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Electricity metering – Glossary of terms

Lecture des compteurs électriques – Glossaire de termes

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- **IEC web site***
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- **IEC Bulletin**
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Terminology, graphical and letter symbols

For general terminology, readers are referred to IEC 60050: *International Electrotechnical Vocabulary* (IEV).

For graphical symbols, and letter symbols and signs approved by the IEC for general use, readers are referred to publications IEC 60027: *Letter symbols to be used in electrical technology*, IEC 60417: *Graphical symbols for use on equipment. Index, survey and compilation of the single sheets* and IEC 60617: *Graphical symbols for diagrams*.

* See web site address on title page.

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International Electrotechnical Commission 3, rue de Varembé Geneva, Switzerland
Telefax: +41 22 919 0300 e-mail: inmail@iec.ch IEC web site http://www.iec.ch

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTRICITY METERING – GLOSSARY OF TERMS

FOREWORD

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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Technical reports do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.

IEC 62051, which is a technical report, has been prepared by IEC technical committee 13: Equipment for electrical energy measurement and load control.

The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
13/1151/CDV	13/1178/RVC

Full information on the voting for the approval of this technical report can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 3.

This document, which is purely informative, is not to be regarded as an International Standard.

The definitions in this glossary are intended to assist in understanding the work of technical committee 13.

The preparation of this report is based on the

- Australian Standard AS 4140.

In addition, the following standard organizations have contributed to the preparation of this technical report:

- CEN technical committee 294, working group 2;
- USA and Canada AMRA/AMSI/IC/IEEE joint working group.

ELECTRICITY METERING – GLOSSARY OF TERMS

1 Scope

This technical report provides definitions of specific terms which may be used for drafting standards for electrical energy measurement, tariff and load control, and customer/utility information exchange systems.

Standards and technical reports which deal with Distribution Automation Systems (DAS) using Distribution Line Carrier (DLC) systems use a number of terms with specific meaning, which are not defined in IEC 60050(371). The present technical report includes these terms and their definitions, as well as those terms that are already defined in IEC 60050(371). It presents a comprehensive means of referring to terms used in standard documents on customer/utility information exchange (CUIE) systems prepared or being prepared by IEC TC 13.

This report also incorporates specific terms used in present and future standards on electricity pre-payment systems, and specific terms concerning the dependability of electricity metering equipment.

2 Sources of terms

The following documents were used to establish this glossary of terms.

General terms given in the IEC 60050 series are repeated with reference to the appropriate IEV term. Other sources are identified by a figure in brackets which refers to the following list:

(1) American National Standards Institute: *IEEE Standard Dictionary of Electrical and Electronics Terms* (1984)

(2) IEC 60050(351): *International Electrotechnical Vocabulary (IEV) – Chapter 351: Automatic control*

(3) IEC 60050(721):1992, *International Electrotechnical Vocabulary (IEV) – Chapter 721: Telegraphy, facsimile and data communication*

(4) ISO/IEC 2382-9:1995, *Information technology – Vocabulary – Part 9: Data communication*

(5) Australian Standard AS 4140-1995: *Metering and utility information exchange – Glossary of terms*

(6) IEC 60050(191):1990, *International Electrotechnical Vocabulary (IEV) – Chapter 191: Dependability and quality of service*

(7) IEC/TR3 60870-1-3:1997, *Telecontrol equipment and systems – Part 1: General considerations – Section 3: Glossary*

(8) ISO/IEC 7498-1:1994, *Information technology – Open Systems Interconnection – Basic Reference Model – The Basic Model*

(9) ISO/IEC 10731:1994, *Information technology – Open Systems Interconnection – Basic Reference Model – Conventions for the definition of OSI services* (source: ITU-T X.210: 1993)

(10) IEC 60050(161):1990, *International Electrotechnical Vocabulary (IEV) – Chapter 161: Electromagnetic compatibility*

(11) ISO 8402:1994, *Quality management and quality assurance – Vocabulary*

(12) South African Specification NRS009-1. *Electricity Sales Systems – Part 1: Glossary and System Overview*. (Subsequently published as South African Standard: SABS 1524-0)

(13) IEC 60050(691):1973, *International Electrotechnical Vocabulary (IEV) – Chapter 691: Tariffs for electricity*

(14) ISO/IEC 2382-14:1997, *Information technology – Vocabulary – Part 14: Reliability, maintainability and availability*

(15) IEC 61107:1996, *Data exchange for meter reading, tariff and load control – Direct local data exchange*

(16) IEC 61134-4-41:1996, *Distribution automation using distribution line carrier systems – Part 4: Data communication protocols – Section 41: Application protocol distribution line message specification*

(17) ISO/IEC 9506-1:1990, *Industrial automation systems – Manufacturing message specification – Part 1: Service definition*

(18) ISO/IEC 9506-2:1990, *Industrial automation systems – Manufacturing message specification – Part 2: Protocol specification*

(19) ISO 8824:1990, *Information technology – Open Systems Interconnection – Specification of Abstract Syntax Notation One (ASN.1)* (Provisionally retained edition)

(20) ISO 8825:1990, *Information technology – Open Systems Interconnection – Specification of Basic Encoding Rules for Abstract Syntax Notation One (ASN.1)* (Provisionally retained edition)

(21) IEC 60050(371):1984, *International Electrotechnical Vocabulary (IEV) – Chapter 371: Telecontrol*

(22) IEC 60050(702):1992, *International Electrotechnical Vocabulary (IEV) – Chapter 702: Oscillations, signals and related devices*

3 Acronyms and abbreviations

AP	Application Process (application layer/OSI)
API	Application Program Interface
ASK	Amplitude Shift Keying
ASN.1	Abstract Syntax Notation 1 (ISO 8824)
A-XDR	Adapted eXternal Data Representation – (IEC TC 57 WG 09 NWIP)
BER	Basic Encoding Rules – ISO 8825
CA	Customer Authorization
CAU**	Customer Automation Unit
CEN	European Committee for Standardization
CENELEC	Comité Européen de Normalisation ELECtrotechnique
CCG*	Customer Communication Gateway
CCITT	Comité Consultatif International Télégraphique et Téléphonique (see ITU-T)
CCT	Complex Control Transducer
CI*	Central Interface
CLI*	Central Low Voltage Interface

* These terms are used in some countries.

