74: Meaning of Revision Number Characters

7.15.5.2. E-meter signatures

Meter's signatures are divided into two subsets of sixteen (16) octets. First subset represents application core while second represents application module signature. The signature is calculated with an algorithm, which assures that integrity of both modules is achieved.

Firmware core signature is used to assure integrity of the core firmware. The presented digest is sixteen (16) octets in size and HEX encoded. Firmware module signature is used to assure integrity of the module firmware. The presented digest is sixteen (16) octets in size and HEX encoded.

7.16. Monitoring functions

7.16.1.Power quality

Power quality module enables measurements and analyses of mains power system voltages. The basic measurements of a voltage sag and swell are the U_{rms} measurements on each phase. A voltage sag or swell threshold is a percentage of U_{rms} nominal.

The basic measurement time interval for mains supply voltage is 200 ms. Basic time intervals are aggregated over recording time interval (aggregation time interval), which is 10 min by the default.

7.16.1.1. Voltage level

At the start of aggregation interval, the meter starts to sample phase U_{rms} voltages with basic time interval and averages them. On the end of aggregation period, calculated average phase voltage is compared to defined thresholds. If the voltage depth value obtained at the end of aggregation time interval falls below the one of threshold voltages presented in the table below corresponding counter is incremented. The depth is the difference between the reference voltage (nominal phase voltage) and the average U_{rms} value measured on particular phase during the aggregation interval. (See the Table 75.)

Threshold Levels	Threshold Voltages Depths	Threshold Level Counters
Level 1	U > +10%	Counter 1 overvoltage
Level 2	+5% < U < +10%	Counter 2 overvoltage
Level 3	0% < U < +5%	Counter 3 overvoltage
Level 4	-5% < U < 0%	Counter 4 undervoltage
Level 5	-10% < U < -5%	Counter 5 undervoltage
Level 6	-15% < U > -10%	Counter 6 undervoltage
Level 7	U < -15%	Counter 7 undervoltage

Table 75: Dip & swell detection model

On each phase, voltage is calculated every 10 minutes. Average voltage with sampling made every 200 ms in 10 min aggregation period is calculated. As a result of this calculation, appropriate level counter is incremented. Nominal voltage (U_n) used in calculations is 230 V. If calculated average voltage at the end of 10 min period is under, over or in the range of certain percentage (see the Table 75), then the appropriate counter is incremented.

Voltage sags are recorded when voltage drops below the threshold for voltage sag for the preset period of time. For each sag the magnitude of voltage sag and duration of voltage sag are recorded. All events are recorded in Power quality log as *undervoltage event*. As soon as voltage drops below value of threshold for voltage sag for a period longer than preset period of time the counter per phase will be incremented.

Voltage swells are recorded when voltage rises above the threshold for voltage swell for the preset period of time. For each swell the magnitude of voltage swell and duration of voltage swell are recorded. All events are recorded in Power quality log as overvoltage event. As soon as voltage rises above value of threshold for voltage swell for a period longer than preset period of time the counter per phase will be incremented.

Voltage that drops below the threshold for voltage cut for the preset time is recorded as a missing voltage event.

Meter measures and records daily peaks and minimums of the phase voltages and peak and minimum of the average voltage of all three phases. Measured voltage values are aggregated and averaged during settable aggregation period. At the end of aggregation period, measured value is compared to value stored in the current register, and if it is greater or lower than existing it overwrites the old value with respect to that if it is peak or minimum register. At the end of the day, values are copied from current registers to the previous registers and current registers are reset.

Daily peak and minimum counters (OBIS 0-0:128.8.e) are described in the Table 76.

ALL phases avg U daily peak – current	(e=0)
ALL phases avg U daily peak – previous	(e=1)
ALL phases avg U daily minimum – current	(e=2)
ALL phases avg U daily minimum – previous	(e=3)
L1 voltage daily peak – current	(e=10)
L1 voltage daily peak – previous	(e=11)
L1 voltage daily minimum – current	(e=12)
L1 voltage daily minimum – previous	(e=13)
L2 voltage daily peak – current	(e=20)
L2 voltage daily peak – previous	(e=21)
L2 voltage daily minimum – current	(e=22)
L2 voltage daily minimum – previous	(e=23)
L3 voltage daily peak – current	(e=30)
L3 voltage daily peak – previous	(e=31)
L3 voltage daily minimum – current	(e=32)
L3 voltage daily minimum – previous	(e=33)

Table 76: Daily peak and minimum counters

The aggregation period for voltage peak and minimum can be set. The voltage sampling is made every 200 ms and after the time set, the average voltage value to be used in daily peak/minimum calculation is defined.

7.16.1.2. Voltage asymmetry

NOTE
These functions are available only in the MT382 meters.

Meter measures voltages and compares them to the average voltage of all three phases. If a difference is greater than predefined threshold, then alarm bit in Alarm ON register is set. When symmetry is established back alarm bit in Alarm OFF register is set. The level of asymmetry, which triggers alarm, can be defined by two thresholds, upper and lower threshold.

Period synchronization is fixed at 10 minutes. Each phase is sampled every 200 ms and at the end of 10-minute period average value for each phase is calculated. All three phases are added together and split with 3 so the result is average of all three phases. This is nominal value and each phase value is then compared with this value. If deviation percentage is greater or smaller than specified, the appropriate alarm is set. The default percentage levels of **Asymmetrical voltages upper threshold** (0-0:128.7.50) is 1030 (103,0%) and **Asymmetrical voltages lower threshold** (0-0:128.7.51) is 970 (97,0%).

97 – 103% is the area in which the asymmetrical voltage alarm bit is not set, but if the average phases voltage is outside +/- 3% range within 10-minute period this alarm in Alarm ON status (bit 14) is set. It is set for the whole 10-minute period. When average phase voltage drops back in 3% range, asymmetrical voltage alarm (bit 14) in Alarm OFF status is set. These alarms are recorded in Alarm ON status and Alarm OFF status.

Both alarms can be deleted. Alarm ON cannot be deleted if present voltage is outside 3% range. Alarm OFF therefore can be deleted as soon as it is set.

7.16.1.3. Asymmetrical voltage (optional)

NOTE

This chapter describes one of the options of the voltage asymmetry method measuring. The mentioned objects have different settings as in the chapter *7.16.1.2*, although they are used for the same purpose.

Which method of voltage asymmetry measuring should be used is determined by the specific customer. **The methods are mutually exclusive**, only one of them can be used in the meter.

NOTE

These functions are available only in the MT382 meters.

Asymmetrical voltage is checked against two thresholds, defined as absolute RMS values in Volts.

Alarm for asymmetrical voltage is generated when:

- two phase voltages fall below the upper threshold defined in the **Asymmetrical voltage upper threshold** (0-0:128.7.50) object and simultaneously remain above the lower threshold defined in the **Asymmetrical voltage lower threshold** (0-0:128.7.51) object and
- one phase voltage remains above the upper threshold.

In case that all three phase voltages fall in the area between thresholds simultaneously, no asymmetrical voltage alarm is generated. Also, when any phase voltage drops below the lower threshold no asymmetrical alarm is generated regardless of the voltage levels of other two phases. See the Figure 90.

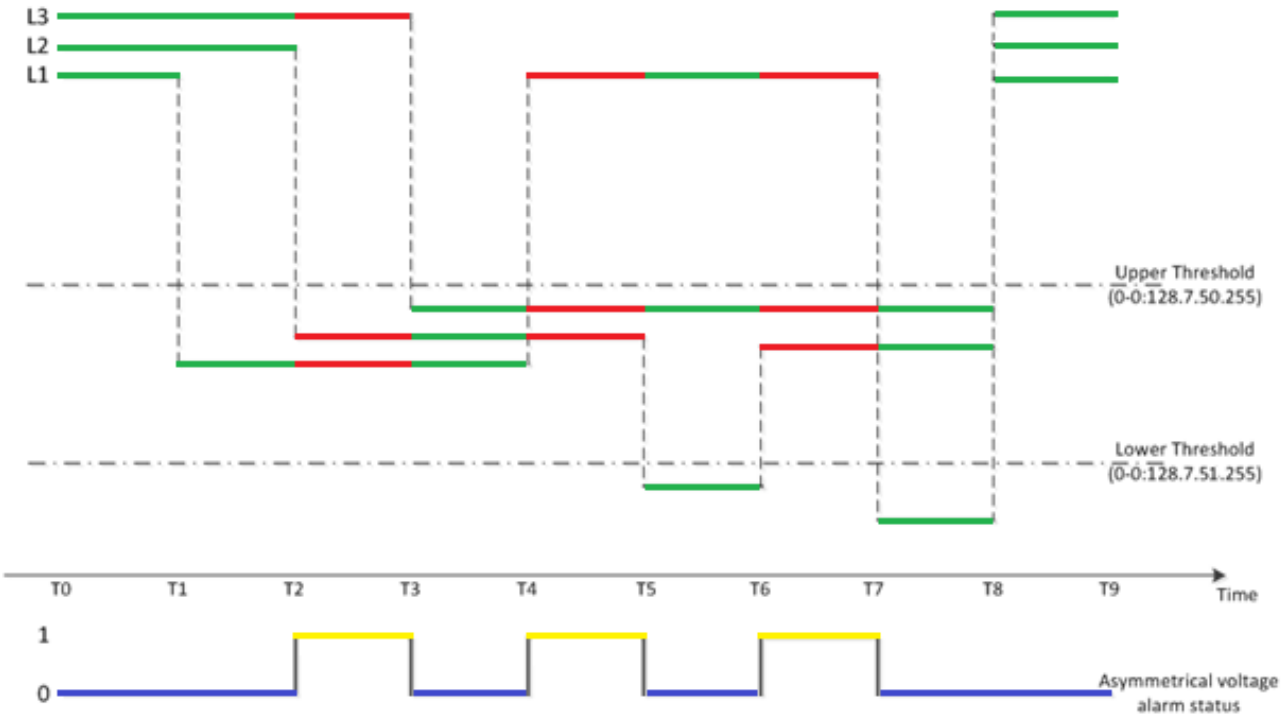


Figure 90: Asymmetrical voltage detection

7.16.1.4. Asymmetric current

In case of an asymmetrical load the sum of the currents in the system is equal to zero but currents are different in amplitude and RMS values. Detection of such condition refers to possible neutral break.
If previously described criteria are fulfilled, the meter alarm IDIS-P1 bit 16 is set in Alarm ON register (Iskraemeco (IE) alarm system).

7.16.1.5. Unexpected consumption

Unexpected consumption function is tied with the alarm IDIS-P1 bit 17 in Alarm status register. If all conditions are fulfilled (disconnector (circuit breaker – CB) is disconnected and power consumption is still detected by the meter), the alarm IDIS-P1 bit 17 is set.

Possible reason for the unexpected power consumption is shown in the Figure 91. Detection of unexpected consumption is applied to prevent stealing of electric energy.

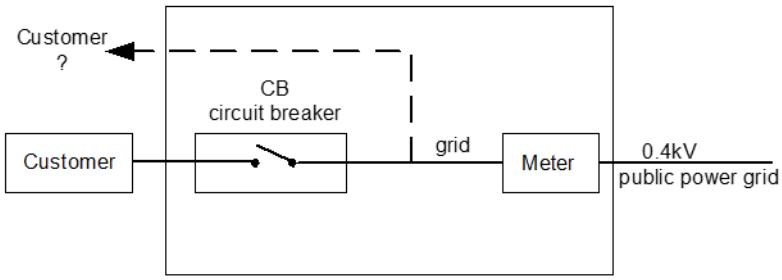


Figure 91: Unexpected consumption

7.16.1.6. Neutral missing detection

NOTE
These functions are available only in the MT382 meters.

If neutral is missing, the virtual neutral (N') is represent with L3 phase decreased toward zero, L1 and L2 phase increased toward interfacial voltage (see the Figure 92).

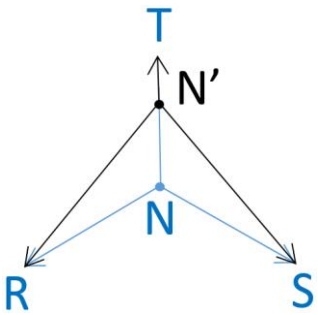


Figure 92: Intended neutral N-N'

Event Neutral missing and system alarm Neutral current 0 depend on the asymmetrical voltage and the deviation of the average voltage from U_n. Neutral missing event occurs if the following occurs:

- Asymmetric voltage occurred (voltage on single phase differs more than 3%),
- Average voltage on one phase (L3) is decreased more than 30% from nominal voltage and average voltage on any other phases (L1 or L2) is increased more than 28% from nominal voltage.

Detection of missing neutral is applied to prevent stealing of electric energy.

7.16.1.7. Neutral fault (optional)

NOTE

This chapter describes one of the options of the missing neutral method detection.

In this chapter, a different method as is described in the chapter *7.16.1.6* is used.

Which method of missing neutral detection should be used is determined by the specific customer. **The methods are mutually exclusive**, only one of them can be used in the meter.

NOTE

These functions are available only in the MT382 meters.

Neutral fault is checked against two thresholds defined in objects as absolute RMS values in Volts.

For this purpose the **Neutral fault upper threshold** (0-0:128.7.53) and the **Neutral fault lower threshold** (0-0:128.7.54) objects are used. When one phase voltage falls below the lower threshold, and one phase voltage rises above the upper threshold, alarm for neutral fault is generated. If any of phases fall below voltage, defined in the **Neutral fault limit threshold** (0-0.128.7.55) object, then no neutral fault is generated.

See the Figure 93.

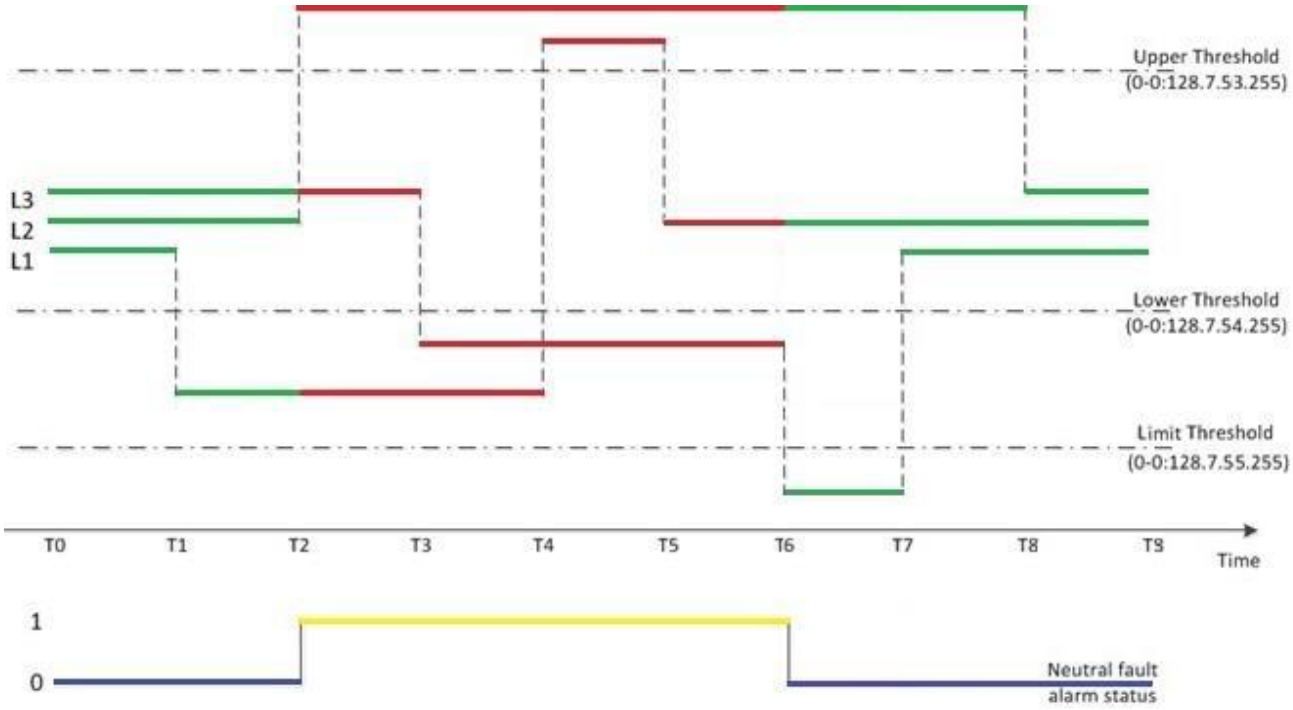


Figure 93: Neutral fault detection

7.16.1.8. Time period for asymmetry voltage and neutral fault

NOTE

This chapter is relevant only when the methods from the chapters *7.16.1.3* and *7.16.1.7* are selected.

Asymmetrical voltage and neutral fault detection use their own configurable time period. The same time period is used for both (asymmetrical voltage and neutral fault). Time period can be configured via the dedicated **Time period for voltage asymmetry and neutral fault** (0-0:128.7.52) object. Time period should be specified in seconds, configured in range from 0 to 65535 seconds.

7.16.1.9. Capturing of voltage values

NOTE
This chapter is relevant only when the methods from the chapters *7.16.1.3* and *7.16.1.7* are selected.

At the moment when the conditions for triggering asymmetrical voltage or neutral fault event are fulfilled, the present phase voltages are stored in **Captured voltage L1** (0-0:128.7.56), **Captured voltage L2** (0-0:128.7.57) and **Captured voltage L3** (0-0:128.7.58) objects. Values from objects can be sent to HES together with Asymmetrical voltage or Neutral fault alarm using Push mechanism.

The same is valid when the conditions for asymmetrical voltage or neutral fault event are withdrawn back in the normal voltage conditions.

7.16.1.10. Power failure

Meter registers number of:

- power failures in all three phases and per phase.
- long power failures in all three phases, in any phase and per phase.
- the time of the power failure in all three phases, in any phase and per phase.
- the duration of last long power failures in all three phases, in any phase and per phase.
- the duration of last long power failure if it is longer than predefined time threshold.
  When power fail time reaches the preset time threshold for long power fail (in seconds) then long power fail is registered, if not, power fail is registered.
- power outages longer than the time threshold for long power failure.