CLCU*	Central Low Voltage Communication Unit
CLPU*	Central Low Voltage Processing Unit
CLU*	Central Low Voltage Unit
CMCU*	Central Medium Voltage Communication Unit
CMI*	Central Medium Voltage Interface
CMPU*	Central Medium Voltage Processing Unit
CMT	Complex Measuring Transducer
CMU*	Central Medium Voltage Unit
CPE*	Customer Premises Equipment
CPU	Central Processing Unit
CU*	Control Unit
CVS	Common Vending System
C&M*	Control and Metering Unit
DA	Distribution Automation
DAS	Distribution Automation System
dB	Decibel
dBm	dB referred to 1 mW at 600 Ω
DCE	Data Circuit-terminating Equipment
DES	Data Encryption Standard
DFM	Distributed Facilities Management
DLC	Distribution Line Carrier
DLMS	Distribution Line Message Specification
DMS	Distribution Management System
DOV	Data Over Voice
DPSK	Differential Phase Shift Keying
DS	Data Set
DSA	Distribution System Automation
DSM	Demand Side Management
DTE	Data Terminal Equipment
EIA	Electronic Industries Association
EMC	Electromagnetic compatibility
FSK	Frequency Shift Keying
FPI	Fault Passage Indicator
HAS	Home Automation System
HV	High Voltage
HHU	Hand Held Unit
ID	IDentification number
IEEE	Institute of Electrical and Electronics Engineers
IMS	Industrial Messaging System
IR	Infrared
ISDN	Integrated Services Digital Network
ISO	International Standards Organization
ITU-T	International Telecommunications Union – Telecommunications
LAN	Local Area Network
LLAC	Logical Link Access Control
LLC	Logical Link Control
LV	Low Voltage

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* These terms are used in some countries.

MAC	Medium Access Control
MAP	Meter Accounting Process
MDT	Mean Down Time
MES	Maximum Error In Service
MEV	Maximum Error in Verification
MIB	Management Information Base
MMS	Manufacturing Message Specification (ISO/IEC 9506-1 and ISO/IEC 9506-2)
MODEM	MOdulator and DEModulator
MTBF	Mean Time Between Failures
MV	Medium Voltage
NET	Network
OSI	Open System Interconnection
PER	Packed Encoding Rules
PEP	Peak Envelope Power
PLC	Power Line Carrier
POST	Point Of Sale Terminal
PSK	Phase Shift Keying
PSTN	Public Switched Telephone Network
PSDN	Packet Switched Data Network
PTT	Public Telephone and Telegraph
RLI*	Remote Low Voltage Interface
RLCU*	Remote Low Voltage Communication Unit
RLPU*	Remote Low Voltage Processing Unit
RLVU*	Remote Low Voltage Unit
RMCU*	Remote Medium Voltage Communication Unit
RMI*	Remote Medium Voltage Interface
RMPU*	Remote Medium Voltage Processing Unit
RMVU	Remote Medium Voltage Unit
RMU*	Ring Main Unit
SCADA	Supervisory Control and Data Acquisition
SCT	Simple Control Transducer
SHA	Secure Hash Algorithm
SMAP	System Management Application Process
SMT	Simple Measuring Transducer
S-FSK	Spread Frequency Shift Keying
TI	Task Invocation
TOU	Time of Use
UBUS	Utility Bus
VAA	Virtual Application Association
VDE	Virtual Distribution Equipment (not to be confused with Verband Deutscher Elektrotechniker)
V.24	Definition for interchange circuits between DTE and DCE
WAN	Wide Area Network

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* These terms are used in some countries.

4 General

4.1 Access method (for meter reading)

The method and technology used for reading a meter:

- Case 0: single meter, local visual reading (conventional visual reading)
- Case A: single meter, local direct electronic reading (automatic reading with a HHU)
- Case B: single meter, local remote reading (outdoor reading of an indoor meter)
- Case C: single meter, distant remote reading (remote access of a single meter)
- Case D: meter network, local remote reading (reading at a LAN access point)
- Case E: meter network, distant remote reading (reading at a WAN access point)

NOTE – CEN TC 294 WG1/N65 (user requirements) specifies these six cases.

4.2 Access point

A physical interface point used to transfer data from/to the meter network. It may be a gateway from a LAN to a higher order network or an interface to a temporary reading equipment such as a HHU, a portable PC, etc.

4.3 Architecture

The overall requirement and application of the communication network, indicating structure and hierarchy.

4.4 Automatically

The capability to produce a desired response to certain predetermined conditions without direct human intervention.

4.5 Basic metering functions

The most essential functions which are implemented in every meter. A system should provide full compatibility with complex meters independent of the amount of other functions provided.

4.6 Company

Term used to refer to a business entity, the purpose of which is to supply a product or service (11).

NOTE – Figures in brackets refer to clause 2: Sources of terms.

4.7 Configuration

Setting of measurement and communication parameters to operate the meter correctly.

4.7.1 Auto-configuration

The capability of a communication system to auto-identify and configure new meters on the network.

4.7.2 Manual-configuration

Setting measurement and communication parameters to operate the meter correctly.

4.7.3 Re-configuration

Restoring the correct configuration of a network after a modification or replacement of a meter.

4.8 Customer

The purchaser and/or user of a product or service supplied by a company (service provider, utility, manufacturer).

NOTE 1 – In a contractual situation, the "customer" may be called the "purchaser".

NOTE 2 – The "customer" may be for example the ultimate consumer, user, beneficiary or purchaser.

NOTE 3 – The "customer" can be either external or internal to a company.

4.9 Customer/utility data exchange

The exchange of information (readings, billings, messages) between customers and utilities via one or more communication networks, using appropriate interfaces between systems and entities.

4.10 Customer premises equipment (CPE)

Equipment which is installed at the customer premises.

4.11 Customer service management system

The system normally used by customer service staff who have direct contact with the public, configured for the modification of data and the entry of any relationships between various data elements, e.g.

a) applications for supply;

b) automatic phone transfers for domestic customers;

c) registered customers;

d) premises;

e) registered guarantors;

f) guarantee agreements;

g) requests for services.

Data may be accessed by identifiers such as customer name, guarantor name, account number, guarantee number or meter number. The system usually contains all customer and installation details, and can process the agreement for supply. It may provide displays (browse screens) to assist in identifying a customer or installation (in case of insufficient information), and maintain a comprehensive history of all changes to important agreements so that an agreement may be subsequently reconstructed.

4.12 Domestic meter

A meter for installation in domestic customers' premises.

4.13 Electromagnetic compatibility

The ability of a device, equipment or system to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment (IEV 161-01-07).

4.14 Electromagnetic compatibility level

The specified value of an electromagnetic disturbance for which electromagnetic compatibility with a very high degree of probability exists for the equipment operating within a given system or part of a system (IEV 161-03-10).

4.15 Electromagnetic disturbance

Any electromagnetic phenomenon which may degrade the performance of a device, equipment or system (IEV 161-01-05).

4.16 Electromagnetic emission

The phenomenon by which electromagnetic energy emanates from a source (IEV 161-01-08).

4.17 Electromagnetic interference

Degradation of the performance of a device, equipment or system caused by an electromagnetic disturbance (IEV 161-01-06).

4.18 Function

A function is a process which constantly or at certain intervals, automatically or on demand, performs certain activities, such as sampling data, reading a data set, verifying or changing a status, or activating a switch. An application is composed of one or more functions. A function can be basic or optional.

4.19 Hand-held unit (HHU)

A portable device for reading and programming equipment or meters at the customer's premises or at the access point.

4.20 Interoperability

The capability to operate products (meters), from different types and manufacturers, on the same network under the same conditions and rules.

4.21 Meter

A device for measuring and totalling the variable consumption of a product. In general a meter consists of a sensor and an integrating device which displays the total consumption in metrological units.

4.22 Metering and control

The facility to record inputs from utility metering systems within the premises and to provide unique signals to control its availability.

4.23 Optional functions

All other functions except the basic functions. They are part of the standard procedure but on implementation they can be omitted whenever not needed.

4.24 Organization

A company, corporation, firm, enterprise or institution, or part thereof, whether incorporated or not, public or private, which has its own functions and administration (11).

4.25 Real time

The actual time during which a physical process occurs, e.g. pertaining to a system or mode of operation in which computation is performed during the time that an external process occurs, in order that the computation results can be used to control, monitor, or respond in a timely manner and in the correct logical sequence to the external process.

4.26 Real-time system

A system whose response time is comparable to the physical process duration.

4.27 Remote

Capable of producing a desired response over a distance.

4.28 Remote meter reading

The facility to interrogate and recover metering data from an on-site meter by communication from a remote access point.

4.29 Severity level

Value of an influencing electromagnetic quantity specified for an immunity test.

NOTE – A test standard can specify several severity levels according to several immunity levels.

4.30 Smart meter

A complex meter with extended features, which may include load control, tariff management, etc.

4.31 Utility

A provider of electricity, gas, water, heat, telecommunications or other related services to its customers.

5 Utility systems/services

5.1 Disconnection/reconnection

The removal of supply to a customer premises by physical disconnection of the supply. Reconnection is the reverse operation, i.e. restoration of supply.

5.2 Distributed facilities management (DFM)

The corporate system which records the detailed information about distribution facilities. The record should include the location and basic information with the associated data base containing the detailed information about the facilities. An automation system may provide direct input and updating of mapping power line carrier information, e.g. low voltage mapping by low voltage distribution line carrier systems.

Also known as automated mapping/facilities management or geographic information system.

5.3 Loss-of-supply monitoring

The provision of a facility for remote indication to the utility of a total or partial loss of supply at the equipment location.

5.4 Meter asset management

The system which maintains data on the characteristics of meters and metering equipment to assist in their management and efficient operation and replacement. All devices approaching the stage where maintenance and recalibration is required are identified in reports for testing and replacement to ensure the metering accuracy. The location of equipment may be easily traced at any point in time to provide control over its utilization.

5.5 Network management

A set of functions which provides the network operator with the ability to monitor, coordinate and control the use of network resources. Key areas include the following:

a) fault management: testing and verification, detection, isolation and correction;

b) configuration management: inventory of network equipment, rearrangement of the network, connection and disconnection of services, setting of options and addresses;

c) performance management: measurement and analysis of usage levels and response times, adjustment/timing of network configuration;

d) accounting management: collection and correlation of usage data, allocation of costs;

e) security management: authentication and control of various levels of access to terminals and the network, recording access for analysis and audit trail.

5.6 On-selling (reselling)

The sale by an intermediate party of a product or service (purchased from a producer or supplier) to a third party (usually an end-user) invariably at a margin over cost.

5.7 Real-time investigations

The facility to perform investigations, from a remote location, into the performance of the distribution or communications network by measuring and analysing the parameters required to determine the state of that network in real time.

5.8 Service order management

The activity of providing the facility for the production of all service or work orders associated with the connection, maintenance and disconnection of supply to a customer. Service order requests are generally recorded in the service order management subsystem via the consumer services subsystem. These requests are subsequently translated into printed service orders at the discretion of the particular service depot for the necessary action.

5.9 Service provider

An organization which provides a product or service to a customer or a utility.

5.10 Value added services

Services other than basic that can be provided at the customer premises, e.g. security and medical alarms, banking and full electronic funds transfer.

5.11 Wheeling

The direct sale by a producer of a product or service, via a second party transmission or distribution system, to a third party (usually an end-user). The second party will normally charge a transport or haulage fee.

6 Physical meters and metering

6.1 Absolute encoder

A device which produces an electrical coded signal, representing the actual value of the mechanical meter index.

6.2 Active pulser

A pulse-emitting device which needs external power to operate the pulse-generating circuit.

6.3 Clock

A time-based device for generating time references with a defined period.

6.4 Clock/calendar

A clock with full date facilities.

6.5 Complex control transducer (CCT)

A transducer-electronics that accepts one or more data values, transmitted as a data message and converts it into some physical actions that control the utility supply to the customer.

6.6 Complex measuring transducer (CMT)

A transducer-electronics that converts some physical property into one or more data values that are transmitted as a data message.

6.7 Customer reference number

Unique customer identification number.

6.8 Encoder converter

A device with an electronic circuit to process the encoder signal (with or without display) able to convert the consumption into a standardized data message. The converter may contain further meter data and/or handle several meters.

6.9 Export metering (customer export metering)

A metering system capable of measuring and recording a product or service supplied by the customer to the utility (5).

NOTE 1 – This is the definition as used in IEC metering product standards, and is common in Europe. In some countries, the reverse concept may exist i.e. this would be described as import metering.

NOTE 2 – There is no world standard convention for the unqualified term *export metering*; accordingly great care must be taken when using this term.

6.10 Identification number (ID)

A unique (random) number (given by the utility or service provider) as a meter and/or customer identification for the utility database.

NOTE – May be identical with the manufacturer's serial number.

6.11 Import metering (customer import metering)

A metering system capable of measuring and recording a product or service supplied to the customer by the utility (5).

NOTE 1 – This is the definition as used in IEC metering product standards, and is common in Europe. In some countries, the reverse concept may exist i.e. this would be described as export metering.

NOTE 2 – There is no world standard convention for the unqualified term *import metering*; accordingly great care must be taken when using this term.

6.12 Passive pulser

A pulse-emitting device, which does not need electrical power for operation. Pulses are generated by the switching of an external control circuit.

6.13 Pulse collector

A pulse-counting device with an electronic totalizer (with or without display) capable of converting consumption into a standardized data message. The pulse collector may contain further meter data from one or several meters.

6.14 Pulser

A device coupled to a sensor or meter which produces incremental pulses with a defined value of the measured media.

6.15 Register

An allocated section of the memory in the control and metering unit to record (and usually display) details as determined by the programme in the unit.

6.16 Remote programming

The facility to set and change tariff parameters in an on-site meter by communications from a point remote from the meter.

6.17 Resolution

Smallest increment of the measured media, indicated on the meter index or in the data content.

6.18 Self-generating pulser

A pulse emitting device which produces electrical pulses powered by the energy of the measured media.

6.19 Sensor

A device used to detect, measure or record physical phenomena.

6.20 Serial number

A sequential meter number (given by the meter manufacturer) as a permanent product identification. According to DLMS, it represents a world-wide-unique number.

6.21 Service order management

The activity of providing the facility for the production of all service or work orders associated with the connection, maintenance and disconnection of supply to a customer. Service order requests are generally recorded in the service order management subsystem via the consumer services subsystem. These requests are subsequently translated into printed service orders at the discretion of the particular service depot for the necessary action.

6.22 Simple control transducer (SCT)

A device that accepts a change between two states to perform some physical action that controls the utility supply to the customer (5). (See Smart control transducer.)

6.23 Simple measuring transducer (SMT)

A device that indicates a change between two states that is proportional to the value of some physical property (5). (See Smart measuring transducer.)

6.24 Tamper monitoring

A facility to detect attempts to corrupt the metering equipment or the data stored within it.