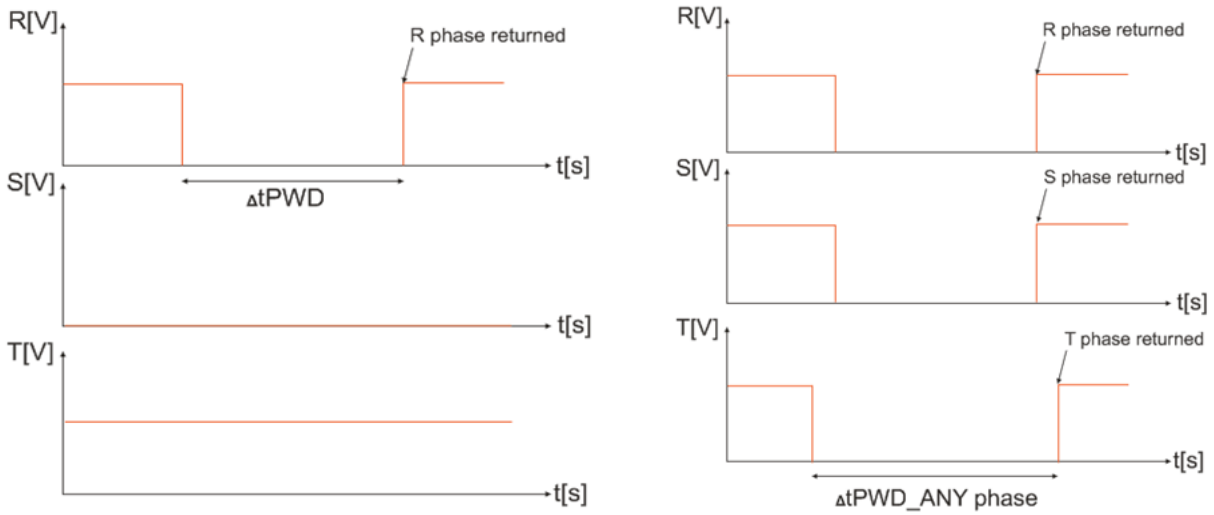


Figure 94: Power fail example

7.16.1.11. Wrong phase sequence

In case of wrong phase connection when phase sequence is not equal to L1L2L3, the phase cursors on the LCD blink. Measurements of active and reactive energy are correct.

7.16.2.Watchdog counter

Meter is equipped with watchdog protection circuit, which would reset main microcontroller in case of undesired processing delay or program flow. Each watchdog reset event is counted in the dedicated **Watchdog resets** (0-0:128.6.0) counter object and logged in standard event log.

Watchdog counter is incremented by one, at system restart after every watchdog reset. Special timer is used to monitor number of watchdog resets within time period. Only when 10 or more watchdog resets are detected within 2-hour period, the watchdog error is generated on the corresponding bit in error register.

8. SECURITY

The security represents crucial part of every meter. Ensuring of the effective security disables unauthorised ingress into the device. Meter's security is divided into:

- **physical security,**
- **logical security**.

The physical security protects the meter from different tampering attempts and unauthorized accesses. With the increase of smart metering and the rise of AMI infrastructures, the logical security was introduced in the Mx382 meter.

8.1. Physical security

Physical security is comprised of:

- **seal protection** and
- the **parameter protection button**.

8.1.1. Seal protection

There are two different set of a seal protection. The first set protects the terminal cover while the second protects the meter cover. The meter cover can be sealed with two sealing screws. The lid on the front side, which covers **Reset** button, can be sealed separately. The terminal cover can also be sealed with one sealing screw at the ME382 meter (see the Figure 95, left) and two sealing screws at the MT382 meter (see the Figure 95, right).

If seals are tampered with and either of the terminals is removed then the corresponding events are recorded in the fraud event log. In case of the terminal cover opening, the dedicated counter (by the **Cover opening counter** object) is incremented as well.

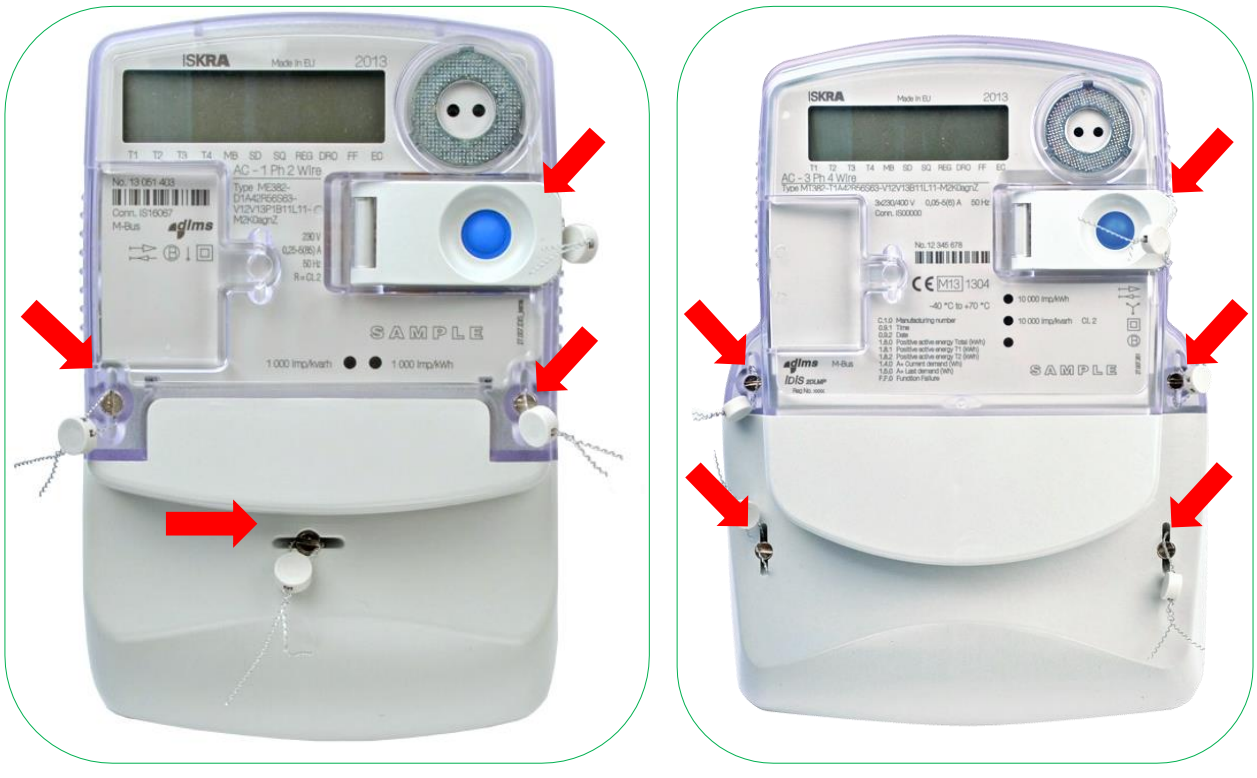


Figure 95: Positions of the seals at ME382 meter (left) and MT382 meter (right)

8.1.2. Parameter protection button

Its primary function is to strengthen the meter access functionality. When put in locked position, objects dedicated to factory parameterization are not accessible anymore. Furthermore, certain attributes of the dedicated objects are also inaccessible even though the proper key or security method was used. The same mechanism applies for executing specific methods. Therefore, meter reset (Master reset) can only be done when the parameter protection button is in unlocked position.

8.2. Logical security

Logical security was introduced on communication channels for authorization and encryption. Logical security is divided into separate DLMS/COSEM security entities with the latest approved cryptographic methods.

Basic types of approved cryptographic algorithms are:

- hash functions,
- symmetric key algorithms and
- public key algorithms.

Hash functions produce short representation of a longer message. It is relatively easy to compute hash value from the particular input while reverse process is extremely difficult to guess. Hash functions take an input of arbitrary length and always output a fixed length value. Therefore, the alternative name for hash functions is message digest. Message M1 runs through a hash function and a fixed message digest H1 is produced and transferred along with the original message.

Symmetric key algorithms (often-called secret key algorithms) use a single key to both apply the protection and to remove or check the protection. For example, the key used to encrypt data is also used to decrypt the encrypted data. This key must be kept secret if the data is to retain its cryptographic protection. Symmetric algorithms are used to provide confidentiality via encryption, an assurance of authenticity or integrity via authentication and mechanism to instantiate key establishment.

There are several approved algorithms for encryption and decryption of data chunks. Every algorithm converts data to be protected (called plaintext) via security context (keys and other security context) into ciphered text. The reverse procedure is also possible as shown in the Figure 96.

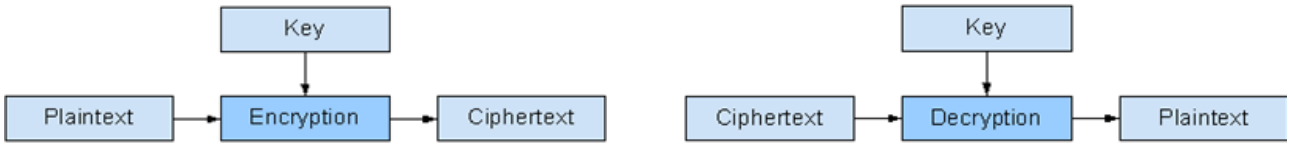


Figure 96: Encryption and decryption procedure

Currently for fore mentioned procedures Advanced Encryption Standard (AES) is used. AES encrypts and decrypts data in 128-bit blocks, using 128, 192 or 256 bit keys. All three key sizes are adequate.

Message authentication code works similar as ordinary hash function with one enhancement. Additionally the secret material (secret key) is used in message digesting.

8.2.1. DLMS/COSEM security

DLMS/COSEM provides two main information security features for accessing and transporting data. Data access security controls access to the data held by a DLMS/COSEM server, while data transport security allows the sending party to apply cryptographic protection to the xDLMS APDUs to ensure confidentiality and integrity. This requires ciphered APDUs.

Data access security is managed by the **Current association** object (0-0:40.0.0). Each COSEM server, i.e. a logical device, may support application associations with various clients, each having a different role, and with this, different access rights.

To be able to access the data, the client must be properly authenticated. Upon Application Association establishment, an authentication context is negotiated between the client and the server. This specifies the required authentication of the peers, and, where needed, the security algorithm to verify the authentication. Three data access security levels are provided:

- lowest level security (no security),
- Low-Level Security (LLS),
- High-Level Security (HLS).

Lowest level security

This authentication context does not require any peer authentication. It allows direct access to the data in the server, within the access rights available in the given application association. Authentication mechanism name is therefore not present in application association request.

Low-level security (LLS)

The purpose of low-level security is to allow the authentication of clients by verifying the password supplied. The server is not authenticated. The client has to supply the correct password during the process of application association establishment. If password is accepted, application association is established and client can access data within the access rights available in the given application association. Otherwise, the application association is not established.

High-level security (HLS)

The purpose of high-level security is to allow mutual authentication of the client and the server participating in an association. This is a 4-pass process, involving the exchange of challenges during Application Association establishment, which is followed by exchanging the results of processing these challenges, using cryptographic methods. If the authentication takes place, the client can proceed to access data within the access rights available in the given Application Association, and it accepts data coming from the server. Otherwise, the Application Association is not established. If the number of unauthorized accesses is bigger than predefined limit, the meter logs a respective event and rejects every subsequent application request for a predefined amount of time (60 s). With this mechanism, the risk of brute force attacks is mitigated. The last unauthorized access is time stamped.

E-meter supports three different clients with three different behaviours regarding authentication minimal requirements as it is shown in the Table 77.

Client name	Minimal Security Requirements
Public	Lowest level security (no security)
Management	HLS (LLS as a backup)
Pre-established	No HLS nor LLS

Table 77: Set of supported clients

For every security level, different authentication procedures are required. Authentication context and specifically the COSEM authentication mechanism name are presented in the Table 78.

Authentication Mechanism Name	ID
COSEM lowest level security mechanism name	0
COSEM low level security mechanism name	1
COSEM high level security mechanism name using MD5	3
COSEM high level security mechanism name using SHA-1	4
COSEM high level security mechanism name using GMAC	5

Table 78: Supported authentication mechanism names

Setting security mechanism ID in **Security setup object** (0-0:43.0.0) to 0 means that access is allowed with every mechanism ID set in the Application association request (password, SHA-1 (Secure Hash Algorithm), MD5 or GMAC (specialization of GCM for generating a MAC on data that is not encrypted)).

Data transport security relies on applying cryptographic protection to xDLMS APDUs. This is achieved via several security mechanisms. The first mechanism is incorporated in application association request with two application service elements (ASE):

- the COSEM application context and
- the user information filled with initiate request primitive.

The Table 79 shows different application context names and the relation between those names and allowed types of xDLMS APDUs. Ciphered APDUs are allowed only in application context name with ciphering.

Application Context Name	ID
Logical Name Referencing no ciphering	1
Short Name Referencing no ciphering	2
Logical Name Referencing with ciphering	3
Short Name Referencing with ciphering	4

Table 79: Application context names

The second mechanism is called the security context. The security context defines security attributes relevant for the data transport security process of ciphering/deciphering. The elements are:

- security policy (determining what kind of protection to be used),
- security suite (specifying the security algorithm),
- security material relevant for the given security suite (encryption keys, authentication keys and initialization vectors.

The security policies that are specified and allowed are:

- Security is not imposed (0),
- All messages to be authenticated (1),
- All messages to be encrypted (2)
- All messages to be authenticated and encrypted (3).

Authenticated xDLMS APDUs may be used even when the security policy in effect does not require that all messages must be authenticated. Messages protected by higher security then what the security policy requires are always allowed (provided that the application context negotiated allows them).

A security suite determines the cryptographic algorithm used for message security. A security suite is identified with a Security suite ID. Security suite (0) utilizes the Galois/Counter Mode (GCM) with AES-128. In this security suite, global keys are protected during transportation using the AES-128 key wrap algorithm.

Security Suite ID	Authentication algorithm	Encryption algorithm	Key transport method
0	AES-GMAC-128	AES-GCM-128	Key wrapping using AES-128 key wrap

Table 80: Security suite

The elements of the security material are encryption, authentication keys and the initialization vector, comprised of system title and the frame counters. There are different types of symmetric keys. Encryption keys, which are retained over several application associations, are called global encryption keys. They shall be changed before the corresponding frame counter reaches its limit. In E-meter, two global encryption keys are supported: unicast encryption key used between one DLMS/COSEM client and one DLMS/COSEM server and broadcast encryption key, used between one DLMS/COSEM client and several DLMS/COSEM servers. Keys that are negotiated each time new application association is constructed are called dedicated keys.

9. FIRMWARE UPGRADE

Meter has built-in special FW upgrade procedure, which can be performed over local or remote communication port. FW rewrite is applied in compliance with Welmec standards and IDIS (Interoperable Device Interface Specifications) association.

The meter FW consists of two parts:

- metrological part (core) and
- application part (module).

Only module part is upgradable.

According to COSEM/DLMS specifications, the meter implements an Image Upgrade COSEM class (18) for upgrade execution. Firmware upgrade procedure is performed by Image Upgrade class specification and has strict rules regarding the steps needed to be carried out to assure authorized and safe upgrade of the firmware.

Image upgrade procedure includes new block transfer from client (HES) to the server (meter), which stores them into dedicated FLASH space. During the transfer process, all meter functionalities work without any restriction. Once the image is completely transferred, it is checked by the meter for proper identification and consistence. This is executed by image verify method in **Image transfer** object (0-0:44.0.0).

Only a verified image can be activated. In the activation process, the old module is erased inside the micro controller unit (MCU) flash and a new one is transferred to the same location from external flash. At end of this process meter internally performs restart. Activation time is within range of ~ 2 s where application process isn't executing. If any malfunction occurs during the activation, meter will restart itself and try to activate the image again.

Module firmware activation can be only transferred first and configured through scheduled activation for the future time. There is also dedicated object **Number of configuration program changes** (0-0:96.2.0) which counts number of successful upgrades, together with the **Date of last configuration program change** (0-0:96.2.1).

Authenticity checking

The core firmware contains base module identification. If the base identification of a transferred module does not match with the reference base identification stored in the core part of the firmware, an error is generated, information is given to the customer, and image is rejected by the meter. In case of successful identification, the meter accepts the image and waits for the activation.

This means that the first 14 octets of the **Active firmware object version 1** (1-1:0.2.0) of the new module version must be same as in previous version.

Example of upgradable modules:

Old Module ID in meter:	**ISKAMMT3821008**00
New Module ID to upgrade:	**ISKAMMT3821008**01

Integrity checking

When building the program code, a corresponding MD5 signature is calculated and attached to the end of the program code. Later on when verification and activation of new module is executed, meter uses this signature for data integrity checking. It recalculates MD5 signature of the transferred module and compares the calculated value with a value created during program code generation. If the two signatures mismatch, the new module is rejected.

Upgrade process information

Meter stores four different event codes in a **Standard event log** with corresponding timestamp (0-0:99.98.0), which are:

- Firmware ready for activation (event 17): indicates that the new firmware has been successfully downloaded and verified, i.e. it is ready for activation;
- Firmware activated (event 18): indicates that a new firmware has been activated;
- Configuration program changes (event 47): indicates change of parameters (parameters are changed during transfer and verification);
- Verification failed (event 51): indicate that verification has failed.

Assuring Accordance for Upgrading

During production, initial communication passwords are set in the factory; however, they can also be changed by a customer. Without passwords, execution of image upgrade procedure is not possible.

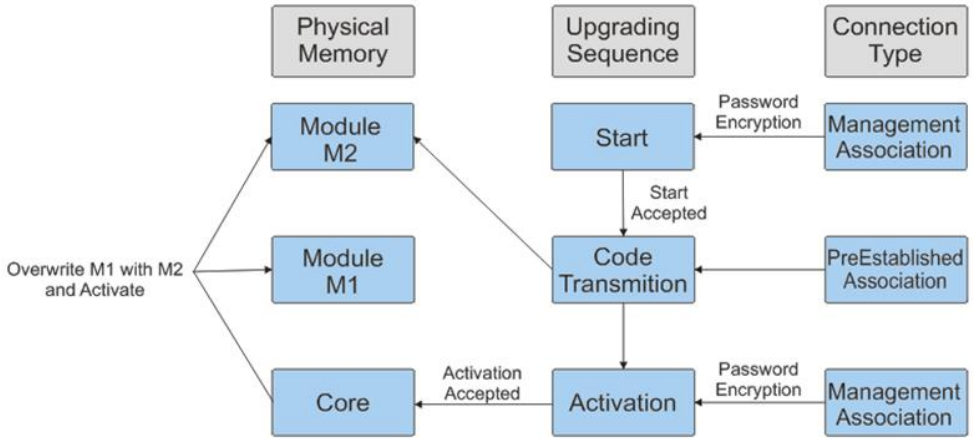


Figure 97: Three-step upgrading procedure

When image is successfully transferred and verified, it needs to be activated. It stays stored and ready for activation until it is activated. This can be done:

- immediately (after transfer and verification),
- by schedule (activation date/time is different when transfer/verification).

The Image transfer services are mapped to COSEM services, accessing attributes and methods of COSEM Image transfer interface objects.

The Image block transfer process can only be started if it is enabled in the server.

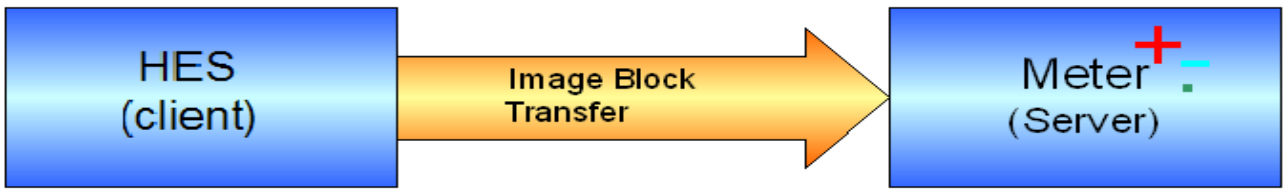


Figure 98: Firmware image transfer process

10. APPLICATION ASSOCIATION

The communication between two devices can be established on several peer protocol layers. This section presents different Application associations between the E-meter (the server) and the COSEM client.

In order to effectively exchange information within an Application association, the pair of AE-invocations shall be mutually aware of and follow a common set of rules that govern the exchange. This common set of rules is called the application context of the application association.

COSEM objects that contain the information about the current application association with the application context are described in details.

Within the current application association different parameters may be changed, thus the number of programming accesses is registered along with the timestamp of the last attempt.

10.1. SAP assignment

SAP (Service Access Point) assignment list contains the list of all logical devices and their SAP addresses within the physical device. The interface class **SAP assignment list** contains the information about the assignment of the logical devices in the physical device.

Example:

Iskraemeco meter with the COSEM Logical Device Name ISK1000712345678 has the following SAP assignment, presented in the Table 81.

SAP Assignment	Physical device name
1	ISK1000712345678

Table 81: COSEM SAP assignment example

The Client dictates the type of the association due to the fact that Server SAP is always 1. The next section briefly encapsulates the core features of the respective association.

Management association is used for management of the device, retrieving the data from the device and authorizing actions in the meter. The Management association is available on remote communication as well as on local interface i.e. optical port.

Pre-established association is used for broadcasting time, image transfer, TOU tables, and load control (scheduled or spontaneous). Is has the same security mechanisms as the management association.

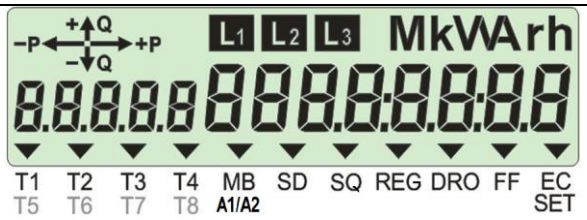
Public association is used for reading basic device configuration information (e.g. SAP, COSEM logical device name, association, serial numbers ...). It is not strongly secured. The Public association is available on remote communication and as well on local interface.

Current Association is a list of associated objects in the E-meter and additional information about application context and mechanism names.

11. TECHNICAL CHARACTERISTICS

11.1. ME382 meter

Reference voltage	
Reference voltage	120 V, 230 V 0,8 U_n – 1,15 U_n
Reference frequency	50 Hz ±2 % 60 Hz ±2 %
Currents (A)	
Reference current	5 A
Maximal current	85 A (DIN connection), 100 A (BS connection)
Thermal current	120% I_{max}
Short circuit current Start-up current	half cycle at rated frequency, 30 x I_{max} <0,4% of reference current
Accuracy class	
Active energy	A or B (EN 50470-3) Class 2 or 1 (IEC 62053-21
Reactive energy	Class 3 or 2 (IEC 62053-23)
Apparent energy	Calibrated up to 3%
Outputs	
Type – Solid State Relay (Auxiliary control switch)	
Contact	Make or break contact
Permitted load	100 mA
Voltage	250 V AC
Pulse length	From 30 ms to 200 ms (adjustable in steps by 1 ms)
Transmission distance	Up to 1000 m
Type – Relay (Load control switch)	
Voltage	250 V AC
Switching voltage	250 V AC
Maximum switching current	6 A
Switching power	1500 VA
Inputs	
Alarm input	
Voltage level	100 – 240 V AC
External button	
Voltage level	No voltage
Self-consumption	
Self-consumption of current circuit	0,06 VA
Self-consumption of voltage circuits	1,6 W / 3,2 VA
	2,1 W / 3,9 VA (GSM communication established)
Communication	
Port 0	Infra-red optical interface (IEC 62056-21 or IEC62056-46)
Port 1	In-house device wired interface (IEC62056-21)
Port 2	M-Bus wired interface for multiutility (EN 13757)
Port 3	GSM communication interface
LED output	
Type	LED – red
Number	2, function kWh/kvarh, kWh/kVAh – programmable
Impulse frequency	≤ 2,5 kHz
Impulse length	30 ms
Constant	Programmable

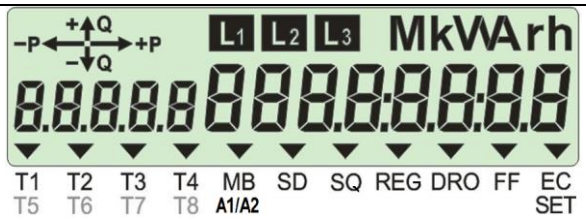
Real time clock	
Accuracy	Crystal: < 5 ppm = ≤ ± 3 min./year (at Top= +25 °C)
Backup power supply	SuperCap: > 7 days, charging time 24 hours at the nominal voltage Lithium battery
EMC	
Electrostatic discharge	Contact 8 kV, air 15 kV (IEC 61000-4-2)
VF magnetic field (80MHz – 2 GHz)	20 V/m active and 40 V/m passive (IEC 61000-4-3)
Transient test	
Current and voltage circuit not under load	6 kV (IEC 61000-4-4)
Auxiliary circuits > 40 V	2 kV
Surge test	
Current and voltage circuits	4 kV (IEC 61000-4-5)
Auxiliary circuits > 40 V	1 kV
Isolation strength	4 kV_{rms}, 50 Hz, 1 min
Impulse voltage	
Current and voltage circuits	12 kV voltage circuit, 6 kV other 1,2/50 µs (EN 50470-1)
Auxiliary circuits	6 kV, 1,2/50 µs (EN 50470-1)
Radio interference suppression	Class B (EN 50022)
Immunity to conducted disturbances	20 V (EN 61000-4-6)
Glow wire test	IEC 695-2-1
Spring hammer test	IEC 60068-2-75
Temperature ranges (IEC 62052-11)	
Operation	-40 °C ... +70 °C
LCD operation	-25 °C ... +70 °C
Storing	-40 °C ... +85 °C
Temperature coefficient (IEC 62052-11)	
Range	-40 °C ... +70 °C less than ± 0.015% / K
Ingress protection IEC 60529	IP 54
Protection class IEC 62052-11	Double isolation
Liquid Crystal Display	 Number of digits for OBIS code: 5 Index digit size: 3 x 6 mm Number of digits for value: 8 Index digit size: 4 x 8 mm

Integrated switching device	
Voltage range	0,8 Un to 1,15 Un
Reference frequency	50 Hz or 60 Hz
Maximum current Imax	85 A (DIN connection), 100 A (BS connection)
Switching device	100 A bistable relay
Switching device lifetime mechanical	1.000.000 switchings
Ambient temperature	-40 °C ... +80 °C
Short-circuit current	30 x I_{max}
Electrical fast transient / burst	4 kV (IEC 61000-4-4)
Climatic conditions	
Type of meter	Indoor meter
Humidity	Max. 95%
Altitude	Max. 2000 m
Mechanical conditions	Meter passed all mechanical tests like shock and vibration tests.
Terminals (diameter)	
Direct connected meter with 85 A terminal block	
Diameter	8,5 mm
Tightening torque	Max. 2,5 N m
Direct connected meter with 100 A terminal block	
Diameter	8,5 mm
Tightening torque	Max. 2,5 N m
Mechanical environment	M1
Electromagnetic environment	E2
Climatic class	3K7
Dimensions	200 mm x 132 mm x 82 mm (ME382, extended terminal cover) 157 mm x 132 mm x 82 mm (ME382, short terminal cover)
Mass	
ME382-D1	Approx. 0,82 kg
ME382-D3	Approx. 0,87 kg

11.2. MT382 meter

Reference voltage	
Indirect connection	3 x 230/400 V 0,8 U_n – 1,15 U_n
Direct connection	3 x 230/400 V, 3 x 120 V/208 V 0,8 U_n – 1,15 U_n
Reference frequency	50 Hz ±2 % 60 Hz ±2 %
Currents (A)	
Indirect connection	
Rated current	5 A
Maximal current	6 A
Thermal current	120% I_{max}
Short circuit current	0,5 sec 20 x I_{max}
Start-up current	< 0,2% of rated current
Direct connection	
Reference current	5 A, 10 A
Maximal current	85 A, 100 A, 120 A
Thermal current	120% I_{max}
Short circuit current	half cycle at rated frequency, 30 x I_{max}
Start-up current	< 0,4 % of reference current
Accuracy class	
Indirect connection	
Active energy	B (EN 50470-3) Class 1 (IEC 62053-21)
Reactive energy	Class 2 (IEC 62053-23)
Apparent energy	Calibrated up to 3%
Direct connection	
Active energy	A or B (EN 50470-3) Class 2 or 1 (IEC 62053-21
Reactive energy	Class 3 or 2 (IEC 62053-23)
Apparent energy	Calibrated up to 3%
Outputs	
Type – Solid State Relay (Auxiliary control switch)	
Contact	Make or break contact
Permitted load	100 mA
Voltage	250 V AC
Pulse length	From 30 ms to 200 ms (adjustable in steps by 1 ms)
Transmission distance	Up to 1000 m
Type – Relay (Load control switch)	
Voltage	250 V AC
Switching voltage	250 V AC
Maximum switching current	6 A
Switching power	1500 VA
Inputs	
Alarm input	
Voltage level	100 – 240 V AC
External button	
Voltage level	No voltage
Self-consumption	
Self-consumption of current circuit	Indirect connection: 0,012 VA/phase Direct connection: 0,05 VA/phase

Self consumption of voltage circuits	0,8 W / 2,2 VA (L2 and L3) 0,8 W / 2,9 VA (L1)
	GSM communication established: 1,2 W / 3,0 VA (L2 and L3) 1,2 W / 3,6 VA (L1)
Communication	
Port 0	Infra-red optical interface (IEC 62056-21 or IEC62056-46)
Port 1	In-house device wired interface (IEC62056-21)
Port 2	M-Bus wired interface for multiutiliy (EN 13757)
Port 3	GSM communication interface
LED output	
Type	LED – red
Number	2, function kWh/kvarh, kWh/kVAh – programmable
Impulse frequency	≤ 2,5 kHz
Impulse length	30 ms
Constant	Programmable
Real time clock	
Accuracy	Crystal: < 5 ppm = ≤ ±3 min./year (at Top= +25 °C)
Backup power supply	SuperCap: > 7 days, charging time: 24 hours at nominal voltage Lithium battery
EMC	
Electrostatic discharge	Contact 8 kV, air 15 kV (IEC 61000-4-2)
VF magnetic field (80MHz – 2 GHz)	20 V/m active and 40 V/m passive (IEC 61000-4-3)
Transient test	
Current and voltage circuit not under load	5 kV (IEC 61000-4-4)
Auxiliary circuits > 40 V	2 kV
Surge test	
Current and voltage circuits	4 kV (IEC 61000-4-5)
Auxiliary circuits > 40 V	1 kV
Isolation strength	4 kV_{rms}, 50 Hz, 1 min
Impulse voltage	
Current and voltage circuits	12 kV voltage circuit, 6 kV other 1.2/50 μs (EN 50470-1)
Auxiliary circuits	6 kV, 1.2/50 μs (EN 50470-1)
Radio interference suppression	Class B (EN 50022)
Immunity to conducted disturbances	20 V (EN 61000-4-6)
Immunity to damped oscillatory waves (Indirect connection)	2.5 kV (common mode) (EN 61000-4-18 slow damped) 1 kV (differential mode)
Glow wire test	IEC 695-2-1
Spring hammer test	IEC 60068-2-75
Temperature ranges (IEC 62052-11)	
Operation	-40 °C ... +70 °C
LCD operation	-25 °C ... +70 °C
Storing	-40 °C ... +85 °C
Temperature coefficient (IEC 62052-11)	
Range	-40 °C ... +70 °C less than ± 0.015% / K
Ingress protection IEC 60529	IP 54

Protection class IEC 62052-11	Double insolation
Liquid Crystal Display	 Number of digits for OBIS code: 5 Index digit size: 3 x 6 mm Number of digits for value: 8 Index digit size: 4 x 8 mm
Climatic conditions	
Type of meter	Indoor meter
Humidity	Max. 95%
Altitude	Max. 2000 m
Mechanical conditions	Meter passed all mechanical tests like shock and vibration tests.
Terminals (diameter)	
Indirect connected meter	
Diameter	5 mm
Tightening torque	Max. 1,5 – 1,7 N m
Direct connected meter with 85 A terminal block	
Diameter	8,5 mm
Tightening torque	Max. 2,6 – 3,0 N m
Direct connected meter with 120A terminal block	
Diameter	9,5 mm
Tightening torque	Max. 2,6 – 3,0 N m
Mechanical environment	M1
Electromagnetic environment	E2
Climatic class	3K7
Dimensions	250 mm x 178 mm x 86 mm (extended terminal cover) 193 mm x 178 mm x 86 mm (short terminal cover) 310 mm x 178 mm x 108 mm (meter with the switching device)
Mass	
MT382-D1	Approx. 1,27 kg
MT382-D2	Approx. 1,37 kg
MT382-D2 with switching device	Approx. 2,13 kg
MT382-T1	Approx. 1,30 kg

11.3. Switching device for the MT382 meter

Reference voltage U_n	3 x 230 V/400 V
Voltage range	0,8 Un to 1,15 Un
Reference frequency	50 Hz or 60 Hz
Maximum current I_{max}	85 A (DIN 43857), 120 A
Switching device	Three 100 A bistable relays
Switching device lifetime mechanical	1.000.000 switchings
Ambient temperature	-40 °C ... +80 °C
Short-circuit current	30 x I_{max}
Electrical fast transient / burst	4 kV (IEC 61000-4-4)
Dimensions	170,5 x 100 x 70 mm
Mass approx.	0,7 kg

12. ANNEX

12.1. Annex 1: Relay, SD and M-Bus disconnect states and transitions

State diagram of the Disconnect control interface class (Cosem Blue Book, ed. 12, page 68):

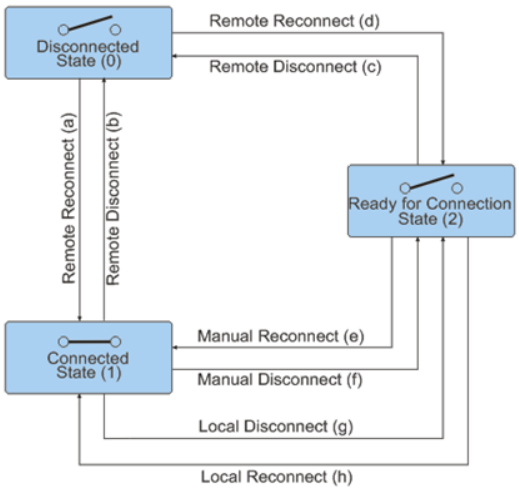


Figure 99: Relay, switching device and M-Bus disconnect state transitions

Mode	Description	
0	None. The disconnect control object is always in 'connected' state	
1	Disconnection:	Remote (b, c) Manual (f) – Press and hold **Scroll** button till **dISconn** appears and release the button Local (g)
	Reconnection:	Remote (d) Manual (e) – Press and hold **Scroll** button till **EntEr** appears and release the button
2	Disconnection:	Remote (b, c) Manual (f) – Press and hold **Scroll** button till **dISconn** appears and release the button Local (g)
	Reconnection:	Remote (a) Manual (e) – Press and hold **Scroll** button till **EntEr** appears and release the button
3	Disconnection:	Remote (b, c) Local (g)
	Reconnection:	Remote (d) Manual (e)
4	Disconnection:	Remote (b, c) Local (g)
	Reconnection:	Remote (a) Manual (e) – Press and hold **Scroll** button till **EntEr** appears and release the button
5	Disconnection:	Remote (b, c) Manual (f) – Press and hold **Scroll** button till **dISconn** appears and release the button Local (g)
	Reconnection:	Remote (d) Manual (e) – Press and hold **Scroll** button till **EntEr** appears and release the button Local (h)
6	Disconnection:	Remote (b, c) Local (g)
	Reconnection:	Remote (d) Manual (e) – Press and hold **Scroll** button till **EntEr** appears and release the button Local (h)

Table 82: Disconnect control modes

Modes of operation of the M-Bus disconnect control:
Manual (e) – Press the button on M-Bus device.
Modes of operation of the switching device:
Manual (e) – Press and hold the **Scroll** button (till the **EntEr** appears and release).