6.25 Theft detection

A facility to identify attempts to circumvent the metering system. It may raise an alarm message automatically.

6.26 Time-of-use (TOU) metering

Metering equipment that records metered or measured quantities according to the periods of the day (e.g. consumption for peak load hours, consumption for day hours, consumption for low load hours) and different days of the week, month or year.

6.27 Timer

A time-based element for measuring the passing of time from some defined or triggered event to the next event, i.e. the elapsed time.

6.28 Transducer

A device that converts a variable physical quantity from one system to another according to a physical law.

7 Meter reading

7.1 Ad hoc meter reading

The reading of a meter other than routine readings. It includes all special readings in response to the utility-initiated or customer-initiated enquiries, such as internal bill checking, account queries from customers, check readings, initial and final readings for change of occupancy, tariff change, and on disconnection and reconnection of a meter.

7.2 Billing date register

A separate register to store the meter index at the billing date (a date determined by the utility or service provider to conclude a pre-determinated billing period). A set of several billing dates is possible to provide season-tariff-information.

7.3 Outdoor reading

Meter reading by access to a public accessible area (e.g. outdoor cabinet, mail box, etc.).

7.4 Reading date

The date on which the billing data is retrieved from a meter. Historically the billing date and the reading date have been the same since the billing period concluded at the precise time the meter was read.

7.5 Reading plug (reading head)

Physical interface or access point for meter reading.

7.6 Routine meter reading

The capturing of information on the consumption of customers to update customer databases, initiated as part of the normal billing cycle, or by some other automatic or pre-programmed requirement. The readings may be performed during a billing period or at the end of a billing period: during a billing period all the current registers are read and stored in the utility customer database; no registers are reset; at the end of a billing period a request for a billing reading is made. This will consist of a reading of all current and billing registers.

7.7 Visual reading

Conventional meter reading by a person.

8 Demand

8.1 Block interval demand

The calculation of demand over the integration period with no overlapping subintervals from previous demand calculations.

EXAMPLE: For a 30 min integration period, successive integration periods may end at 09:30, 10:00, 10:30 and so on.

8.2 Cumulative maximum demand

Value held in a register to which the new maximum demand values are added at the end of each billing period.

8.3 Demand integration period

The interval of time upon which the demand measurement is based.

EXAMPLE: 15 min, 30 min.

8.4 Maximum demand

The highest value of average demand recorded to date during the specified or billing period.

8.5 Rising demand

The average demand for the time elapsed since the beginning of the current integration period. It is calculated through dividing the consumption since the beginning of the current integration period by the time elapsed.

8.6 Sliding-window (rolling-interval) demand

The calculation of demand averaged over an integration period which includes subintervals of previous demand calculations.

EXAMPLE: An integration period of 30 min with a subinterval of 5 min. If the first integration period commences at 09:00, successive integration periods will begin at 09:05, 09:10, and so on (the periods ending at 09:30, 09:35, 09:40, and so on).

9 Billing and tariffs

9.1 Account adjustment

The act of recording and calculating adjustments to accounts which have been incorrectly billed or incorrectly charged. Two types of account adjustments may be performed: financial adjustments which involve changes to the account and to the outstanding amount, or meter adjustments which involve changes in meter information which is used in the billing calculation. The financial impact of the adjustment is calculated and the changes are recorded and where necessary, a revised account is issued.

9.2 Billing

The process of producing and delivering a bill (an account) for payment by a customer, calculated from the tariff schedule, and for the majority of customers, the consumption measured and recorded by the metering system. Bills are also calculated on estimated consumption and for unmetered installations. Customers are billed at regular cycles, e.g. monthly, bi-monthly, quarterly, or yearly and when an account is finalized or when a special reading is requested.

9.3 Billing date

A date, determined by the utility or service provider, to conclude a pre-determinated billing period for use in the customer account preparation. All consumption during the billing period is recorded and transferred to the billing date register. Several billing dates are possible.

9.4 Billing period

The billing period is the time between consecutive billing dates, nominally in months, e.g. one, three or six months, but in practice defined as a number of days, e.g. 28, 31, 60, 89, 90, 91.

9.5 Block tariff

A tariff which consists of more than one level of consumption, during a fixed time period, where the price per unit is constant within each level of consumption but varies from one level to another, i.e. a tariff in which the charge is based on a series of different consumption blocks supplied during a specified period.

EXAMPLE:

Consumption	*Tariff*
First 100 kWh per month	x/kWh
Next 900 kWh per month	y/kWh
Remaining kWh in month	z/kWh

9.6 Collection of payments

The system to record the collection of customer payments, the transfer of items between accounts, the maintenance and daily reconciliation of ledgers, and the provision of management reports. Financial history is kept on the system to facilitate customer enquiries.

9.7 Interruptible tariff

A tariff applicable where supply may be interrupted, totally or partially, to limit demand on the system according to pre-agreed contract terms.

9.8 Maximum daily quantity

Maximum consumption rate of product or service over a defined daily interval.

9.9 Maximum hourly quantity

Maximum consumption rate of product or service over a defined hourly interval.

9.10 Metering parameters

All those parameters which include tariff, pricing and load control structures and apply to complex tariffs such as TOU (time of use) tariffs which typically have different rates applied during the 24 hour period and different sets of rates applying on different days of the week.

9.11 Price/rate matrix

The prices applied to each tariff-rate included in the time/rate matrix.

9.12 Rebate

A discount or actual payment to the customer for a different (reduced) quality of service, e.g. interruption of supply, or community service obligation, e.g. to a specified socially disadvantaged group, or following an overpayment.

9.13 Receipting (cash collection)

The system to record the collection of customer payments, the transfer of items between accounts, the maintenance and daily reconciliation of ledgers, and the provision of management reports. Financial history is kept on the system to facilitate customer enquiries.

9.14 Restricted-hours tariff

A tariff applicable to supplies available only during specified hours.

EXAMPLE:

Item	*Tariff*
(All) consumption from 21:00 to 07:00	x/kWh

9.15 Seasonal time of use tariff

TOU tariff with seasonality.

9.16 Seasonality

A change in the tariff structure at fixed times (see billing date) during the year to allow for seasonal variations, typically winter, spring, summer and autumn.

9.17 Service standing charge

Fixed charge portion of a tariff over a period of time.

9.18 Special tariff

Individual tariffs based on a special agreement or tariff contract. Examples of special tariffs are given in IEC 60050(691).

9.19 Spot pricing

The setting by a utility or service provider of a price (for a product or service) that is then applicable for a nominated time to encourage the customer to increase or decrease demand to match the available utility system capacity.

9.20 Tariff

The price structure applied to the consumption of a product or service provided to a customer. Where a customer is supplied under a number of tariffs, the installation is divided so that meters are able to measure each separate portion of the total consumption to be charged at the nominated tariff. The price structure may also include a fixed component such as a supply or service charge. Tariffs might be the subject of a specific contract (13).

9.21 Time-of-use demand tariff

A tariff comprising different rates for demand and/or consumption which vary according to the time of use either over a 24 h period or between weekday and weekend (and sometimes public holidays) use. For example, rates for peak-load hours and for low-load hours.