12.2. Annex 2: ME382 object list

Firmware CORE version: ISKACME382100800
Firmware MODULE version: ISKAMME382100806

OBJECT NAME	OBIS CODE
Activity calendar	
Activity calendar	0-0:13.0.0*255
Association LN	
Current association	0-0:40.0.0*255
Auto answer	
Auto answer	0-0:2.2.0*255
Auto connect	
Auto connect	0-0:2.1.0*255
Clock	
Clock	0-0:1.0.0*255
Data	
COSEM logical device name	0-0:42.0.0*255
Security - receive frame counter - unicast key	0-0:43.1.0*255
Security - receive frame counter - broadcast key	0-0:43.1.1*255
Device ID 1, manufacturing number	0-0:96.1.0*255
Device ID 2	0-0:96.1.1*255
Device ID 3	0-0:96.1.2*255
Device ID 4	0-0:96.1.3*255
Device ID 5	0-0:96.1.4*255
Device ID 6	0-0:96.1.5*255
Device ID 7	0-0:96.1.6*255
Device ID 8	0-0:96.1.7*255
Device ID 9	0-0:96.1.8*255
Number of configuration program changes	0-0:96.2.0*255
Date of last configuration program change	0-0:96.2.1*255
Status of security switches	0-0:96.2.4*255
State of input control signals	0-0:96.3.1*255
State of output control signals	0-0:96.3.2*255
Internal operating status, global	0-0:96.5.0*255
Number of power failures, in all three phases	0-0:96.7.0*255
Number of long power failures, in all three phases	0-0:96.7.5*255
Number of long power failures, in any phase	0-0:96.7.9*255
Time of power failure, in all three phases	0-0:96.7.10*255
Time of power failure, in any phase	0-0:96.7.14*255
Number of power failures, in any phase	0-0:96.7.21*255
Profile status - Load profile with period 1	0-0:96.10.1*255
Profile status - Load profile with period 2	0-0:96.10.2*255
Profile status 2	0-0:96.10.3*255
Profile status 3	0-0:96.10.4*255
ID serial process status channel 0	0-0:96.10.128*255
Event object - Standard event log	0-0:96.11.0*255
Event object - Fraud detection log	0-0:96.11.1*255
Event object - Disconnector control log	0-0:96.11.2*255
Event object - M-Bus event log	0-0:96.11.3*255
Event object - Power quality log	0-0:96.11.4*255
Event object - Communication event log	0-0:96.11.5*255
Consumer message text - Consumer information	0-0:96.13.0*255
Consumer message code - Meter display	0-0:96.13.1*255

OBJECT NAME	OBIS CODE
Currently active energy tariff	0-0:96.14.0*255
Manual Tariffication Script Activation	0-0:96.14.11*255
Cover opening counter	0-0:96.15.0*255
Breaker opening counter	0-0:96.15.1*255
Image transfer counter	0-0:96.63.10*255
ROM checksum	0-0:96.96.0*255
Last modified secure parameter identifier	0-0:96.128.0*255
Last modified secure parameter old value	0-0:96.128.1*255
Last modified secure parameter new value	0-0:96.128.2*255
Error register	0-0:97.97.0*255
Error register object 2	0-0:97.97.1*255
Alarm register 1	0-0:97.98.0*255
Alarm register 2	0-0:97.98.1*255
Alarm filter 1	0-0:97.98.10*255
Alarm filter 2	0-0:97.98.11*255
Alarm descriptor 1	0-0:97.98.20*255
Alarm descriptor 2	0-0:97.98.21*255
RTC mode	0-0:128.1.0*255
RTC calibration value	0-0:128.1.1*255
RTC backup type	0-0:128.1.2*255
RTC backup duration	0-0:128.1.3*255
Measurement calibration status	0-0:128.5.0*255
Measurement calibration constants	0-0:128.5.1*255
Watchdog resets	0-0:128.6.0*255
Number of short power failures	0-0:128.6.1*255
L1 level 1 U > +10%	0-0:128.7.11*255
L1 level 2 +5% < U < +10%	0-0:128.7.12*255
L1 level 3 0% < U < +5%	0-0:128.7.13*255
L1 level 4 -5% < U < 0%	0-0:128.7.14*255
L1 level 5 -10% < U < -5%	0-0:128.7.15*255
L1 level 6 -15% < U > -10%	0-0:128.7.16*255
L1 level 7 U < -15%	0-0:128.7.17*255
Voltage peak and minimum aggregation period [s]	0-0:128.8.50*255
Over voltage monitor and load disconnection - Enabled	0-0:128.9.1*255
Over voltage monitor and load disconnection - Disconnect voltage level	0-0:128.9.2*255
Over voltage monitor and load disconnection - Reconnect voltage level	0-0:128.9.3*255
Over voltage monitor and load disconnection - Disconnect time	0-0:128.9.4*255
Over voltage monitor and load disconnection - Reconnect time	0-0:128.9.5*255
Tariff switch source	0-0:128.10.0*255
Tariff synchronized with meas. per.	0-0:128.10.1*255
Previous values readout count	0-0:128.11.4*255
GSM signal quality	0-0:128.20.0*255
GSM status	0-0:128.20.1*255
ID GSM ICCID	0-0:128.20.2*255
GSM program version	0-0:128.20.3*255
GSM IMEI	0-0:128.20.4*255
GSM network name	0-0:128.20.5*255
GSM Wipsoft program version	0-0:128.20.6*255
GSM signal strength indication limit 1	0-0:128.20.11*255
GSM signal strength indication limit 2	0-0:128.20.12*255
Load management delay mode	0-0:128.30.0*255
Load management power on delay [s]	0-0:128.30.2*255
Load management switch on delay [s]	0-0:128.30.3*255

OBJECT NAME	OBIS CODE
Signal control delay mode	0-0:128.30.10*255
Signal control power on delay [s]	0-0:128.30.12*255
Signal control switch on delay [s]	0-0:128.30.13*255
Service control functionality	0-0:128.30.14*255
Switching device type	0-0:128.30.20*255
Manual reconnect period	0-0:128.30.24*255
Disconnection control status	0-0:128.30.25*255
Disconnection control status 2	0-0:128.30.26*255
Mem Partition 0	0-0:128.40.0*255
Mem Partition 1	0-0:128.40.1*255
Mem Partition 2	0-0:128.40.2*255
Mem Partition 3	0-0:128.40.3*255
Mem Partition 4	0-0:128.40.4*255
Flashdev spy param	0-0:128.41.0*255
Flashdev spy values	0-0:128.41.1*255
M-Bus client configuration	0-0:128.50.1*255
Payment mode	0-0:128.60.0*255
Payment status	0-0:128.60.3*255
Credit transfer	0-0:128.60.30*255
Energy register reference	0-0:128.60.31*255
Accounting register reference	0-0:128.60.32*255
Power limit mode	0-0:128.61.10*255
Available power	0-0:128.61.11*255
Maximum available power	0-0:128.61.12*255
Limited power	0-0:128.61.13*255
Available power exceeding time	0-0:128.61.14*255
Maximum available power exceeding time	0-0:128.61.15*255
Over current duration	0-0:128.62.10*255
DLMS options channel 0	0-0:128.70.0*255
DLMS association restrictions channel 0	0-0:128.70.1*255
Profile access options	0-0:128.90.0*255
Authentication key 1	0-0:128.100.1*255
Authentication key 2	0-0:128.100.2*255
Authentication key 3	0-0:128.100.3*255
Authentication key 4	0-0:128.100.4*255
Master key	0-0:128.100.10*255
Global unicast encryption key	0-0:128.100.20*255
Global broadcast encryption key	0-0:128.100.21*255
Authentication key	0-0:128.100.22*255
Performance data	0-0:128.102.0*255
Performance events	0-0:128.102.1*255
Device mode	0-0:128.103.0*255
Device stamp	0-0:128.103.1*255
Device flags	0-0:128.103.2*255
Measuring configuration	0-0:196.0.0*255
Transformer - measurement type	0-0:196.0.1*255
Startup current hysteresis	0-0:196.0.23*255
Display format for energy	0-0:196.1.0*255
Display format for demand	0-0:196.1.1*255
Display configuration	0-0:196.1.3*255
Configurable I/O settings	0-0:196.3.0*255
Metropulse output configuration	0-0:196.3.6*255
Currency rate scaler	0-0:196.60.0*255

OBJECT NAME	OBIS CODE
Error filter 1	0-0:196.97.0*255
Error filter 2	0-0:196.97.1*255
Error 1 display filter	0-0:196.97.10*255
Error 2 display filter	0-0:196.97.11*255
Authentication failure stamp	0-0:196.98.0*255
Authentication failure count	0-0:196.98.1*255
Decryption and authentication failure count limit	0-0:196.98.2*255
Authentication mechanism restrictions	0-0:196.98.3*255
Decryption failure stamp	0-0:196.98.4*255
Decryption failure count	0-0:196.98.5*255
M-Bus Device ID 1 channel 1	0-1:96.1.0*255
M-Bus Device ID 2 channel 1	0-1:96.1.1*255
Profile status for M-Bus master load profile 1	0-1:96.10.3*255
ID serial process status channel 1	0-1:96.10.128*255
Event objects - M-Bus master control logs 1	0-1:96.11.4*255
DLMS options channel 1	0-1:128.70.0*255
DLMS association restrictions channel 1	0-1:128.70.1*255
Master key - Consumer information	0-1:128.100.10*255
Global unicast encryption key - Consumer information	0-1:128.100.20*255
Global broadcast encryption key - Consumer information	0-1:128.100.21*255
Authentication key - Consumer information	0-1:128.100.22*255
M-Bus Device ID 1 channel 2	0-2:96.1.0*255
M-Bus Device ID 2 channel 2	0-2:96.1.1*255
Profile status for M-Bus master load profile 2	0-2:96.10.3*255
ID serial process status channel 2	0-2:96.10.128*255
Event objects - M-Bus master control logs 2	0-2:96.11.4*255
DLMS options channel 2	0-2:128.70.0*255
DLMS association restrictions channel 2	0-2:128.70.1*255
M-Bus Device ID 1 channel 3	0-3:96.1.0*255
M-Bus Device ID 2 channel 3	0-3:96.1.1*255
Profile status for M-Bus master load profile 3	0-3:96.10.3*255
ID serial process status channel 3	0-3:96.10.128*255
Event objects - M-Bus master control logs 3	0-3:96.11.4*255
M-Bus Device ID 1 channel 4	0-4:96.1.0*255
M-Bus Device ID 2 channel 4	0-4:96.1.1*255
Profile status for M-Bus master load profile 4	0-4:96.10.3*255
Event objects - M-Bus master control logs 4	0-4:96.11.4*255
Electricity ID 1	1-0:0.0.0*255
Billing period counter	1-0:0.1.0*255
Time stamp of the most recent billing period	1-0:0.1.2*255
Active firmware version	1-0:0.2.0*255
Time switch program number	1-0:0.2.2*255
Active firmware core signature	1-0:0.2.8*255
Active energy, metrological LED	1-0:0.3.0*255
Reactive energy, metrological LED	1-0:0.3.1*255
Apparent energy, metrological LED	1-0:0.3.2*255
Active energy, output pulse meter constant [impulses/kWh]	1-0:0.3.3*255
Reactive energy, output pulse meter constant [impulses/kvarh]	1-0:0.3.4*255
Apparent energy, output pulse meter constant [impulses/kVAh]	1-0:0.3.5*255
Transformer ratio - current (numerator)	1-0:0.4.2*255
Transformer ratio - voltage (numerator)	1-0:0.4.3*255
Transformer ratio - current (denominator)	1-0:0.4.5*255
Transformer ratio - voltage (denominator)	1-0:0.4.6*255

OBJECT NAME	OBIS CODE
Measurement period 1, for average value 1	1-0:0.8.0*255
Local time	1-0:0.9.1*255
Local date	1-0:0.9.2*255
Time integral for voltage sag	1-0:12.31.129*255
Counter for voltage sag	1-0:12.32.0*255
Time integral for voltage swell	1-0:12.35.129*255
Counter for voltage swell	1-0:12.36.0*255
Number of voltage sags in phase L1	1-0:32.32.0*255
Number of voltage swells in phase L1	1-0:32.36.0*255
Internal operating status, statusword 1	1-0:96.5.1*255
Power failure alarm filtering limit [s]	1-0:96.239.0*255
Alarm on status 1	1-0:96.242.0*255
Alarm on status 2	1-0:96.242.10*255
Alarm off status 1	1-0:96.243.0*255
Alarm off status 2	1-0:96.243.10*255
Event system	1-0:96.245.0*255
Fraud detection hold-off period	1-0:96.245.10*255
Alarm system	1-0:96.246.0*255
Active firmware version 1	1-1:0.2.0*255
Active firmware module signature	1-1:0.2.8*255
Demand register	
Demand register - Active energy import (+A)	1-0:1.4.0*255
Average import power (+A)	1-0:1.24.0*255
Demand register - Active energy export (-A)	1-0:2.4.0*255
Demand register - Reactive energy import (+R)	1-0:3.4.0*255
Demand register - Reactive energy export (-R)	1-0:4.4.0*255
Demand register - Apparent energy import (+VA)	1-0:9.4.0*255
Demand register - Apparent energy export (-VA)	1-0:10.4.0*255
Demand register - Active energy combined (|+A|+|-A|)	1-0:15.4.0*255
Average total power (|+A|+|-A|)	1-0:15.24.0*255
Average net power (|+A|-|-A|)	1-0:16.24.0*255
Sliding average current L1 (for fuse supervision)	1-0:31.4.0*255
Disconnect control	
Disconnect control	0-0:96.3.10*255
M-Bus master disconnect control object 1	0-1:24.4.0*255
Load management - Relay control 1	0-1:96.3.10*255
M-Bus master disconnect control object 2	0-2:24.4.0*255
Load management - Relay control 2	0-2:96.3.10*255
M-Bus master disconnect control object 3	0-3:24.4.0*255
M-Bus master disconnect control object 4	0-4:24.4.0*255
Extended register	
M-Bus value channel 1, instance 1	0-1:24.2.1*255
M-Bus value channel 1, instance 2	0-1:24.2.2*255
M-Bus value channel 1, instance 3	0-1:24.2.3*255
M-Bus value channel 1, instance 4	0-1:24.2.4*255
M-Bus value channel 2, instance 1	0-2:24.2.1*255
M-Bus value channel 2, instance 2	0-2:24.2.2*255
M-Bus value channel 2, instance 3	0-2:24.2.3*255
M-Bus value channel 2, instance 4	0-2:24.2.4*255
M-Bus value channel 3, instance 1	0-3:24.2.1*255
M-Bus value channel 3, instance 2	0-3:24.2.2*255
M-Bus value channel 3, instance 3	0-3:24.2.3*255
M-Bus value channel 3, instance 4	0-3:24.2.4*255

OBJECT NAME	OBIS CODE
M-Bus value channel 4, instance 1	0-4:24.2.1*255
M-Bus value channel 4, instance 2	0-4:24.2.2*255
M-Bus value channel 4, instance 3	0-4:24.2.3*255
M-Bus value channel 4, instance 4	0-4:24.2.4*255
Last average demand register - Active energy import (+A)	1-0:1.5.0*255
Maximum demand register - Active energy import (+A)	1-0:1.6.0*255
Maximum demand register - Active energy import (+A) Rate 1	1-0:1.6.1*255
Maximum demand register - Active energy import (+A) Rate 2	1-0:1.6.2*255
Maximum demand register - Active energy import (+A) Rate 3	1-0:1.6.3*255
Maximum demand register - Active energy import (+A) Rate 4	1-0:1.6.4*255
Maximum demand register - Active energy import (+A) Rate 5	1-0:1.6.5*255
Maximum demand register - Active energy import (+A) Rate 6	1-0:1.6.6*255
Maximum demand register - Active energy import (+A) Rate 7	1-0:1.6.7*255
Maximum demand register - Active energy import (+A) Rate 8	1-0:1.6.8*255
Last average demand register - Active energy export (-A)	1-0:2.5.0*255
Maximum demand register - Active energy export (-A)	1-0:2.6.0*255
Maximum demand register - Active energy export (-A) Rate 1	1-0:2.6.1*255
Maximum demand register - Active energy export (-A) Rate 2	1-0:2.6.2*255
Maximum demand register - Active energy export (-A) Rate 3	1-0:2.6.3*255
Maximum demand register - Active energy export (-A) Rate 4	1-0:2.6.4*255
Maximum demand register - Active energy export (-A) Rate 5	1-0:2.6.5*255
Maximum demand register - Active energy export (-A) Rate 6	1-0:2.6.6*255
Maximum demand register - Active energy export (-A) Rate 7	1-0:2.6.7*255
Maximum demand register - Active energy export (-A) Rate 8	1-0:2.6.8*255
Last average demand register - Reactive energy import (+R)	1-0:3.5.0*255
Maximum demand register - Reactive energy import (+R)	1-0:3.6.0*255
Maximum demand register - Reactive energy import (+R) Rate 1	1-0:3.6.1*255
Maximum demand register - Reactive energy import (+R) Rate 2	1-0:3.6.2*255
Maximum demand register - Reactive energy import (+R) Rate 3	1-0:3.6.3*255
Maximum demand register - Reactive energy import (+R) Rate 4	1-0:3.6.4*255
Maximum demand register - Reactive energy import (+R) Rate 5	1-0:3.6.5*255
Maximum demand register - Reactive energy import (+R) Rate 6	1-0:3.6.6*255
Maximum demand register - Reactive energy import (+R) Rate 7	1-0:3.6.7*255
Maximum demand register - Reactive energy import (+R) Rate 8	1-0:3.6.8*255
Last average demand register - Reactive energy export (-R)	1-0:4.5.0*255
Maximum demand register - Reactive energy export (-R)	1-0:4.6.0*255
Maximum demand register - Reactive energy export (-R) Rate 1	1-0:4.6.1*255
Maximum demand register - Reactive energy export (-R) Rate 2	1-0:4.6.2*255
Maximum demand register - Reactive energy export (-R) Rate 3	1-0:4.6.3*255
Maximum demand register - Reactive energy export (-R) Rate 4	1-0:4.6.4*255
Maximum demand register - Reactive energy export (-R) Rate 5	1-0:4.6.5*255
Maximum demand register - Reactive energy export (-R) Rate 6	1-0:4.6.6*255
Maximum demand register - Reactive energy export (-R) Rate 7	1-0:4.6.7*255
Maximum demand register - Reactive energy export (-R) Rate 8	1-0:4.6.8*255
Last average demand register - Apparent energy import (+VA)	1-0:9.5.0*255
Maximum demand register - Apparent energy import (+VA)	1-0:9.6.0*255
Maximum demand register - Apparent energy import (+VA) Rate 1	1-0:9.6.1*255
Maximum demand register - Apparent energy import (+VA) Rate 2	1-0:9.6.2*255
Maximum demand register - Apparent energy import (+VA) Rate 3	1-0:9.6.3*255
Maximum demand register - Apparent energy import (+VA) Rate 4	1-0:9.6.4*255
Maximum demand register - Apparent energy import (+VA) Rate 5	1-0:9.6.5*255
Maximum demand register - Apparent energy import (+VA) Rate 6	1-0:9.6.6*255
Maximum demand register - Apparent energy import (+VA) Rate 7	1-0:9.6.7*255

OBJECT NAME	OBIS CODE
Maximum demand register - Apparent energy import (+VA) Rate 8	1-0:9.6.8*255
Last average demand register - Apparent energy export (-VA)	1-0:10.5.0*255
Maximum demand register - Apparent energy export (-VA)	1-0:10.6.0*255
Maximum demand register - Apparent energy export (-VA) Rate 1	1-0:10.6.1*255
Maximum demand register - Apparent energy export (-VA) Rate 2	1-0:10.6.2*255
Maximum demand register - Apparent energy export (-VA) Rate 3	1-0:10.6.3*255
Maximum demand register - Apparent energy export (-VA) Rate 4	1-0:10.6.4*255
Maximum demand register - Apparent energy export (-VA) Rate 5	1-0:10.6.5*255
Maximum demand register - Apparent energy export (-VA) Rate 6	1-0:10.6.6*255
Maximum demand register - Apparent energy export (-VA) Rate 7	1-0:10.6.7*255
Maximum demand register - Apparent energy export (-VA) Rate 8	1-0:10.6.8*255
Minimum power factor (+A/+VA)	1-0:13.3.0*255
Last average power factor (+A/+VA)	1-0:13.5.0*255
Active demand last combined (|+A|+|-A|)	1-0:15.5.0*255
Maximum demand register - Active energy combined (|+A|+|-A|)	1-0:15.6.0*255
Maximum demand register - Active energy combined (|+A|+|-A|) Rate 1	1-0:15.6.1*255
Maximum demand register - Active energy combined (|+A|+|-A|) Rate 2	1-0:15.6.2*255
Maximum demand register - Active energy combined (|+A|+|-A|) Rate 3	1-0:15.6.3*255
Maximum demand register - Active energy combined (|+A|+|-A|) Rate 4	1-0:15.6.4*255
Maximum demand register - Active energy combined (|+A|+|-A|) Rate 5	1-0:15.6.5*255
Maximum demand register - Active energy combined (|+A|+|-A|) Rate 6	1-0:15.6.6*255
Maximum demand register - Active energy combined (|+A|+|-A|) Rate 7	1-0:15.6.7*255
Maximum demand register - Active energy combined (|+A|+|-A|) Rate 8	1-0:15.6.8*255
GPRS modem setup	
GPRS modem setup	0-0:25.4.0*255
IEC HDLC setup class	
IEC HDLC setup channel 0	0-0:22.0.0*255
IEC HDLC setup channel 1	0-1:22.0.0*255
IEC HDLC setup channel 2	0-2:22.0.0*255
IEC local port setup	
IEC local port setup channel 0	0-0:20.0.0*255
IEC local port setup channel 1	0-1:20.0.0*255
IEC local port setup channel 2	0-2:20.0.0*255
Image transfer interface class	
Image transfer	0-0:44.0.0*255
IPv4 setup	
IPv4 setup	0-0:25.1.0*255
Limiter	
Limiter 1	0-0:17.0.0*255
Limiter 2	0-0:17.0.1*255
M-Bus client	
M-Bus client channel 1	0-1:24.1.0*255
M-Bus client channel 2	0-2:24.1.0*255
M-Bus client channel 3	0-3:24.1.0*255
M-Bus client channel 4	0-4:24.1.0*255
M-Bus master port setup	
M-Bus master port setup 1	0-0:24.6.0*255
Modem configuration	
Modem configuration	0-0:2.0.0*255
PPP setup	
PPP setup	0-0:25.3.0*255
Profile generic	
General local port readout	0-0:21.0.0*255