EXAMPLE:	*Consumtion*		*Tariff*
	Weekdays from:	Demand charge:	x1/kW
	07:00 to 21:00	Energy charge:	y1/kWh
	Weekdays from:	Demand charge:	x2/kW
	21:00 to 07:00	Energy charge:	y2/kWh
	Weekends	Demand charge:	x3/kW
		Energy charge:	y3/kWh

9.22 Time-of-use tariff

A tariff comprising different rates according to the time of use over a 24 h period (or between weekdays and a weekend or a public holiday), e.g. rates for peak-load hours and low-load hours.

EXAMPLE:	*Consumption*	*Tariff*
	Weekdays from 07:00 to 21:00	x/kWh
	Weekdays from 21:00 to 07:00	y/kWh
	Weekends	z/kWh

9.23 Time/rate matrix

The table of the time periods, for each day category, to which each rate applies. This is used to allocate consumption/demands on a real-time basis to meet the requirements of the tariffs. A matrix will be required for the current tariff and a new matrix may be communicated to the control and metering unit for implementation of a tariff change.

10 Load management and load control

10.1 Appliance consumption monitoring

The act of recording the consumption of specific appliances by the logging of data on a particular appliance or by real time analysis of load on the meter.

10.2 Appliance control

The process by which a customer and/or the utility can connect or disconnect specific appliances to/from the supply or modify the operation of specific appliances upon command via the customer communications gateway or an in-house controller.

10.3 Computerized operations management

An integrated system approach using computer technology for automatic and/or remote data collection and/or control to improve utility operations.

10.4 Demand side management (DSM)

The implementation of programmes designed to influence product or service demands for the mutual benefit of the utility and its customers. These programmes are structured to enable the utility to benefit by inducing changes to the time pattern, and the magnitude of demand which maximizes the production and cost effective use of the utility's resources, and to enable the customer to benefit by being better able to control total cost and usage.

10.5 Emergency load shedding

The emergency process of deliberately removing preselected loads from a utility supply system in response to an abnormal condition in order to maintain the stability of the system or to maintain supply to as large a number of customers as possible.

10.6 Load balancing

The ability to use real time network investigations and/or on-site intelligence to reconfigure distribution networks or to limit customer loads to maintain desired levels of service and to improve the utilisation of assets.

10.7 Load control by utility

The procedure to limit the supply or load at the customer premises by command from a point remote from the customer premises.

10.8 Load management by customer

Control of use by the customer to optimize supply charges. The utility may assist the customer by providing real time information on pricing and consumption.

10.9 Load management by utility

Control of the load at the customer premises by the utility.

10.10 Load profile

The recording, storage and analysis of consumption data over a period of time for a particular installation. The data would typically be recorded at appropriate intervals, e.g. hourly or half-hourly, to allow consumption to be graphed on a daily basis.

10.11 Load shedding

The process of deliberately removing preselected loads from a utility supply system in response to an abnormal condition in order to maintain the stability of the system, to maintain supply to as large a number of customers as possible, or to avoid excessive supply costs.

10.12 Over-pressure protection device

A physical pressure-limiting device to protect the installation against unsafe over-pressure conditions.

10.13 Remote control

Control of an operation from a distance. This involves a link between the control device and the apparatus to be operated.

NOTE – The communications may be performed by means of direct wire, mechanical means, or other channels, e.g. power line carrier (PLC), infrared (IR), microwave, UHF/VHF radio or fibre optics.

10.14 Smart control transducer

A receiving device that accepts one or more data values, transmitted as a data message, and converts them into some real physical action.

10.15 Smart measuring transducer

An emitting device that converts one or more physical properties into a coded data message.

10.16 System control

The corporate facility that controls the total system to ensure that supply is maintained to the greatest number of customers.

11 Distribution system automation

11.1 Air-break switch

A circuit switching device (in an electricity distribution system) using air as the insulation medium and having the ability to make and break normal load current.

11.2 Circuit breaker

A switch with the ability to make and break fault currents (as well as normal load currents).

11.3 Distribution switch

A circuit switching device in an electricity distribution system with the ability to make and break normal load current.

NOTE – Where the switch is capable of breaking fault currents, it is known as a circuit breaker.

11.4 Distribution system automation (DSA)

The total monitoring, control and operation of a product or service distribution system, including the following:

a) control centre automation;

b) substation/control station/regulator station automation;

c) feeder/line/district automation;

d) distribution metering automation.

NOTE 1 – In a distribution system, SCADA is used to provide high level, high reliability real time information for protection and control of major system components.

NOTE 2 – For metering and utility information systems, the elements of DSA involved are those not normally covered by SCADA and not requiring the high performance characteristics of SCADA.

11.5 Fault indicator

A device strategically placed on a distribution feeder to assist in locating power system faults. It is intended for permanent installation and may have options of remote indication of a fault.

11.6 Load transfer switch

A switch used alone or with other switches to re-configure the electricity supply system to supply a load from a different source.

11.7 Recloser

A circuit switching device in an electricity distribution system able to close the circuit after a set time, after the detection of overcurrent faults, and the interruption of the circuit by the protection relay of a feeder by:

a) detecting overcurrent faults e.g. three-phase, phase-to-phase, single-phase-to-earth;

b) interrupting the circuit after a predetermined or calculated time;

c) closing the circuit after a set time.

Also known as automatic circuit recloser or pole-top recloser.

11.8 Ring main unit (RMU)

A circuit switching device in an electricity system with the ability to switch sections of a feeder, and protect and isolate distribution transformer(s).

11.9 Sectionalizer

A circuit device in an electricity distribution system with the ability to perform the following sequence a set number of times:

a) open a de-energized circuit after a predetermined time or sequence;

b) close a de-energized circuit after a predetermined time or sequence.

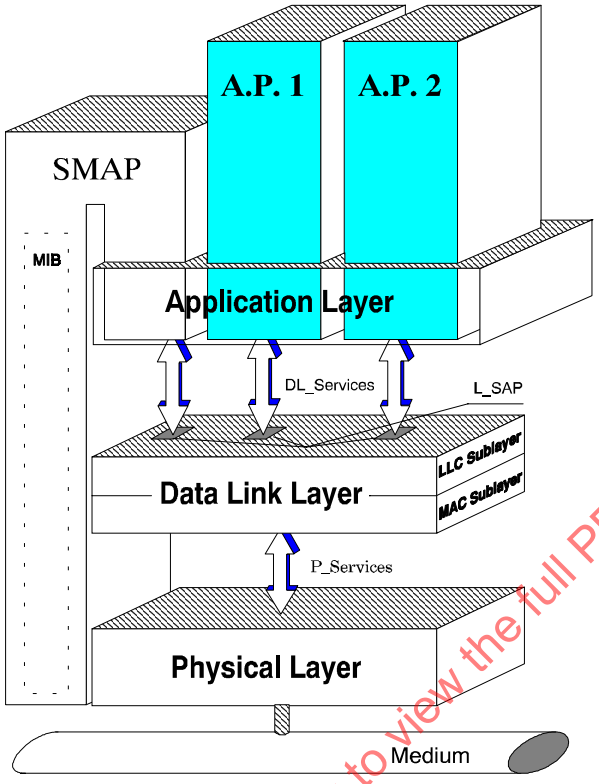
11.10 Supervisory control and data acquisition (SCADA)

A system that supervises and controls a geographically distributed process and provides high reliability protection and telemetry functions in real time.