OBJECT NAME	OBIS CODE
General display readout	0-0:21.0.1*255
Alternate display readout	0-0:21.0.2*255
Data of billing period 1	0-0:98.1.0*255
Data of billing period 2	0-0:98.2.0*255
Standard event log	0-0:99.98.0*255
Fraud detection log	0-0:99.98.1*255
Disconnector control log	0-0:99.98.2*255
M-Bus event log	0-0:99.98.3*255
Power quality log	0-0:99.98.4*255
Communication event log	0-0:99.98.5*255
M-Bus master load profile for channel 1	0-1:24.3.0*255
M-Bus master control log object 1	0-1:24.5.0*255
M-Bus master load profile for channel 2	0-2:24.3.0*255
M-Bus master control log object 2	0-2:24.5.0*255
M-Bus master load profile for channel 3	0-3:24.3.0*255
M-Bus master control log object 3	0-3:24.5.0*255
M-Bus master load profile for channel 4	0-4:24.3.0*255
M-Bus master control log object 4	0-4:24.5.0*255
Load profile with period 1, i.e. General load profile	1-0:99.1.0*255
Load profile with period 2, i.e. Daily values profile	1-0:99.2.0*255
Power failure event log	1-0:99.97.0*255
Certification data log	1-0:99.99.0*255
Push setup	
Push setup - On connectivity	0-0:25.9.0*255
Push setup - Interval 1	0-1:25.9.0*255
Push setup - Interval 2	0-2:25.9.0*255
Push setup - Interval 3	0-3:25.9.0*255
Push setup - On alarm	0-4:25.9.0*255
Push setup - On power down	0-5:25.9.0*255
Push setup - Consumer information	0-6:25.9.0*255
Push setup - On installation	0-7:25.9.0*255
Register	
Battery use time counter	0-0:96.6.0*255
Battery estimated remaining use time	0-0:96.6.6*255
Duration of last long power failure, in all three phases	0-0:96.7.15*255
Duration of last long power failure, in any phase	0-0:96.7.19*255
Time threshold for long power failure	0-0:96.7.20*255
L1 daily peak voltage - current	0-0:128.8.10*255
L1 daily peak voltage - previous	0-0:128.8.11*255
L1 daily minimum voltage - current	0-0:128.8.12*255
L1 daily minimum voltage - previous	0-0:128.8.13*255
No connection timeout	0-0:128.20.30*255
Available credit	0-0:128.60.1*255
Emergency credit	0-0:128.60.2*255
Total purchase value	0-0:128.60.4*255
Initial emergency credit limit	0-0:128.60.10*255
Emergency credit limit	0-0:128.60.11*255
Emergency credit threshold	0-0:128.60.12*255
Active auxiliary charge	0-0:128.60.20*255
Active rate 1	0-0:128.60.21*255
Active rate 2	0-0:128.60.22*255
Active rate 3	0-0:128.60.23*255
Active rate 4	0-0:128.60.24*255

OBJECT NAME	OBIS CODE
Active rate 5	0-0:128.60.25*255
Active rate 6	0-0:128.60.26*255
Active rate 7	0-0:128.60.27*255
Active rate 8	0-0:128.60.28*255
Passive auxiliary charge	0-0:128.60.40*255
Passive rate 1	0-0:128.60.41*255
Passive rate 2	0-0:128.60.42*255
Passive rate 3	0-0:128.60.43*255
Passive rate 4	0-0:128.60.44*255
Passive rate 5	0-0:128.60.45*255
Passive rate 6	0-0:128.60.46*255
Passive rate 7	0-0:128.60.47*255
Passive rate 8	0-0:128.60.48*255
Nominal voltage	1-0:0.6.0*255
Measurement period 3, for instantaneous values	1-0:0.8.2*255
Clock time shift limit	1-0:0.9.11*255
Cumulative maximum demand register - Active energy import (+A)	1-0:1.2.0*255
Cumulative maximum demand register - Active energy import (+A) Rate 1	1-0:1.2.1*255
Cumulative maximum demand register - Active energy import (+A) Rate 2	1-0:1.2.2*255
Cumulative maximum demand register - Active energy import (+A) Rate 3	1-0:1.2.3*255
Cumulative maximum demand register - Active energy import (+A) Rate 4	1-0:1.2.4*255
Cumulative maximum demand register - Active energy import (+A) Rate 5	1-0:1.2.5*255
Cumulative maximum demand register - Active energy import (+A) Rate 6	1-0:1.2.6*255
Cumulative maximum demand register - Active energy import (+A) Rate 7	1-0:1.2.7*255
Cumulative maximum demand register - Active energy import (+A) Rate 8	1-0:1.2.8*255
Instantaneous active import power (+A)	1-0:1.7.0*255
Active energy import (+A)	1-0:1.8.0*255
Active energy import (+A) Rate 1	1-0:1.8.1*255
Active energy import (+A) Rate 2	1-0:1.8.2*255
Active energy import (+A) Rate 3	1-0:1.8.3*255
Active energy import (+A) Rate 4	1-0:1.8.4*255
Active energy import (+A) Rate 5	1-0:1.8.5*255
Active energy import (+A) Rate 6	1-0:1.8.6*255
Active energy import (+A) Rate 7	1-0:1.8.7*255
Active energy import (+A) Rate 8	1-0:1.8.8*255
Active energy import (+A), Time integral 2	1-0:1.9.0*255
Active energy import (+A), Time integral 2 Rate 1	1-0:1.9.1*255
Active energy import (+A), Time integral 2 Rate 2	1-0:1.9.2*255
Active energy import (+A), Time integral 2 Rate 3	1-0:1.9.3*255
Active energy import (+A), Time integral 2 Rate 4	1-0:1.9.4*255
Active energy import (+A), Time integral 2 Rate 5	1-0:1.9.5*255
Active energy import (+A), Time integral 2 Rate 6	1-0:1.9.6*255
Active energy import (+A), Time integral 2 Rate 7	1-0:1.9.7*255
Active energy import (+A), Time integral 2 Rate 8	1-0:1.9.8*255
Cumulative maximum demand register - Active energy export (-A)	1-0:2.2.0*255
Cumulative maximum demand register - Active energy export (-A) Rate 1	1-0:2.2.1*255
Cumulative maximum demand register - Active energy export (-A) Rate 2	1-0:2.2.2*255
Cumulative maximum demand register - Active energy export (-A) Rate 3	1-0:2.2.3*255
Cumulative maximum demand register - Active energy export (-A) Rate 4	1-0:2.2.4*255
Cumulative maximum demand register - Active energy export (-A) Rate 5	1-0:2.2.5*255
Cumulative maximum demand register - Active energy export (-A) Rate 6	1-0:2.2.6*255
Cumulative maximum demand register - Active energy export (-A) Rate 7	1-0:2.2.7*255
Cumulative maximum demand register - Active energy export (-A) Rate 8	1-0:2.2.8*255

OBJECT NAME	OBIS CODE
Instantaneous active export power (-A)	1-0:2.7.0*255
Active energy export (-A)	1-0:2.8.0*255
Active energy export (-A) Rate 1	1-0:2.8.1*255
Active energy export (-A) Rate 2	1-0:2.8.2*255
Active energy export (-A) Rate 3	1-0:2.8.3*255
Active energy export (-A) Rate 4	1-0:2.8.4*255
Active energy export (-A) Rate 5	1-0:2.8.5*255
Active energy export (-A) Rate 6	1-0:2.8.6*255
Active energy export (-A) Rate 7	1-0:2.8.7*255
Active energy export (-A) Rate 8	1-0:2.8.8*255
Active energy export (-A), Time integral 2	1-0:2.9.0*255
Active energy export (-A), Time integral 2 Rate 1	1-0:2.9.1*255
Active energy export (-A), Time integral 2 Rate 2	1-0:2.9.2*255
Active energy export (-A), Time integral 2 Rate 3	1-0:2.9.3*255
Active energy export (-A), Time integral 2 Rate 4	1-0:2.9.4*255
Active energy export (-A), Time integral 2 Rate 5	1-0:2.9.5*255
Active energy export (-A), Time integral 2 Rate 6	1-0:2.9.6*255
Active energy export (-A), Time integral 2 Rate 7	1-0:2.9.7*255
Active energy export (-A), Time integral 2 Rate 8	1-0:2.9.8*255
Cumulative maximum demand register - Reactive energy import (+R)	1-0:3.2.0*255
Cumulative maximum demand register - Reactive energy import (+R) Rate 1	1-0:3.2.1*255
Cumulative maximum demand register - Reactive energy import (+R) Rate 2	1-0:3.2.2*255
Cumulative maximum demand register - Reactive energy import (+R) Rate 3	1-0:3.2.3*255
Cumulative maximum demand register - Reactive energy import (+R) Rate 4	1-0:3.2.4*255
Cumulative maximum demand register - Reactive energy import (+R) Rate 5	1-0:3.2.5*255
Cumulative maximum demand register - Reactive energy import (+R) Rate 6	1-0:3.2.6*255
Cumulative maximum demand register - Reactive energy import (+R) Rate 7	1-0:3.2.7*255
Cumulative maximum demand register - Reactive energy import (+R) Rate 8	1-0:3.2.8*255
Instantaneous reactive import power (+R)	1-0:3.7.0*255
Reactive energy import (+R)	1-0:3.8.0*255
Reactive energy import (+R) Rate 1	1-0:3.8.1*255
Reactive energy import (+R) Rate 2	1-0:3.8.2*255
Reactive energy import (+R) Rate 3	1-0:3.8.3*255
Reactive energy import (+R) Rate 4	1-0:3.8.4*255
Reactive energy import (+R) Rate 5	1-0:3.8.5*255
Reactive energy import (+R) Rate 6	1-0:3.8.6*255
Reactive energy import (+R) Rate 7	1-0:3.8.7*255
Reactive energy import (+R) Rate 8	1-0:3.8.8*255
Cumulative maximum demand register - Reactive energy export (-R)	1-0:4.2.0*255
Cumulative maximum demand register - Reactive energy export (-R) Rate 1	1-0:4.2.1*255
Cumulative maximum demand register - Reactive energy export (-R) Rate 2	1-0:4.2.2*255
Cumulative maximum demand register - Reactive energy export (-R) Rate 3	1-0:4.2.3*255
Cumulative maximum demand register - Reactive energy export (-R) Rate 4	1-0:4.2.4*255
Cumulative maximum demand register - Reactive energy export (-R) Rate 5	1-0:4.2.5*255
Cumulative maximum demand register - Reactive energy export (-R) Rate 6	1-0:4.2.6*255
Cumulative maximum demand register - Reactive energy export (-R) Rate 7	1-0:4.2.7*255
Cumulative maximum demand register - Reactive energy export (-R) Rate 8	1-0:4.2.8*255
Instantaneous reactive export power (-R)	1-0:4.7.0*255
Reactive energy export (-R)	1-0:4.8.0*255
Reactive energy export (-R) Rate 1	1-0:4.8.1*255
Reactive energy export (-R) Rate 2	1-0:4.8.2*255
Reactive energy export (-R) Rate 3	1-0:4.8.3*255
Reactive energy export (-R) Rate 4	1-0:4.8.4*255

OBJECT NAME	OBIS CODE
Reactive energy export (-R) Rate 5	1-0:4.8.5*255
Reactive energy export (-R) Rate 6	1-0:4.8.6*255
Reactive energy export (-R) Rate 7	1-0:4.8.7*255
Reactive energy export (-R) Rate 8	1-0:4.8.8*255
Reactive energy QI (+Ri)	1-0:5.8.0*255
Reactive energy QI (+Ri) Rate 1	1-0:5.8.1*255
Reactive energy QI (+Ri) Rate 2	1-0:5.8.2*255
Reactive energy QI (+Ri) Rate 3	1-0:5.8.3*255
Reactive energy QI (+Ri) Rate 4	1-0:5.8.4*255
Reactive energy QI (+Ri) Rate 5	1-0:5.8.5*255
Reactive energy QI (+Ri) Rate 6	1-0:5.8.6*255
Reactive energy QI (+Ri) Rate 7	1-0:5.8.7*255
Reactive energy QI (+Ri) Rate 8	1-0:5.8.8*255
Reactive energy QII (+Rc)	1-0:6.8.0*255
Reactive energy QII (+Rc) Rate 1	1-0:6.8.1*255
Reactive energy QII (+Rc) Rate 2	1-0:6.8.2*255
Reactive energy QII (+Rc) Rate 3	1-0:6.8.3*255
Reactive energy QII (+Rc) Rate 4	1-0:6.8.4*255
Reactive energy QII (+Rc) Rate 5	1-0:6.8.5*255
Reactive energy QII (+Rc) Rate 6	1-0:6.8.6*255
Reactive energy QII (+Rc) Rate 7	1-0:6.8.7*255
Reactive energy QII (+Rc) Rate 8	1-0:6.8.8*255
Reactive energy QIII (-Ri)	1-0:7.8.0*255
Reactive energy QIII (-Ri) Rate 1	1-0:7.8.1*255
Reactive energy QIII (-Ri) Rate 2	1-0:7.8.2*255
Reactive energy QIII (-Ri) Rate 3	1-0:7.8.3*255
Reactive energy QIII (-Ri) Rate 4	1-0:7.8.4*255
Reactive energy QIII (-Ri) Rate 5	1-0:7.8.5*255
Reactive energy QIII (-Ri) Rate 6	1-0:7.8.6*255
Reactive energy QIII (-Ri) Rate 7	1-0:7.8.7*255
Reactive energy QIII (-Ri) Rate 8	1-0:7.8.8*255
Reactive energy QIV (-Rc)	1-0:8.8.0*255
Reactive energy QIV (-Rc) Rate 1	1-0:8.8.1*255
Reactive energy QIV (-Rc) Rate 2	1-0:8.8.2*255
Reactive energy QIV (-Rc) Rate 3	1-0:8.8.3*255
Reactive energy QIV (-Rc) Rate 4	1-0:8.8.4*255
Reactive energy QIV (-Rc) Rate 5	1-0:8.8.5*255
Reactive energy QIV (-Rc) Rate 6	1-0:8.8.6*255
Reactive energy QIV (-Rc) Rate 7	1-0:8.8.7*255
Reactive energy QIV (-Rc) Rate 8	1-0:8.8.8*255
Cumulative maximum demand register - Apparent energy import (+VA)	1-0:9.2.0*255
Cumulative maximum demand register - Apparent energy import (+VA) Rate 1	1-0:9.2.1*255
Cumulative maximum demand register - Apparent energy import (+VA) Rate 2	1-0:9.2.2*255
Cumulative maximum demand register - Apparent energy import (+VA) Rate 3	1-0:9.2.3*255
Cumulative maximum demand register - Apparent energy import (+VA) Rate 4	1-0:9.2.4*255
Cumulative maximum demand register - Apparent energy import (+VA) Rate 5	1-0:9.2.5*255
Cumulative maximum demand register - Apparent energy import (+VA) Rate 6	1-0:9.2.6*255
Cumulative maximum demand register - Apparent energy import (+VA) Rate 7	1-0:9.2.7*255
Cumulative maximum demand register - Apparent energy import (+VA) Rate 8	1-0:9.2.8*255
Instantaneous apparent import power (+VA)	1-0:9.7.0*255
Apparent energy import (+VA)	1-0:9.8.0*255
Apparent energy import (+VA) Rate 1	1-0:9.8.1*255
Apparent energy import (+VA) Rate 2	1-0:9.8.2*255

OBJECT NAME	OBIS CODE
Apparent energy import (+VA) Rate 3	1-0:9.8.3*255
Apparent energy import (+VA) Rate 4	1-0:9.8.4*255
Apparent energy import (+VA) Rate 5	1-0:9.8.5*255
Apparent energy import (+VA) Rate 6	1-0:9.8.6*255
Apparent energy import (+VA) Rate 7	1-0:9.8.7*255
Apparent energy import (+VA) Rate 8	1-0:9.8.8*255
Cumulative maximum demand register - Apparent energy export (-VA)	1-0:10.2.0*255
Cumulative maximum demand register - Apparent energy export (-VA) Rate 1	1-0:10.2.1*255
Cumulative maximum demand register - Apparent energy export (-VA) Rate 2	1-0:10.2.2*255
Cumulative maximum demand register - Apparent energy export (-VA) Rate 3	1-0:10.2.3*255
Cumulative maximum demand register - Apparent energy export (-VA) Rate 4	1-0:10.2.4*255
Cumulative maximum demand register - Apparent energy export (-VA) Rate 5	1-0:10.2.5*255
Cumulative maximum demand register - Apparent energy export (-VA) Rate 6	1-0:10.2.6*255
Cumulative maximum demand register - Apparent energy export (-VA) Rate 7	1-0:10.2.7*255
Cumulative maximum demand register - Apparent energy export (-VA) Rate 8	1-0:10.2.8*255
Instantaneous apparent export power (-VA)	1-0:10.7.0*255
Apparent energy export (-VA)	1-0:10.8.0*255
Apparent energy export (-VA) Rate 1	1-0:10.8.1*255
Apparent energy export (-VA) Rate 2	1-0:10.8.2*255
Apparent energy export (-VA) Rate 3	1-0:10.8.3*255
Apparent energy export (-VA) Rate 4	1-0:10.8.4*255
Apparent energy export (-VA) Rate 5	1-0:10.8.5*255
Apparent energy export (-VA) Rate 6	1-0:10.8.6*255
Apparent energy export (-VA) Rate 7	1-0:10.8.7*255
Apparent energy export (-VA) Rate 8	1-0:10.8.8*255
Threshold for voltage sag	1-0:12.31.0*255
Voltage : any phase, Under limit duration	1-0:12.33.0*255
Magnitude for voltage sag	1-0:12.34.0*255
Threshold for voltage swell	1-0:12.35.0*255
Voltage : any phase, Over limit duration	1-0:12.37.0*255
Magnitude for voltage swell	1-0:12.38.0*255
Threshold for missing voltage (voltage cut)	1-0:12.39.0*255
Time threshold for voltage sag	1-0:12.43.0*255
Time threshold for voltage swell	1-0:12.44.0*255
Time threshold for voltage cut	1-0:12.45.0*255
Instantaneous power factor (+A/+VA)	1-0:13.7.0*255
Instantaneous net frequency : any phase	1-0:14.7.0*255
Cumulative maximum demand register - Active energy combined (|+A|+|-A|)	1-0:15.2.0*255
Cumulative maximum demand register - Active energy combined (|+A|+|-A|) Rate 1	1-0:15.2.1*255
Cumulative maximum demand register - Active energy combined (|+A|+|-A|) Rate 2	1-0:15.2.2*255
Cumulative maximum demand register - Active energy combined (|+A|+|-A|) Rate 3	1-0:15.2.3*255
Cumulative maximum demand register - Active energy combined (|+A|+|-A|) Rate 4	1-0:15.2.4*255
Cumulative maximum demand register - Active energy combined (|+A|+|-A|) Rate 5	1-0:15.2.5*255
Cumulative maximum demand register - Active energy combined (|+A|+|-A|) Rate 6	1-0:15.2.6*255
Cumulative maximum demand register - Active energy combined (|+A|+|-A|) Rate 7	1-0:15.2.7*255
Cumulative maximum demand register - Active energy combined (|+A|+|-A|) Rate 8	1-0:15.2.8*255
Instantaneous active power combined (|+A|+|-A|)	1-0:15.7.0*255
Active energy combined (|+A|+|-A|)	1-0:15.8.0*255
Active energy combined (|+A|+|-A|) Rate 1	1-0:15.8.1*255
Active energy combined (|+A|+|-A|) Rate 2	1-0:15.8.2*255
Active energy combined (|+A|+|-A|) Rate 3	1-0:15.8.3*255
Active energy combined (|+A|+|-A|) Rate 4	1-0:15.8.4*255
Active energy combined (|+A|+|-A|) Rate 5	1-0:15.8.5*255

OBJECT NAME	OBIS CODE
Active energy combined (|+A|+|-A|) Rate 6	1-0:15.8.6*255
Active energy combined (|+A|+|-A|) Rate 7	1-0:15.8.7*255
Active energy combined (|+A|+|-A|) Rate 8	1-0:15.8.8*255
Active energy combined (|+A|-|-A|)	1-0:16.8.0*255
Active energy combined (|+A|-|-A|) Rate 1	1-0:16.8.1*255
Active energy combined (|+A|-|-A|) Rate 2	1-0:16.8.2*255
Active energy combined (|+A|-|-A|) Rate 3	1-0:16.8.3*255
Active energy combined (|+A|-|-A|) Rate 4	1-0:16.8.4*255
Active energy combined (|+A|-|-A|) Rate 5	1-0:16.8.5*255
Active energy combined (|+A|-|-A|) Rate 6	1-0:16.8.6*255
Active energy combined (|+A|-|-A|) Rate 7	1-0:16.8.7*255
Active energy combined (|+A|-|-A|) Rate 8	1-0:16.8.8*255
Instantaneous active import power (+A) L1	1-0:21.7.0*255
Instantaneous current L1	1-0:31.7.0*255
Instantaneous voltage L1	1-0:32.7.0*255
Average voltage L1	1-0:32.24.0*255
Duration of last voltage sag in phase L1	1-0:32.33.0*255
Magnitude of last voltage sag in phase L1	1-0:32.34.0*255
Duration of last voltage swell in phase L1	1-0:32.37.0*255
Magnitude of last voltage swell in phase L1	1-0:32.38.0*255
Instantaneous power factor (+A/+VA) L1	1-0:33.7.0*255
Instantaneous current (sum over all phases)	1-0:90.7.0*255
Register activation	
Register activation - energy	0-0:14.0.1*255
Register activation - maximum demand	0-0:14.0.2*255
Register monitor	
Alarm monitor 1	0-0:16.1.0*255
Alarm monitor 2	0-0:16.1.1*255
Supervision monitor 1 - Fuse supervision L1	1-0:31.4.0*255
SAP assignment	
SAP assignment	0-0:41.0.0*255
Script table	
Global meter reset	0-0:10.0.0*255
MDI reset / End of billing period	0-0:10.0.1*255
Tariffication script table	0-0:10.0.100*255
Activate test mode	0-0:10.0.101*255
Activate normal mode	0-0:10.0.102*255
Load management script table	0-0:10.0.103*255
Disconnector script table	0-0:10.0.106*255
Image activation	0-0:10.0.107*255
Push script table	0-0:10.0.108*255
Activate display test mode	0-0:10.1.101*255
Activate prepayment	0-0:10.1.251*255
Upgrade script table	0-0:10.1.253*255
M-Bus install	0-0:10.50.128*255
M-Bus remove	0-0:10.50.129*255
M-Bus disconnector script table	0-1:10.0.106*255
Security setup	
Security setup	0-0:43.0.0*255
Security setup - Consumer information	0-0:43.0.1*255
Single action schedule	
End of billing period 1 scheduler	0-0:15.0.0*255
Disconnect control scheduler	0-0:15.0.1*255

OBJECT NAME	OBIS CODE
Image transfer activation scheduler	0-0:15.0.2*255
End of billing period 2 scheduler	0-0:15.1.0*255
M-Bus disconnect control scheduler	0-1:15.0.1*255
Push action scheduler - Interval 1	0-1:15.0.4*255
Push action scheduler - Interval 2	0-2:15.0.4*255
Push action scheduler - Interval 3	0-3:15.0.4*255
Push action scheduler - Consumer information	0-4:15.0.4*255
Special days table	
Special days table	0-0:11.0.0*255
TCP-UDP setup	
TCP-UDP setup	0-0:25.0.0*255

12.3. Annex 3: MT382 object list

Firmware CORE version: ISKACMT382100800
Firmware MODULE version: ISKAMMT382100806

OBJECT NAME	OBIS CODE
Activity calendar	
Activity calendar	0-0:13.0.0*255
Association LN	
Current association	0-0:40.0.0*255
Auto answer	
Auto answer	0-0:2.2.0*255
Auto connect	
Auto connect	0-0:2.1.0*255
Clock	
Clock	0-0:1.0.0*255
Data	
COSEM logical device name	0-0:42.0.0*255
Security - receive frame counter - unicast key	0-0:43.1.0*255
Security - receive frame counter - broadcast key	0-0:43.1.1*255
Device ID 1, manufacturing number	0-0:96.1.0*255
Device ID 2	0-0:96.1.1*255
Device ID 3	0-0:96.1.2*255
Device ID 4	0-0:96.1.3*255
Device ID 5	0-0:96.1.4*255
Device ID 6	0-0:96.1.5*255
Device ID 7	0-0:96.1.6*255
Device ID 8	0-0:96.1.7*255
Device ID 9	0-0:96.1.8*255
Number of configuration program changes	0-0:96.2.0*255
Date of last configuration program change	0-0:96.2.1*255
Status of security switches	0-0:96.2.4*255
State of input control signals	0-0:96.3.1*255
State of output control signals	0-0:96.3.2*255
Internal operating status, global	0-0:96.5.0*255
Number of power failures, in all three phases	0-0:96.7.0*255
Number of power failures, in phase L1	0-0:96.7.1*255
Number of power failures, in phase L2	0-0:96.7.2*255
Number of power failures, in phase L3	0-0:96.7.3*255
Number of long power failures, in all three phases	0-0:96.7.5*255
Number of long power failures, in phase L1	0-0:96.7.6*255
Number of long power failures, in phase L2	0-0:96.7.7*255
Number of long power failures, in phase L3	0-0:96.7.8*255
Number of long power failures, in any phase	0-0:96.7.9*255
Time of power failure, in all three phases	0-0:96.7.10*255
Time of power failure, in phase L1	0-0:96.7.11*255
Time of power failure, in phase L2	0-0:96.7.12*255
Time of power failure, in phase L3	0-0:96.7.13*255
Time of power failure, in any phase	0-0:96.7.14*255
Number of power failures, in any phase	0-0:96.7.21*255
Profile status - Load profile with period 1	0-0:96.10.1*255
Profile status - Load profile with period 2	0-0:96.10.2*255
Profile status 2	0-0:96.10.3*255
Profile status 3	0-0:96.10.4*255
ID serial process status channel 0	0-0:96.10.128*255

OBJECT NAME	OBIS CODE
Event object - Standard event log	0-0:96.11.0*255
Event object - Fraud detection log	0-0:96.11.1*255
Event object - Disconnector control log	0-0:96.11.2*255
Event object - M-Bus event log	0-0:96.11.3*255
Event object - Power quality log	0-0:96.11.4*255
Event object - Communication event log	0-0:96.11.5*255
Consumer message text - Consumer information	0-0:96.13.0*255
Consumer message code - Meter display	0-0:96.13.1*255
Currently active energy tariff	0-0:96.14.0*255
Manual Tariffication Script Activation	0-0:96.14.11*255
Cover opening counter	0-0:96.15.0*255
Breaker opening counter	0-0:96.15.1*255
Image transfer counter	0-0:96.63.10*255
ROM checksum	0-0:96.96.0*255
Last modified secure parameter identifier	0-0:96.128.0*255
Last modified secure parameter old value	0-0:96.128.1*255
Last modified secure parameter new value	0-0:96.128.2*255
Error register	0-0:97.97.0*255
Error register object 2	0-0:97.97.1*255
Alarm register 1	0-0:97.98.0*255
Alarm register 2	0-0:97.98.1*255
Alarm filter 1	0-0:97.98.10*255
Alarm filter 2	0-0:97.98.11*255
Alarm descriptor 1	0-0:97.98.20*255
Alarm descriptor 2	0-0:97.98.21*255
RTC mode	0-0:128.1.0*255
RTC calibration value	0-0:128.1.1*255
RTC backup type	0-0:128.1.2*255
RTC backup duration	0-0:128.1.3*255
Measurement calibration status	0-0:128.5.0*255
Measurement calibration constants	0-0:128.5.1*255
Watchdog resets	0-0:128.6.0*255
Number of short power failures	0-0:128.6.1*255
L1 level 1 U > +10%	0-0:128.7.11*255
L1 level 2 +5% < U < +10%	0-0:128.7.12*255
L1 level 3 0% < U < +5%	0-0:128.7.13*255
L1 level 4 -5% < U < 0%	0-0:128.7.14*255
L1 level 5 -10% < U < -5%	0-0:128.7.15*255
L1 level 6 -15% < U > -10%	0-0:128.7.16*255
L1 level 7 U < -15%	0-0:128.7.17*255
L2 level 1 U > +10%	0-0:128.7.21*255
L2 level 2 +5% < U < +10%	0-0:128.7.22*255
L2 level 3 0% < U < +5%	0-0:128.7.23*255
L2 level 4 -5% < U < 0%	0-0:128.7.24*255
L2 level 5 -10% < U < -5%	0-0:128.7.25*255
L2 level 6 -15% < U > -10%	0-0:128.7.26*255
L2 level 7 U < -15%	0-0:128.7.27*255
L3 level 1 U > +10%	0-0:128.7.31*255
L3 level 2 +5% < U < +10%	0-0:128.7.32*255
L3 level 3 0% < U < +5%	0-0:128.7.33*255
L3 level 4 -5% < U < 0%	0-0:128.7.34*255
L3 level 5 -10% < U < -5%	0-0:128.7.35*255
L3 level 6 -15% < U > -10%	0-0:128.7.36*255

OBJECT NAME	OBIS CODE
L3 level 7 U < -15%	0-0:128.7.37*255
ANY level 1 U > +10%	0-0:128.7.41*255
ANY level 2 +5% < U < +10%	0-0:128.7.42*255
ANY level 3 0% < U < +5%	0-0:128.7.43*255
ANY level 4 -5% < U < 0%	0-0:128.7.44*255
ANY level 5 -10% < U < -5%	0-0:128.7.45*255
ANY level 6 -15% < U > -10%	0-0:128.7.46*255
ANY level 7 U < -15%	0-0:128.7.47*255
Asymmetrical voltages upper threshold	0-0:128.7.50*255
Asymmetrical voltages lower threshold	0-0:128.7.51*255
Voltage peak and minimum aggregation period [s]	0-0:128.8.50*255
Over voltage monitor and load disconnection - Enabled	0-0:128.9.1*255
Over voltage monitor and load disconnection - Disconnect voltage level	0-0:128.9.2*255
Over voltage monitor and load disconnection - Reconnect voltage level	0-0:128.9.3*255
Over voltage monitor and load disconnection - Disconnect time	0-0:128.9.4*255
Over voltage monitor and load disconnection - Reconnect time	0-0:128.9.5*255
Tariff switch source	0-0:128.10.0*255
Tariff synchronized with meas. per.	0-0:128.10.1*255
Previous values readout count	0-0:128.11.4*255
GSM signal quality	0-0:128.20.0*255
GSM status	0-0:128.20.1*255
ID GSM ICCID	0-0:128.20.2*255
GSM program version	0-0:128.20.3*255
GSM IMEI	0-0:128.20.4*255
GSM network name	0-0:128.20.5*255
GSM Wipsoft program version	0-0:128.20.6*255
GSM signal strength indication limit 1	0-0:128.20.11*255
GSM signal strength indication limit 2	0-0:128.20.12*255
Load management delay mode	0-0:128.30.0*255
Load management power on delay [s]	0-0:128.30.2*255
Load management switch on delay [s]	0-0:128.30.3*255
Signal control delay mode	0-0:128.30.10*255
Signal control power on delay [s]	0-0:128.30.12*255
Signal control switch on delay [s]	0-0:128.30.13*255
Service control functionality	0-0:128.30.14*255
Switching device type	0-0:128.30.20*255
Manual reconnect period	0-0:128.30.24*255
Disconnection control status	0-0:128.30.25*255
Disconnection control status 2	0-0:128.30.26*255
Mem Partition 0	0-0:128.40.0*255
Mem Partition 1	0-0:128.40.1*255
Mem Partition 2	0-0:128.40.2*255
Mem Partition 3	0-0:128.40.3*255
Mem Partition 4	0-0:128.40.4*255
Flashdev spy param	0-0:128.41.0*255
Flashdev spy values	0-0:128.41.1*255
M-Bus client configuration	0-0:128.50.1*255
Payment mode	0-0:128.60.0*255
Payment status	0-0:128.60.3*255
Credit transfer	0-0:128.60.30*255
Energy register reference	0-0:128.60.31*255
Accounting register reference	0-0:128.60.32*255
Power limit mode	0-0:128.61.10*255

OBJECT NAME	OBIS CODE
Available power	0-0:128.61.11*255
Maximum available power	0-0:128.61.12*255
Limited power	0-0:128.61.13*255
Available power exceeding time	0-0:128.61.14*255
Maximum available power exceeding time	0-0:128.61.15*255
Over current duration	0-0:128.62.10*255
DLMS options channel 0	0-0:128.70.0*255
DLMS association restrictions channel 0	0-0:128.70.1*255
Profile access options	0-0:128.90.0*255
Authentication key 1	0-0:128.100.1*255
Authentication key 2	0-0:128.100.2*255
Authentication key 3	0-0:128.100.3*255
Authentication key 4	0-0:128.100.4*255
Master key	0-0:128.100.10*255
Global unicast encryption key	0-0:128.100.20*255
Global broadcast encryption key	0-0:128.100.21*255
Authentication key	0-0:128.100.22*255
Performance data	0-0:128.102.0*255
Performance events	0-0:128.102.1*255
Device mode	0-0:128.103.0*255
Device stamp	0-0:128.103.1*255
Device flags	0-0:128.103.2*255
Measuring configuration	0-0:196.0.0*255
Transformer - measurement type	0-0:196.0.1*255
Energy registration method	0-0:196.0.10*255
Startup current hysteresis	0-0:196.0.23*255
Display format for energy	0-0:196.1.0*255
Display format for demand	0-0:196.1.1*255
Display configuration	0-0:196.1.3*255
Configurable I/O settings	0-0:196.3.0*255
Metropulse output configuration	0-0:196.3.6*255
Currency rate scaler	0-0:196.60.0*255
Error filter 1	0-0:196.97.0*255
Error filter 2	0-0:196.97.1*255
Error 1 display filter	0-0:196.97.10*255
Error 2 display filter	0-0:196.97.11*255
Authentication failure stamp	0-0:196.98.0*255
Authentication failure count	0-0:196.98.1*255
Decryption and authentication failure count limit	0-0:196.98.2*255
Authentication mechanism restrictions	0-0:196.98.3*255
Decryption failure stamp	0-0:196.98.4*255
Decryption failure count	0-0:196.98.5*255
M-Bus Device ID 1 channel 1	0-1:96.1.0*255
M-Bus Device ID 2 channel 1	0-1:96.1.1*255
Profile status for M-Bus master load profile 1	0-1:96.10.3*255
ID serial process status channel 1	0-1:96.10.128*255
Event objects - M-Bus master control logs 1	0-1:96.11.4*255
DLMS options channel 1	0-1:128.70.0*255
DLMS association restrictions channel 1	0-1:128.70.1*255
Master key - Consumer information	0-1:128.100.10*255
Global unicast encryption key - Consumer information	0-1:128.100.20*255
Global broadcast encryption key - Consumer information	0-1:128.100.21*255
Authentication key - Consumer information	0-1:128.100.22*255

OBJECT NAME	OBIS CODE
M-Bus Device ID 1 channel 2	0-2:96.1.0*255
M-Bus Device ID 2 channel 2	0-2:96.1.1*255
Profile status for M-Bus master load profile 2	0-2:96.10.3*255
ID serial process status channel 2	0-2:96.10.128*255
Event objects - M-Bus master control logs 2	0-2:96.11.4*255
DLMS options channel 2	0-2:128.70.0*255
DLMS association restrictions channel 2	0-2:128.70.1*255
M-Bus Device ID 1 channel 3	0-3:96.1.0*255
M-Bus Device ID 2 channel 3	0-3:96.1.1*255
Profile status for M-Bus master load profile 3	0-3:96.10.3*255
ID serial process status channel 3	0-3:96.10.128*255
Event objects - M-Bus master control logs 3	0-3:96.11.4*255
M-Bus Device ID 1 channel 4	0-4:96.1.0*255
M-Bus Device ID 2 channel 4	0-4:96.1.1*255
Profile status for M-Bus master load profile 4	0-4:96.10.3*255
Event objects - M-Bus master control logs 4	0-4:96.11.4*255
Electricity ID 1	1-0:0.0.0*255
Billing period counter	1-0:0.1.0*255
Time stamp of the most recent billing period	1-0:0.1.2*255
Active firmware version	1-0:0.2.0*255
Time switch program number	1-0:0.2.2*255
Active firmware core signature	1-0:0.2.8*255
Active energy, metrological LED	1-0:0.3.0*255
Reactive energy, metrological LED	1-0:0.3.1*255
Apparent energy, metrological LED	1-0:0.3.2*255
Active energy, output pulse meter constant [impulses/kWh]	1-0:0.3.3*255
Reactive energy, output pulse meter constant [impulses/kvarh]	1-0:0.3.4*255
Apparent energy, output pulse meter constant [impulses/kVAh]	1-0:0.3.5*255
Transformer ratio - current (numerator)	1-0:0.4.2*255
Transformer ratio - voltage (numerator)	1-0:0.4.3*255
Transformer ratio - current (denominator)	1-0:0.4.5*255
Transformer ratio - voltage (denominator)	1-0:0.4.6*255
Measurement period 1, for average value 1	1-0:0.8.0*255
Local time	1-0:0.9.1*255
Local date	1-0:0.9.2*255
Time integral for voltage sag	1-0:12.31.129*255
Counter for voltage sag	1-0:12.32.0*255
Time integral for voltage swell	1-0:12.35.129*255
Counter for voltage swell	1-0:12.36.0*255
Number of voltage sags in phase L1	1-0:32.32.0*255
Number of voltage swells in phase L1	1-0:32.36.0*255
Number of voltage sags in phase L2	1-0:52.32.0*255
Number of voltage swells in phase L2	1-0:52.36.0*255
Number of voltage sags in phase L3	1-0:72.32.0*255
Number of voltage swells in phase L3	1-0:72.36.0*255
Internal operating status, statusword 1	1-0:96.5.1*255
Power failure alarm filtering limit [s]	1-0:96.239.0*255
Alarm on status 1	1-0:96.242.0*255
Alarm on status 2	1-0:96.242.10*255
Alarm off status 1	1-0:96.243.0*255
Alarm off status 2	1-0:96.243.10*255
Event system	1-0:96.245.0*255
Fraud detection hold-off period	1-0:96.245.10*255