12 Open systems interconnection

12.1 Collapsed architecture

A subset of the OSI reference model which consists of only three layers: physical layer, data link layer and application layer.



AP = Application Process
DL_Services = Data Link Services
LLC Sublayer = Logical Link Control Sublayer
L_SAP = Link Service Access Point
MAC Sublayer = Medium Access Control Sublayer
MIB = Management Information Base
P_Services = Physical Services
SMAP = System Management Application Process

Figure 1 – Collapsed architecture

12.2 Layer

One of seven (3) functional entities within the OSI model (normal and collapsed architecture).

Table 1 – OSI model – Functional layers

Layer	Normal	Collapsed
7	Application	Application
6	Presentation	
5	Session	
4	Transport	
3	Network	
2	Data-link	Data-Link
1	Physical	Physical

12.2.1 Physical layer (OSI layer 1)

That layer of the OSI reference model which provides bit transmission between one node and the next, physical interfacing with media, data signal encoding and defines electrical parameters, connector size, shape and pinouts.

12.2.2 Data link layer (OSI layer 2)

That layer of the OSI reference model which performs and controls specified transmission service functions by means of a link protocol.

12.2.3 Network layer (OSI layer 3)

That layer of the OSI reference model which establishes the source to destination path across the network, switches, routes and controls congestion of information packets.

12.2.4 Transport layer (OSI layer 4)

That layer of the OSI reference model which provides reliable transmission of layer 7 messages end-to-end across the communications network.

12.2.5 Session layer (OSI layer 5)

That layer of the OSI reference model which establishes and terminates end-to-end sessions, provides process synchronization, and determines if half-duplex or full-duplex is to be used.

12.2.6 Presentation layer (OSI layer 6)

That layer of the OSI reference model which establishes the syntax (form) in which data is exchanged.

12.2.7 Application layer (OSI layer 7)

That layer of the OSI reference model which provides end-user services such as file transfers, electronic messages and remote data base access.

12.3 Layer management

N_connection Function related to the management of the N_layer partly performed in the N_layer itself according to the N_protocol of the layer (activities such as activation and error control) and performed as subset of systems management (8).

12.3.1 N_connection

An association established by the N_layer between two or more N+1_entities for the transfer of data (8).

12.3.2 N_data communication

An N_function which transfers N_protocol data units according to an N_protocol (8).

12.3.3 N_directory

An N_function by which the global title of an N_entity is translated into the N-1_address of an N-1_service access point to which the N_entity is attached (8).

12.3.4 N_entity

An active element within an N_subsystem (8).

12.3.5 N_facility

A part of an N_service (8).

12.3.6 N_function

A part of the activity of N_entities (8).

12.3.7 N_interface data

Information transferred from an N+l_entity to an N_entity for transmission to a correspondent N+l_entity or conversely in a reception phase (8).

12.3.8 N_layer

A subdivision of the OSI architecture, constituted by subsystem of the same rank (N) (8).

12.3.9 N_protocol

A set of rules and formats (semantic and syntactic) which determines the communication behaviour of N_entities in the performance of N_functions (8).

12.3.10 N_protocol control information

Information exchanged between N_entities, using an N-1_connection to coordinate their joint operation (8).

12.3.11 N_protocol data unit

A unit of data specified in an N_protocol and consisting of N_protocol control information and possibly N_user data (8).

12.3.12 N_relay

An N_function by means of which an N_entity forwards data received from one correspondent N_entity to another correspondent N_entity (8).

12.3.13 N_service

A capability of the N_layer and the layers beneath it, which is provided to N+l_entities at the boundary between the N_layer and the N+1_layer (8).

12.3.14 N_service access point

The point at which N_services are provided by an N_entity to an N+1_entity (8).

12.3.15 N_service data unit

An amount of N_interface data whose identity is preserved from one end of an N_connection to the other (8).

12.3.16 N_subsystem

An element in a hierarchical division of a system which interacts directly only with elements in the next higher division of that system (8).

12.3.17 N_user data

The data transferred between N_entities for whom the N_entities are providing services (8).

12.4 Open systems interconnection (OSI)

A framework for communications processes in which the process is divided into seven functional layers, arranged one above the other with each having a separate responsibility. Each layer communicates only with the layer immediately above and below it.

12.5 Sublayer

A subdivision of a layer (8).

12.6 System management application entity

An application entity which executes systems management functions (8).

12.7 Systems management

Function in the application layer related to the management of various OSI resources and their status across all layers of the OSI architecture (8).

13 Data communications

13.1 Acknowledgement

A function of the N_layer which allows a receiving N_entity to inform a sending N_entity of a receipt of an N_protocol data unit (8).

13.2 Analog signal

Signal in the form of a continuously variable value (7).

13.3 Application

An application is a set of functions which together form a logical unit which supports a process of a business enterprise.

13.4 Asynchronous transmission

Data transmission in which the time of occurrence of the start of each character, or block of characters, is arbitrary; once started, the time of occurrence of each signal representing a bit within the character, or block, has the same relationship to significant instants of a fixed time base (4).

13.5 Authentication

Monitoring the identity of each party at the beginning of the communication.

13.6 Availability

The availability of a unit or system characterizes its ability to perform its required function at any given moment (7).

13.7 Available bandwidth

The frequency band within which the composite loss does not exceed and the return losses do not fall short of the specified values.

13.8 Avalanche protection

The ability to cope with alarms from the majority of customer installations at any one time without the loss of the communications system(s) when distribution network faults occur. Depending on the system architecture, this may be achieved by concentrators distributed within the communications system or at the utility's computer facilities.

13.9 Bandwidth

The bandwidth of a device is the difference between the limiting frequencies within which performance in respect to some characteristic falls within specified limits (5).

13.10 Baud

The unit of modulation rate or the unit of transfer rate of signal elements of constant duration in a discretely timed or digital signal; the number of bauds is equal to the reciprocal of the duration in seconds of the shortest signal element or of the unit interval in such a signal (3).

EXAMPLE: If the duration of the unit interval is 20 ms, the modulation rate is 50 Bd.

13.11 Bit error rate

The ratio of the number of bits received inverted to the total number of bits sent (IEV 371-08-01).

13.12 Bit rate

The speed at which bits are transmitted, usually expressed in bits per second [bits/s] (1).

13.13 Blocking

A function performed by an N_entity to map multiple N_service data unit into one N_protocol data unit (8).

13.14 Bridge

A device to link two LANs together. Every LAN has its own internal data communication which is not heard by an external LAN. A bridge is limited to the physical and link layer of the ISO-OSI model.

13.15 Broadcast communications

The sending of a command or message to a number of receivers without the need to individually address each command or message.

13.16 Bus (topology)

A network topology consisting of two or more nodes sharing a communications channel. Each node on the channel receives all messages and determines, based on an address contained in the message, whether to accept and process the message or to ignore it.

13.17 Bus-system

A wired data communication network connecting a limited number of communication devices (meters) to an access point or concentrator.

13.18 Byte

An ordered group of a fixed number of binary digits operated as an entity (IEV 721-02-18).

NOTE – The word "byte" without qualification may be used as a synonym for octet.

13.19 Carrier

An electrical or electromagnetic wave modulated to transport information.

13.20 CCITT (The Comité Consultatif International Télégraphique et Téléphonique)

See ITU-T.

13.21 Channel

A single path for communications, usually in distinction from other parallel paths. Channels may be separated from one another in many ways, including different conducting paths, different frequencies or different times. Channels may be single direction or two-way. Essentially, only one communications can take place at a time.

NOTE – The word "path" is a broad interpretation that includes separation by frequency, division or time division. The term "channel" may signify either an one-way path, providing transmission in one direction only, or a two-way path, providing transmission in two directions.

13.22 Common mode voltage

The mean of the voltages appearing between each conductor and a specified reference, usually earth or frame (IEV 161-04-09).

13.23 Communications network

A data communications system allowing a number of devices to communicate with each other. The primary function of a communications network is to transmit information from one point to another.

13.24 Concentrator

An intelligent station in a hierarchical communications network at which incoming data is processed as appropriate and then retransmitted, repackaged, discarded, responded to, consolidated, prioritized or increased to multiple messages (5). (See also "smart node").

13.25 Control and metering unit (C&M)*

A device, for each utility (at the customer premises) that provides for the metering of the product or service (including time-of-use tariffs) and control of load by the customer and/or the utility.

13.26 Control unit (CU)*

A device that accepts and stores information from the simple measuring transducer and the complex measuring transducer, and provides information to the simple control transducer and the complex control transducer.

13.27 Customer automation unit (CAU)*

Gateway and barrier between the home automation system, the utility communication channel and the physical interface to the customer.

13.28 Customer communications gateway (CCG)*

A protocol converter between the internal message standard and the communications channel message standard.

13.29 Data encryption

The changing of the form of a data stream which only the intended recipient can read or alter the information and detect unauthorized messages.

13.30 Data format

A data format is a description of requirements of a data item in terms of name (domain), size (number of digits or characters) and possible content (value range). Accordingly, a group can have a data format.

13.31 Data integrity

The ability of a communications system to deliver data from its source to its destination with an acceptable residual error rate.

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* These terms are used in some countries.

13.32 Data item or variable

A data item is a piece of information (also known as a variable or field). It is the smallest possible unit that can be exchanged in one transaction between utility and a meter. A data item is used to send information to the other side of the transmission path or to activate or deactivate a function.

13.33 Data security

The prevention of one or all of the following:

a) unauthorized access to the information contained in a data stream;

b) unauthorized alteration of the information contained in a data stream;

c) unauthorized generation of a message which is taken as valid by the receiving equipment.

NOTE – Data security is usually achieved by data encryption.

13.34 Data set or group

A data set is a group of data items. Data items can be grouped for several reasons:

to minimize communication overhead (several data items are transferred in one transaction);

to couple data items that are strongly related to each other (e.g. a meter index and the date and time at which it has been sampled).

13.35 Data transfer rate

The number of bits, characters, or blocks per unit time passing between corresponding equipment in a data transmission system. It is expressed in terms of bits, characters, or blocks per second, minute or hour (5).

13.36 Data transfer time

The time that elapses between the initial offering of a unit of user data to a network by transmitting data terminal equipment and the complete delivery of that unit to receiving data terminal equipment (5).

13.37 Fibre optics

The use of modulated light waves in a fibre optic cable as the physical communications medium.

13.38 Frame

A sequence of bits containing information, control and check fields, and having a reliable means of indicating the start and the end, for example by frame delimiting characters possibly in conjunction with a length field (7).

13.39 Gateway

A device that fully implements the ISO-OSI model with all layers. Used to concentrate (concentrator) and/or to convert data protocols between different communication systems and standards.

13.40 Group alarm

The combination of several individual alarms into one alarm.

13.41 Group command

A command which is addressed to several individual receiving units.

13.42 Hamming distance

The number of positions in which two code words of the same length differ from each other (5).

13.43 Header

The control information prefixed to a message text, e.g. source or destination code, priority, message type.

13.44 Inbound

Meter communication initiated by the meter.

13.45 Information capacity (in a communication system)

The amount of different information in a telecontrol system which may be handled at the control centre or master station and at the outstations.

NOTE 1 – The information capacity is often expressed by the number of commands and by the amount of monitored information which can be handled.

NOTE 2 – The information capacity of telecontrol equipment at the control centre or master station may be shared between several customer units or substations of customers.

13.46 Information capacity (in a remote control system)

The information capacity is a measure of the overall performance (throughput) of the system.

NOTE 1 – The information capacity is often expressed by the number of commands and by the amount of monitored information which can be handled.

NOTE 2 – The information capacity of remote control equipment at the control centre or master station may be shared between several customer units or substations of customers.

13.47 Information transfer efficiency

The ratio of the information content of a message transferred from a data source and accepted as valid by a data sink to the total number of bits expended for the message transfer.

13.48 Information transfer rate

The average number of bits of information per second transferred from a data source and accepted as valid by a data sink.

13.49 Infrared (IR) communication

The use of modulated infrared waves as the physical medium for communication.

13.50 Interface

A point or means of interaction between two systems.

13.51 Integrated services digital network (ISDN)

A network which provides a hierarchy of digital switching and transmission methods capable of simultaneous transmission of voice and data services on a single access line.

13.52 Local area network (LAN)

A data communication network, connecting a limited number of communication devices (meters), covering a moderately sized geographical area.

13.53 Local data exchange

Data exchange between one or a number of customer premises equipment (CPE) at a given location and a handheld unit.

13.54 Logical address

A group of bits that identify the application process destination of the data or the originating application process.

13.55 Mains signalling

A communications technique which permits the use of relatively low-frequency signals to transmit data over distribution networks, whose primary purpose is to transport electrical power.

13.56 Multiplexing

The process of transmitting multiple signals from different sources over a common cable or transmission line.

13.57 Multistar topology

Same as ”star”, but with multiple connections on every “ray” to the concentrator. Several ”barbed rays” may be used.

13.58 Network

Either the product distribution network, or the customer/utility data exchange communication network. A system that allows a number of devices to communicate with each other (5).

NOTE – To ensure clarity, reference should be made to the distribution network or the communications network respectively.

(*See also* Communications network.)

(*See also* Network layer (OSI layer 3).)

13.59 Node

A point where one or more functional units (meters) are connected to a communication network.

13.60 Octet

A sequence of eight bits, treated as a unit. The bits may collectively have a particular significance, e.g. they represent a character, or no significance, e.g. eight status indicators.

13.61 Operation

An operation is the smallest possible action within a function, such as reading a data item or set. A function is composed of one or more operations.

13.62 Optical port

A communications port in which the information transfer is via light signals (e.g. optical interface) (15).

13.63 Outbound

Meter communication initiated by the control centre or master station.