OBJECT NAME	OBIS CODE
Alarm system	1-0:96.246.0*255
Active firmware version 1	1-1:0.2.0*255
Active firmware module signature	1-1:0.2.8*255
Demand register	
Demand register - Active energy import (+A)	1-0:1.4.0*255
Average import power (+A)	1-0:1.24.0*255
Demand register - Active energy export (-A)	1-0:2.4.0*255
Demand register - Reactive energy import (+R)	1-0:3.4.0*255
Demand register - Reactive energy export (-R)	1-0:4.4.0*255
Demand register - Apparent energy import (+VA)	1-0:9.4.0*255
Demand register - Apparent energy export (-VA)	1-0:10.4.0*255
Demand register - Active energy combined (|+A|+|-A|)	1-0:15.4.0*255
Average total power (|+A|+|-A|)	1-0:15.24.0*255
Average net power (|+A|-|-A|)	1-0:16.24.0*255
Sliding average current L1 (for fuse supervision)	1-0:31.4.0*255
Sliding average current L2 (for fuse supervision)	1-0:51.4.0*255
Sliding average current L3 (for fuse supervision)	1-0:71.4.0*255
Disconnect control	
Disconnect control	0-0:96.3.10*255
M-Bus master disconnect control object 1	0-1:24.4.0*255
Load management - Relay control 1	0-1:96.3.10*255
M-Bus master disconnect control object 2	0-2:24.4.0*255
Load management - Relay control 2	0-2:96.3.10*255
M-Bus master disconnect control object 3	0-3:24.4.0*255
M-Bus master disconnect control object 4	0-4:24.4.0*255
Extended register	
M-Bus value channel 1, instance 1	0-1:24.2.1*255
M-Bus value channel 1, instance 2	0-1:24.2.2*255
M-Bus value channel 1, instance 3	0-1:24.2.3*255
M-Bus value channel 1, instance 4	0-1:24.2.4*255
M-Bus value channel 2, instance 1	0-2:24.2.1*255
M-Bus value channel 2, instance 2	0-2:24.2.2*255
M-Bus value channel 2, instance 3	0-2:24.2.3*255
M-Bus value channel 2, instance 4	0-2:24.2.4*255
M-Bus value channel 3, instance 1	0-3:24.2.1*255
M-Bus value channel 3, instance 2	0-3:24.2.2*255
M-Bus value channel 3, instance 3	0-3:24.2.3*255
M-Bus value channel 3, instance 4	0-3:24.2.4*255
M-Bus value channel 4, instance 1	0-4:24.2.1*255
M-Bus value channel 4, instance 2	0-4:24.2.2*255
M-Bus value channel 4, instance 3	0-4:24.2.3*255
M-Bus value channel 4, instance 4	0-4:24.2.4*255
Last average demand register - Active energy import (+A)	1-0:1.5.0*255
Maximum demand register - Active energy import (+A)	1-0:1.6.0*255
Maximum demand register - Active energy import (+A) Rate 1	1-0:1.6.1*255
Maximum demand register - Active energy import (+A) Rate 2	1-0:1.6.2*255
Maximum demand register - Active energy import (+A) Rate 3	1-0:1.6.3*255
Maximum demand register - Active energy import (+A) Rate 4	1-0:1.6.4*255
Maximum demand register - Active energy import (+A) Rate 5	1-0:1.6.5*255
Maximum demand register - Active energy import (+A) Rate 6	1-0:1.6.6*255
Maximum demand register - Active energy import (+A) Rate 7	1-0:1.6.7*255
Maximum demand register - Active energy import (+A) Rate 8	1-0:1.6.8*255
Last average demand register - Active energy export (-A)	1-0:2.5.0*255

OBJECT NAME	OBIS CODE
Maximum demand register - Active energy export (-A)	1-0:2.6.0*255
Maximum demand register - Active energy export (-A) Rate 1	1-0:2.6.1*255
Maximum demand register - Active energy export (-A) Rate 2	1-0:2.6.2*255
Maximum demand register - Active energy export (-A) Rate 3	1-0:2.6.3*255
Maximum demand register - Active energy export (-A) Rate 4	1-0:2.6.4*255
Maximum demand register - Active energy export (-A) Rate 5	1-0:2.6.5*255
Maximum demand register - Active energy export (-A) Rate 6	1-0:2.6.6*255
Maximum demand register - Active energy export (-A) Rate 7	1-0:2.6.7*255
Maximum demand register - Active energy export (-A) Rate 8	1-0:2.6.8*255
Last average demand register - Reactive energy import (+R)	1-0:3.5.0*255
Maximum demand register - Reactive energy import (+R)	1-0:3.6.0*255
Maximum demand register - Reactive energy import (+R) Rate 1	1-0:3.6.1*255
Maximum demand register - Reactive energy import (+R) Rate 2	1-0:3.6.2*255
Maximum demand register - Reactive energy import (+R) Rate 3	1-0:3.6.3*255
Maximum demand register - Reactive energy import (+R) Rate 4	1-0:3.6.4*255
Maximum demand register - Reactive energy import (+R) Rate 5	1-0:3.6.5*255
Maximum demand register - Reactive energy import (+R) Rate 6	1-0:3.6.6*255
Maximum demand register - Reactive energy import (+R) Rate 7	1-0:3.6.7*255
Maximum demand register - Reactive energy import (+R) Rate 8	1-0:3.6.8*255
Last average demand register - Reactive energy export (-R)	1-0:4.5.0*255
Maximum demand register - Reactive energy export (-R)	1-0:4.6.0*255
Maximum demand register - Reactive energy export (-R) Rate 1	1-0:4.6.1*255
Maximum demand register - Reactive energy export (-R) Rate 2	1-0:4.6.2*255
Maximum demand register - Reactive energy export (-R) Rate 3	1-0:4.6.3*255
Maximum demand register - Reactive energy export (-R) Rate 4	1-0:4.6.4*255
Maximum demand register - Reactive energy export (-R) Rate 5	1-0:4.6.5*255
Maximum demand register - Reactive energy export (-R) Rate 6	1-0:4.6.6*255
Maximum demand register - Reactive energy export (-R) Rate 7	1-0:4.6.7*255
Maximum demand register - Reactive energy export (-R) Rate 8	1-0:4.6.8*255
Last average demand register - Apparent energy import (+VA)	1-0:9.5.0*255
Maximum demand register - Apparent energy import (+VA)	1-0:9.6.0*255
Maximum demand register - Apparent energy import (+VA) Rate 1	1-0:9.6.1*255
Maximum demand register - Apparent energy import (+VA) Rate 2	1-0:9.6.2*255
Maximum demand register - Apparent energy import (+VA) Rate 3	1-0:9.6.3*255
Maximum demand register - Apparent energy import (+VA) Rate 4	1-0:9.6.4*255
Maximum demand register - Apparent energy import (+VA) Rate 5	1-0:9.6.5*255
Maximum demand register - Apparent energy import (+VA) Rate 6	1-0:9.6.6*255
Maximum demand register - Apparent energy import (+VA) Rate 7	1-0:9.6.7*255
Maximum demand register - Apparent energy import (+VA) Rate 8	1-0:9.6.8*255
Last average demand register - Apparent energy export (-VA)	1-0:10.5.0*255
Maximum demand register - Apparent energy export (-VA)	1-0:10.6.0*255
Maximum demand register - Apparent energy export (-VA) Rate 1	1-0:10.6.1*255
Maximum demand register - Apparent energy export (-VA) Rate 2	1-0:10.6.2*255
Maximum demand register - Apparent energy export (-VA) Rate 3	1-0:10.6.3*255
Maximum demand register - Apparent energy export (-VA) Rate 4	1-0:10.6.4*255
Maximum demand register - Apparent energy export (-VA) Rate 5	1-0:10.6.5*255
Maximum demand register - Apparent energy export (-VA) Rate 6	1-0:10.6.6*255
Maximum demand register - Apparent energy export (-VA) Rate 7	1-0:10.6.7*255
Maximum demand register - Apparent energy export (-VA) Rate 8	1-0:10.6.8*255
Minimum power factor (+A/+VA)	1-0:13.3.0*255
Last average power factor (+A/+VA)	1-0:13.5.0*255
Active demand last combined (|+A|+|-A|)	1-0:15.5.0*255
Maximum demand register - Active energy combined (|+A|+|-A|)	1-0:15.6.0*255

OBJECT NAME	OBIS CODE
Maximum demand register - Active energy combined (|+A|+|-A|) Rate 1	1-0:15.6.1*255
Maximum demand register - Active energy combined (|+A|+|-A|) Rate 2	1-0:15.6.2*255
Maximum demand register - Active energy combined (|+A|+|-A|) Rate 3	1-0:15.6.3*255
Maximum demand register - Active energy combined (|+A|+|-A|) Rate 4	1-0:15.6.4*255
Maximum demand register - Active energy combined (|+A|+|-A|) Rate 5	1-0:15.6.5*255
Maximum demand register - Active energy combined (|+A|+|-A|) Rate 6	1-0:15.6.6*255
Maximum demand register - Active energy combined (|+A|+|-A|) Rate 7	1-0:15.6.7*255
Maximum demand register - Active energy combined (|+A|+|-A|) Rate 8	1-0:15.6.8*255
GPRS modem setup	
GPRS modem setup	0-0:25.4.0*255
IEC HDLC setup class	
IEC HDLC setup channel 0	0-0:22.0.0*255
IEC HDLC setup channel 1	0-1:22.0.0*255
IEC HDLC setup channel 2	0-2:22.0.0*255
IEC local port setup	
IEC local port setup channel 0	0-0:20.0.0*255
IEC local port setup channel 1	0-1:20.0.0*255
IEC local port setup channel 2	0-2:20.0.0*255
Image transfer interface class	
Image transfer	0-0:44.0.0*255
IPv4 setup	
IPv4 setup	0-0:25.1.0*255
Limiter	
Limiter 1	0-0:17.0.0*255
Limiter 2	0-0:17.0.1*255
M-Bus client	
M-Bus client channel 1	0-1:24.1.0*255
M-Bus client channel 2	0-2:24.1.0*255
M-Bus client channel 3	0-3:24.1.0*255
M-Bus client channel 4	0-4:24.1.0*255
M-Bus master port setup	
M-Bus master port setup 1	0-0:24.6.0*255
Modem configuration	
Modem configuration	0-0:2.0.0*255
PPP setup	
PPP setup	0-0:25.3.0*255
Profile generic	
General local port readout	0-0:21.0.0*255
General display readout	0-0:21.0.1*255
Alternate display readout	0-0:21.0.2*255
Data of billing period 1	0-0:98.1.0*255
Data of billing period 2	0-0:98.2.0*255
Standard event log	0-0:99.98.0*255
Fraud detection log	0-0:99.98.1*255
Disconnector control log	0-0:99.98.2*255
M-Bus event log	0-0:99.98.3*255
Power quality log	0-0:99.98.4*255
Communication event log	0-0:99.98.5*255
M-Bus master load profile for channel 1	0-1:24.3.0*255
M-Bus master control log object 1	0-1:24.5.0*255
M-Bus master load profile for channel 2	0-2:24.3.0*255
M-Bus master control log object 2	0-2:24.5.0*255
M-Bus master load profile for channel 3	0-3:24.3.0*255

OBJECT NAME	OBIS CODE
M-Bus master control log object 3	0-3:24.5.0*255
M-Bus master load profile for channel 4	0-4:24.3.0*255
M-Bus master control log object 4	0-4:24.5.0*255
Load profile with period 1, i.e. General load profile	1-0:99.1.0*255
Load profile with period 2, i.e. Daily values profile	1-0:99.2.0*255
Power failure event log	1-0:99.97.0*255
Certification data log	1-0:99.99.0*255
Push setup	
Push setup - On connectivity	0-0:25.9.0*255
Push setup - Interval 1	0-1:25.9.0*255
Push setup - Interval 2	0-2:25.9.0*255
Push setup - Interval 3	0-3:25.9.0*255
Push setup - On alarm	0-4:25.9.0*255
Push setup - On power down	0-5:25.9.0*255
Push setup - Consumer information	0-6:25.9.0*255
Push setup - On installation	0-7:25.9.0*255
Register	
Battery use time counter	0-0:96.6.0*255
Battery estimated remaining use time	0-0:96.6.6*255
Duration of last long power failure, in all three phases	0-0:96.7.15*255
Duration of last long power failure, in phase L1	0-0:96.7.16*255
Duration of last long power failure, in phase L2	0-0:96.7.17*255
Duration of last long power failure, in phase L3	0-0:96.7.18*255
Duration of last long power failure, in any phase	0-0:96.7.19*255
Time threshold for long power failure	0-0:96.7.20*255
ALL phases average voltage daily peak - current	0-0:128.8.0*255
ALL phases average voltage daily peak - previous	0-0:128.8.1*255
ALL phases average voltage daily minimum - current	0-0:128.8.2*255
ALL phases average voltage daily minimum - previous	0-0:128.8.3*255
L1 daily peak voltage - current	0-0:128.8.10*255
L1 daily peak voltage - previous	0-0:128.8.11*255
L1 daily minimum voltage - current	0-0:128.8.12*255
L1 daily minimum voltage - previous	0-0:128.8.13*255
L2 daily peak voltage - current	0-0:128.8.20*255
L2 daily peak voltage - previous	0-0:128.8.21*255
L2 daily minimum voltage - current	0-0:128.8.22*255
L2 daily minimum voltage - previous	0-0:128.8.23*255
L3 daily peak voltage - current	0-0:128.8.30*255
L3 daily peak voltage - previous	0-0:128.8.31*255
L3 daily minimum voltage - current	0-0:128.8.32*255
L3 daily minimum voltage - previous	0-0:128.8.33*255
No connection timeout	0-0:128.20.30*255
Available credit	0-0:128.60.1*255
Emergency credit	0-0:128.60.2*255
Total purchase value	0-0:128.60.4*255
Initial emergency credit limit	0-0:128.60.10*255
Emergency credit limit	0-0:128.60.11*255
Emergency credit threshold	0-0:128.60.12*255
Active auxiliary charge	0-0:128.60.20*255
Active rate 1	0-0:128.60.21*255
Active rate 2	0-0:128.60.22*255
Active rate 3	0-0:128.60.23*255
Active rate 4	0-0:128.60.24*255

OBJECT NAME	OBIS CODE
Active rate 5	0-0:128.60.25*255
Active rate 6	0-0:128.60.26*255
Active rate 7	0-0:128.60.27*255
Active rate 8	0-0:128.60.28*255
Passive auxiliary charge	0-0:128.60.40*255
Passive rate 1	0-0:128.60.41*255
Passive rate 2	0-0:128.60.42*255
Passive rate 3	0-0:128.60.43*255
Passive rate 4	0-0:128.60.44*255
Passive rate 5	0-0:128.60.45*255
Passive rate 6	0-0:128.60.46*255
Passive rate 7	0-0:128.60.47*255
Passive rate 8	0-0:128.60.48*255
Nominal voltage	1-0:0.6.0*255
Measurement period 3, for instantaneous values	1-0:0.8.2*255
Clock time shift limit	1-0:0.9.11*255
Cumulative maximum demand register - Active energy import (+A)	1-0:1.2.0*255
Cumulative maximum demand register - Active energy import (+A) Rate 1	1-0:1.2.1*255
Cumulative maximum demand register - Active energy import (+A) Rate 2	1-0:1.2.2*255
Cumulative maximum demand register - Active energy import (+A) Rate 3	1-0:1.2.3*255
Cumulative maximum demand register - Active energy import (+A) Rate 4	1-0:1.2.4*255
Cumulative maximum demand register - Active energy import (+A) Rate 5	1-0:1.2.5*255
Cumulative maximum demand register - Active energy import (+A) Rate 6	1-0:1.2.6*255
Cumulative maximum demand register - Active energy import (+A) Rate 7	1-0:1.2.7*255
Cumulative maximum demand register - Active energy import (+A) Rate 8	1-0:1.2.8*255
Instantaneous active import power (+A)	1-0:1.7.0*255
Active energy import (+A)	1-0:1.8.0*255
Active energy import (+A) Rate 1	1-0:1.8.1*255
Active energy import (+A) Rate 2	1-0:1.8.2*255
Active energy import (+A) Rate 3	1-0:1.8.3*255
Active energy import (+A) Rate 4	1-0:1.8.4*255
Active energy import (+A) Rate 5	1-0:1.8.5*255
Active energy import (+A) Rate 6	1-0:1.8.6*255
Active energy import (+A) Rate 7	1-0:1.8.7*255
Active energy import (+A) Rate 8	1-0:1.8.8*255
Active energy import (+A), Time integral 2	1-0:1.9.0*255
Active energy import (+A), Time integral 2 Rate 1	1-0:1.9.1*255
Active energy import (+A), Time integral 2 Rate 2	1-0:1.9.2*255
Active energy import (+A), Time integral 2 Rate 3	1-0:1.9.3*255
Active energy import (+A), Time integral 2 Rate 4	1-0:1.9.4*255
Active energy import (+A), Time integral 2 Rate 5	1-0:1.9.5*255
Active energy import (+A), Time integral 2 Rate 6	1-0:1.9.6*255
Active energy import (+A), Time integral 2 Rate 7	1-0:1.9.7*255
Active energy import (+A), Time integral 2 Rate 8	1-0:1.9.8*255
Cumulative maximum demand register - Active energy export (-A)	1-0:2.2.0*255
Cumulative maximum demand register - Active energy export (-A) Rate 1	1-0:2.2.1*255
Cumulative maximum demand register - Active energy export (-A) Rate 2	1-0:2.2.2*255
Cumulative maximum demand register - Active energy export (-A) Rate 3	1-0:2.2.3*255
Cumulative maximum demand register - Active energy export (-A) Rate 4	1-0:2.2.4*255
Cumulative maximum demand register - Active energy export (-A) Rate 5	1-0:2.2.5*255
Cumulative maximum demand register - Active energy export (-A) Rate 6	1-0:2.2.6*255
Cumulative maximum demand register - Active energy export (-A) Rate 7	1-0:2.2.7*255
Cumulative maximum demand register - Active energy export (-A) Rate 8	1-0:2.2.8*255

OBJECT NAME	OBIS CODE
Instantaneous active export power (-A)	1-0:2.7.0*255
Active energy export (-A)	1-0:2.8.0*255
Active energy export (-A) Rate 1	1-0:2.8.1*255
Active energy export (-A) Rate 2	1-0:2.8.2*255
Active energy export (-A) Rate 3	1-0:2.8.3*255
Active energy export (-A) Rate 4	1-0:2.8.4*255
Active energy export (-A) Rate 5	1-0:2.8.5*255
Active energy export (-A) Rate 6	1-0:2.8.6*255
Active energy export (-A) Rate 7	1-0:2.8.7*255
Active energy export (-A) Rate 8	1-0:2.8.8*255
Active energy export (-A), Time integral 2	1-0:2.9.0*255
Active energy export (-A), Time integral 2 Rate 1	1-0:2.9.1*255
Active energy export (-A), Time integral 2 Rate 2	1-0:2.9.2*255
Active energy export (-A), Time integral 2 Rate 3	1-0:2.9.3*255
Active energy export (-A), Time integral 2 Rate 4	1-0:2.9.4*255
Active energy export (-A), Time integral 2 Rate 5	1-0:2.9.5*255
Active energy export (-A), Time integral 2 Rate 6	1-0:2.9.6*255
Active energy export (-A), Time integral 2 Rate 7	1-0:2.9.7*255
Active energy export (-A), Time integral 2 Rate 8	1-0:2.9.8*255
Cumulative maximum demand register - Reactive energy import (+R)	1-0:3.2.0*255
Cumulative maximum demand register - Reactive energy import (+R) Rate 1	1-0:3.2.1*255
Cumulative maximum demand register - Reactive energy import (+R) Rate 2	1-0:3.2.2*255
Cumulative maximum demand register - Reactive energy import (+R) Rate 3	1-0:3.2.3*255
Cumulative maximum demand register - Reactive energy import (+R) Rate 4	1-0:3.2.4*255
Cumulative maximum demand register - Reactive energy import (+R) Rate 5	1-0:3.2.5*255
Cumulative maximum demand register - Reactive energy import (+R) Rate 6	1-0:3.2.6*255
Cumulative maximum demand register - Reactive energy import (+R) Rate 7	1-0:3.2.7*255
Cumulative maximum demand register - Reactive energy import (+R) Rate 8	1-0:3.2.8*255
Instantaneous reactive import power (+R)	1-0:3.7.0*255
Reactive energy import (+R)	1-0:3.8.0*255
Reactive energy import (+R) Rate 1	1-0:3.8.1*255
Reactive energy import (+R) Rate 2	1-0:3.8.2*255
Reactive energy import (+R) Rate 3	1-0:3.8.3*255
Reactive energy import (+R) Rate 4	1-0:3.8.4*255
Reactive energy import (+R) Rate 5	1-0:3.8.5*255
Reactive energy import (+R) Rate 6	1-0:3.8.6*255
Reactive energy import (+R) Rate 7	1-0:3.8.7*255
Reactive energy import (+R) Rate 8	1-0:3.8.8*255
Cumulative maximum demand register - Reactive energy export (-R)	1-0:4.2.0*255
Cumulative maximum demand register - Reactive energy export (-R) Rate 1	1-0:4.2.1*255
Cumulative maximum demand register - Reactive energy export (-R) Rate 2	1-0:4.2.2*255
Cumulative maximum demand register - Reactive energy export (-R) Rate 3	1-0:4.2.3*255
Cumulative maximum demand register - Reactive energy export (-R) Rate 4	1-0:4.2.4*255
Cumulative maximum demand register - Reactive energy export (-R) Rate 5	1-0:4.2.5*255
Cumulative maximum demand register - Reactive energy export (-R) Rate 6	1-0:4.2.6*255
Cumulative maximum demand register - Reactive energy export (-R) Rate 7	1-0:4.2.7*255
Cumulative maximum demand register - Reactive energy export (-R) Rate 8	1-0:4.2.8*255
Instantaneous reactive export power (-R)	1-0:4.7.0*255
Reactive energy export (-R)	1-0:4.8.0*255
Reactive energy export (-R) Rate 1	1-0:4.8.1*255
Reactive energy export (-R) Rate 2	1-0:4.8.2*255
Reactive energy export (-R) Rate 3	1-0:4.8.3*255
Reactive energy export (-R) Rate 4	1-0:4.8.4*255

OBJECT NAME	OBIS CODE
Reactive energy export (-R) Rate 5	1-0:4.8.5*255
Reactive energy export (-R) Rate 6	1-0:4.8.6*255
Reactive energy export (-R) Rate 7	1-0:4.8.7*255
Reactive energy export (-R) Rate 8	1-0:4.8.8*255
Reactive energy QI (+Ri)	1-0:5.8.0*255
Reactive energy QI (+Ri) Rate 1	1-0:5.8.1*255
Reactive energy QI (+Ri) Rate 2	1-0:5.8.2*255
Reactive energy QI (+Ri) Rate 3	1-0:5.8.3*255
Reactive energy QI (+Ri) Rate 4	1-0:5.8.4*255
Reactive energy QI (+Ri) Rate 5	1-0:5.8.5*255
Reactive energy QI (+Ri) Rate 6	1-0:5.8.6*255
Reactive energy QI (+Ri) Rate 7	1-0:5.8.7*255
Reactive energy QI (+Ri) Rate 8	1-0:5.8.8*255
Reactive energy QII (+Rc)	1-0:6.8.0*255
Reactive energy QII (+Rc) Rate 1	1-0:6.8.1*255
Reactive energy QII (+Rc) Rate 2	1-0:6.8.2*255
Reactive energy QII (+Rc) Rate 3	1-0:6.8.3*255
Reactive energy QII (+Rc) Rate 4	1-0:6.8.4*255
Reactive energy QII (+Rc) Rate 5	1-0:6.8.5*255
Reactive energy QII (+Rc) Rate 6	1-0:6.8.6*255
Reactive energy QII (+Rc) Rate 7	1-0:6.8.7*255
Reactive energy QII (+Rc) Rate 8	1-0:6.8.8*255
Reactive energy QIII (-Ri)	1-0:7.8.0*255
Reactive energy QIII (-Ri) Rate 1	1-0:7.8.1*255
Reactive energy QIII (-Ri) Rate 2	1-0:7.8.2*255
Reactive energy QIII (-Ri) Rate 3	1-0:7.8.3*255
Reactive energy QIII (-Ri) Rate 4	1-0:7.8.4*255
Reactive energy QIII (-Ri) Rate 5	1-0:7.8.5*255
Reactive energy QIII (-Ri) Rate 6	1-0:7.8.6*255
Reactive energy QIII (-Ri) Rate 7	1-0:7.8.7*255
Reactive energy QIII (-Ri) Rate 8	1-0:7.8.8*255
Reactive energy QIV (-Rc)	1-0:8.8.0*255
Reactive energy QIV (-Rc) Rate 1	1-0:8.8.1*255
Reactive energy QIV (-Rc) Rate 2	1-0:8.8.2*255
Reactive energy QIV (-Rc) Rate 3	1-0:8.8.3*255
Reactive energy QIV (-Rc) Rate 4	1-0:8.8.4*255
Reactive energy QIV (-Rc) Rate 5	1-0:8.8.5*255
Reactive energy QIV (-Rc) Rate 6	1-0:8.8.6*255
Reactive energy QIV (-Rc) Rate 7	1-0:8.8.7*255
Reactive energy QIV (-Rc) Rate 8	1-0:8.8.8*255
Cumulative maximum demand register - Apparent energy import (+VA)	1-0:9.2.0*255
Cumulative maximum demand register - Apparent energy import (+VA) Rate 1	1-0:9.2.1*255
Cumulative maximum demand register - Apparent energy import (+VA) Rate 2	1-0:9.2.2*255
Cumulative maximum demand register - Apparent energy import (+VA) Rate 3	1-0:9.2.3*255
Cumulative maximum demand register - Apparent energy import (+VA) Rate 4	1-0:9.2.4*255
Cumulative maximum demand register - Apparent energy import (+VA) Rate 5	1-0:9.2.5*255
Cumulative maximum demand register - Apparent energy import (+VA) Rate 6	1-0:9.2.6*255
Cumulative maximum demand register - Apparent energy import (+VA) Rate 7	1-0:9.2.7*255
Cumulative maximum demand register - Apparent energy import (+VA) Rate 8	1-0:9.2.8*255
Instantaneous apparent import power (+VA)	1-0:9.7.0*255
Apparent energy import (+VA)	1-0:9.8.0*255
Apparent energy import (+VA) Rate 1	1-0:9.8.1*255
Apparent energy import (+VA) Rate 2	1-0:9.8.2*255

OBJECT NAME	OBIS CODE
Apparent energy import (+VA) Rate 3	1-0:9.8.3*255
Apparent energy import (+VA) Rate 4	1-0:9.8.4*255
Apparent energy import (+VA) Rate 5	1-0:9.8.5*255
Apparent energy import (+VA) Rate 6	1-0:9.8.6*255
Apparent energy import (+VA) Rate 7	1-0:9.8.7*255
Apparent energy import (+VA) Rate 8	1-0:9.8.8*255
Cumulative maximum demand register - Apparent energy export (-VA)	1-0:10.2.0*255
Cumulative maximum demand register - Apparent energy export (-VA) Rate 1	1-0:10.2.1*255
Cumulative maximum demand register - Apparent energy export (-VA) Rate 2	1-0:10.2.2*255
Cumulative maximum demand register - Apparent energy export (-VA) Rate 3	1-0:10.2.3*255
Cumulative maximum demand register - Apparent energy export (-VA) Rate 4	1-0:10.2.4*255
Cumulative maximum demand register - Apparent energy export (-VA) Rate 5	1-0:10.2.5*255
Cumulative maximum demand register - Apparent energy export (-VA) Rate 6	1-0:10.2.6*255
Cumulative maximum demand register - Apparent energy export (-VA) Rate 7	1-0:10.2.7*255
Cumulative maximum demand register - Apparent energy export (-VA) Rate 8	1-0:10.2.8*255
Instantaneous apparent export power (-VA)	1-0:10.7.0*255
Apparent energy export (-VA)	1-0:10.8.0*255
Apparent energy export (-VA) Rate 1	1-0:10.8.1*255
Apparent energy export (-VA) Rate 2	1-0:10.8.2*255
Apparent energy export (-VA) Rate 3	1-0:10.8.3*255
Apparent energy export (-VA) Rate 4	1-0:10.8.4*255
Apparent energy export (-VA) Rate 5	1-0:10.8.5*255
Apparent energy export (-VA) Rate 6	1-0:10.8.6*255
Apparent energy export (-VA) Rate 7	1-0:10.8.7*255
Apparent energy export (-VA) Rate 8	1-0:10.8.8*255
Threshold for voltage sag	1-0:12.31.0*255
Voltage : any phase, Under limit duration	1-0:12.33.0*255
Magnitude for voltage sag	1-0:12.34.0*255
Threshold for voltage swell	1-0:12.35.0*255
Voltage : any phase, Over limit duration	1-0:12.37.0*255
Magnitude for voltage swell	1-0:12.38.0*255
Threshold for missing voltage (voltage cut)	1-0:12.39.0*255
Time threshold for voltage sag	1-0:12.43.0*255
Time threshold for voltage swell	1-0:12.44.0*255
Time threshold for voltage cut	1-0:12.45.0*255
Instantaneous power factor (+A/+VA)	1-0:13.7.0*255
Instantaneous net frequency : any phase	1-0:14.7.0*255
Cumulative maximum demand register - Active energy combined (|+A|+|-A|)	1-0:15.2.0*255
Cumulative maximum demand register - Active energy combined (|+A|+|-A|) Rate 1	1-0:15.2.1*255
Cumulative maximum demand register - Active energy combined (|+A|+|-A|) Rate 2	1-0:15.2.2*255
Cumulative maximum demand register - Active energy combined (|+A|+|-A|) Rate 3	1-0:15.2.3*255
Cumulative maximum demand register - Active energy combined (|+A|+|-A|) Rate 4	1-0:15.2.4*255
Cumulative maximum demand register - Active energy combined (|+A|+|-A|) Rate 5	1-0:15.2.5*255
Cumulative maximum demand register - Active energy combined (|+A|+|-A|) Rate 6	1-0:15.2.6*255
Cumulative maximum demand register - Active energy combined (|+A|+|-A|) Rate 7	1-0:15.2.7*255
Cumulative maximum demand register - Active energy combined (|+A|+|-A|) Rate 8	1-0:15.2.8*255
Instantaneous active power combined (|+A|+|-A|)	1-0:15.7.0*255
Active energy combined (|+A|+|-A|)	1-0:15.8.0*255
Active energy combined (|+A|+|-A|) Rate 1	1-0:15.8.1*255
Active energy combined (|+A|+|-A|) Rate 2	1-0:15.8.2*255
Active energy combined (|+A|+|-A|) Rate 3	1-0:15.8.3*255
Active energy combined (|+A|+|-A|) Rate 4	1-0:15.8.4*255
Active energy combined (|+A|+|-A|) Rate 5	1-0:15.8.5*255

OBJECT NAME	OBIS CODE
Active energy combined (|+A|+|-A|) Rate 6	1-0:15.8.6*255
Active energy combined (|+A|+|-A|) Rate 7	1-0:15.8.7*255
Active energy combined (|+A|+|-A|) Rate 8	1-0:15.8.8*255
Active energy combined (|+A|-|-A|)	1-0:16.8.0*255
Active energy combined (|+A|-|-A|) Rate 1	1-0:16.8.1*255
Active energy combined (|+A|-|-A|) Rate 2	1-0:16.8.2*255
Active energy combined (|+A|-|-A|) Rate 3	1-0:16.8.3*255
Active energy combined (|+A|-|-A|) Rate 4	1-0:16.8.4*255
Active energy combined (|+A|-|-A|) Rate 5	1-0:16.8.5*255
Active energy combined (|+A|-|-A|) Rate 6	1-0:16.8.6*255
Active energy combined (|+A|-|-A|) Rate 7	1-0:16.8.7*255
Active energy combined (|+A|-|-A|) Rate 8	1-0:16.8.8*255
Instantaneous active import power (+A) L1	1-0:21.7.0*255
Instantaneous current L1	1-0:31.7.0*255
Instantaneous voltage L1	1-0:32.7.0*255
Average voltage L1	1-0:32.24.0*255
Duration of last voltage sag in phase L1	1-0:32.33.0*255
Magnitude of last voltage sag in phase L1	1-0:32.34.0*255
Duration of last voltage swell in phase L1	1-0:32.37.0*255
Magnitude of last voltage swell in phase L1	1-0:32.38.0*255
Instantaneous power factor (+A/+VA) L1	1-0:33.7.0*255
Instantaneous active import power (+A) L2	1-0:41.7.0*255
Instantaneous current L2	1-0:51.7.0*255
Instantaneous voltage L2	1-0:52.7.0*255
Average voltage L2	1-0:52.24.0*255
Duration of last voltage sag in phase L2	1-0:52.33.0*255
Magnitude of last voltage sag in phase L2	1-0:52.34.0*255
Duration of last voltage swell in phase L2	1-0:52.37.0*255
Magnitude of last voltage swell in phase L2	1-0:52.38.0*255
Instantaneous power factor (+A/+VA) L2	1-0:53.7.0*255
Instantaneous active import power (+A) L3	1-0:61.7.0*255
Instantaneous current L3	1-0:71.7.0*255
Instantaneous voltage L3	1-0:72.7.0*255
Average voltage L3	1-0:72.24.0*255
Duration of last voltage sag in phase L3	1-0:72.33.0*255
Magnitude of last voltage sag in phase L3	1-0:72.34.0*255
Duration of last voltage swell in phase L3	1-0:72.37.0*255
Magnitude of last voltage swell in phase L3	1-0:72.38.0*255
Instantaneous power factor (+A/+VA) L3	1-0:73.7.0*255
Instantaneous current (sum over all phases)	1-0:90.7.0*255
Register activation	
Register activation - energy	0-0:14.0.1*255
Register activation - maximum demand	0-0:14.0.2*255
Register monitor	
Alarm monitor 1	0-0:16.1.0*255
Alarm monitor 2	0-0:16.1.1*255
Supervision monitor 1 - Fuse supervision L1	1-0:31.4.0*255
Supervision monitor 2 - Fuse supervision L2	1-0:51.4.0*255
Supervision monitor 3 - Fuse supervision L3	1-0:71.4.0*255
SAP assignment	
SAP assignment	0-0:41.0.0*255
Script table	
Global meter reset	0-0:10.0.0*255

OBJECT NAME	OBIS CODE
MDI reset / End of billing period	0-0:10.0.1*255
Tariffication script table	0-0:10.0.100*255
Activate test mode	0-0:10.0.101*255
Activate normal mode	0-0:10.0.102*255
Load management script table	0-0:10.0.103*255
Disconnector script table	0-0:10.0.106*255
Image activation	0-0:10.0.107*255
Push script table	0-0:10.0.108*255
Activate display test mode	0-0:10.1.101*255
Activate prepayment	0-0:10.1.251*255
Upgrade script table	0-0:10.1.253*255
M-Bus install	0-0:10.50.128*255
M-Bus remove	0-0:10.50.129*255
M-Bus disconnector script table	0-1:10.0.106*255
Security setup	
Security setup	0-0:43.0.0*255
Security setup - Consumer information	0-0:43.0.1*255
Single action schedule	
End of billing period 1 scheduler	0-0:15.0.0*255
Disconnect control scheduler	0-0:15.0.1*255
Image transfer activation scheduler	0-0:15.0.2*255
End of billing period 2 scheduler	0-0:15.1.0*255
M-Bus disconnect control scheduler	0-1:15.0.1*255
Push action scheduler - Interval 1	0-1:15.0.4*255
Push action scheduler - Interval 2	0-2:15.0.4*255
Push action scheduler - Interval 3	0-3:15.0.4*255
Push action scheduler - Consumer information	0-4:15.0.4*255
Special days table	
Special days table	0-0:11.0.0*255
TCP-UDP setup	
TCP-UDP setup	0-0:25.0.0*255

Iskraemeco d.d., Merjenje in upravljanje energije
4000 Kranj, Savska loka 4, Slovenia
Telephone (+386 4) 206 40 00, Fax: (+386 4) 206 43 76
http://www.iskraemeco.com, E-mail: info@iskraemeco.com

Published: Iskraemeco, Information subject to alteration without notice.