13.64 Overall information transmission efficiency

The ratio of the correctly transferred information content of a message in bits to the product of the time required for the transmission of that message and the bit transmission rate.

NOTE – The calculation of the overall transmission efficiency shall consider delays caused by transmission of polling frames, acknowledgement frames, average delays expended for error recovery, round trip propagation delays of signals, etc.

13.65 Overall response time

The time interval between the initiation of an event at a sending station and the output, at the same station, of the associated response coming from a receiving station.

13.66 Overall transfer time

The time duration while information is delayed after the event in the sending station and until presentation at the receiving station.

NOTE – The overall transfer time includes the delays due to the input peripheral device in the sending station and the corresponding peripheral output device at the receiving station.

13.67 Packet

A group of binary digits (bits) including data and control elements, which is transmitted as a whole. The data and control elements, and possibly error control information, are arranged in a specified format.

13.68 Physical address

A group of bits that represent the terminal destination of the data or the originating terminal.

13.69 Point-to-point configuration

A communications configuration whereby one station is connected to another station by a dedicated transmission link or by switched network.

13.70 Polling

The periodic interrogation of a set of meters (under program control) to allow data and status retrieval in a master-slave communication.

13.71 Polling system

A communication system in which the monitored information is captured on request from a master station.

13.72 Protocol

The rules for communication system operation that must be followed if communication is to be effected (5).

13.73 Public switched telephone network (PSTN)

A network which provides a communications path for limited-bandwidth analogue transmissions.

13.74 Public telephone and telegraph (PTT)

The collection of services provided by a public telecommunications administration. In some countries: Post, telephone and telegraph.

13.75 Radio-frequency communications

The use of modulated radio waves as the physical medium for communications.

13.76 Reliability

The ability of a functional unit to perform a required function under stated conditions for a stated period of time (4).

13.77 Repeater

A device used to extend the physical length of a LAN. The repeater restores the signals on the physical layer. It is related to the physical layer of the ISO-OSI model only.

13.78 Residual error rate

The ratio of the number of bits, unit elements, characters, or blocks incorrectly received but undetected or uncorrected by the error-control equipment, to the total number of bits, unit elements, characters, or blocks sent (5).

13.79 Ring topology

All metering equipment is connected to a closed cable loop. The concentrator may be located at any node on the loop.

13.80 Ripple control

A one-way audio frequency communication system for tariff and load control.

13.81 Router

A smart bridge which covers layers 1 to 3 of the ISO-OSI model.

13.82 Routing

A function within a layer which translates the title of an entity or the service access point address to which the entity is attached into a path by which the entity can be reached (8).

13.83 Security

The ability of a communications system to avoid placing the controlled system in a potentially dangerous or unstable situation. It applies to the consequences of failures arising out of malfunctions of the equipment and from undetected information errors.

13.84 Simplex transmission

One-way data transmission.

13.85 Smart node

A special purpose module which interfaces networks to monitor traffic, diagnoses network difficulties, injects packets, maintains a data base and/or configures the network.

13.86 Star (topology)

A network topology consisting of several series of separate communications links between nodes and a central controller. All transmissions from one node to another pass through a central controller, which is responsible for managing and controlling all communications. Loss of one link affects only a single node.

Also known as port topology.

13.87 Success rate

The percentage of commands issued by a control unit which are correctly responded to by the designated receiving device.

13.88 Telecontrol

The control of operational equipment at a distance. Effecting the transmission of information by telecommunications techniques.

NOTE – Telecontrol may comprise any combination of command, alarm, indication, metering, protection and tripping facilities, without any use of speech messages.

13.89 Topology

The physical configuration of the devices and the communications link which connects them, e.g. star, bus.

13.90 Transparent

The property of a device, network or process whereby the content of information which passes through is not altered. For example, a communications repeater does not alter the data passing through it, it merely improves the signal level.

13.91 Tree topology

Several sections with several meters connected to one concentrator at the base.

13.92 Twisted pair

A twisted pair of wires used for carrying data, voice communications or electrical power.

13.93 International Telecommunications Union – Telecommunications (ITU-T)

An international organization concerned with devising and proposing recommendations for international telecommunications.

13.94 Wide area network (WAN)

An extended data communication network connecting a large number of communication devices (meters) over a large geographical area.

13.95 Word

A character string, binary element string or bit string which is considered as an entity.

14 Distribution automation using DLC media

14.1 Central Low Voltage Unit *

Apparatus, located in a MV/LV substation, which performs the functions required by Network Automation and Customer Automation. It organises the communication with the Remote Low Voltage Units (RLUs) via the LV-network (by means of the injection of the transmission signal on the LV bus-bars).

14.2 Central Medium Voltage Unit *

Apparatus, located in a HV/MV substation, which provides the injection of the transmission signal on the MV power lines. It establishes a communication channel with the Remote Medium Voltage Units (RMUs), installed in MV/LV substations, and MV customers, directly supplied by the MV network.

14.3 Central Unit *

Central computer which performs the functions required by the application needs.

14.4 Command

Information used to cause a change of state of operational equipment (IEV 371-03-01).

14.5 Communication Unit *

Device which performs data transfer between data source and data sink via one or more data links according to a protocol, e.g.:

CMCU*: Central Medium Voltage Communication Unit;
RMCU*: Remote Medium Voltage Communication Unit;
CLCU *: Central Low Voltage Communication Unit;
RLCU*: Remote Low Voltage Communication Unit.

The xxCUs can communicate with each other (via the power mains) and with their processing units.

14.6 Composite loss

The composite loss brought about by the quadripole made up of the coupling device terminated by the nominal coupling-side and equipment-side impedance.

14.7 Control centre

A control centre is a location where telecontrol of outstations is performed (IEV 371-06-01).

14.8 Control lines

In the context of this document, all the lines for control, signalling and measurement purposes.

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* These terms are used in some countries.

14.9 Coupling

The means by which signals are transferred from one conductor to another. Types of coupling include:

a) capacitive coupling;

b) inductive coupling;

c) direct coupling.

14.10 Cross-talk

The phenomenon by which a signal transmitted on one circuit or channel of a transmission system creates an undesired effect in another circuit or channel.

14.11 Data circuit terminating equipment; line coupler

The interfacing equipment sometimes required to couple the DTE (data terminal equipment) with a transmission circuit or channel.

14.12 Data terminal equipment

The functional unit of a data station which serves as a data source or a data sink and provides for the data communication control function to be performed in accordance with a protocol (5).

14.13 De-blocking

A function performed by an N_entity to identify multiple N_service data units which are contained in one N_protocol data unit. It is the reverse function of blocking (8).

14.14 Differential Mode Voltage

The voltage between two active conductors (10).

14.15 Differential phase-shift keying (DPSK)

A method of modulation employed for digital transmission. In DPSK, each signal element is a change in the phase of the carrier with respect to its previous phase angle.

14.16 Distribution line carrier (DLC)

A communications technique that enables the transmission and reception of information over low-voltage and medium-voltage distribution networks, used for the primary purpose of transmitting electrical power.

Also known as Power line carrier (PLC).

14.17 Distribution lines

Power lines used for distribution purpose.

14.18 Earth terminal

A terminal of the coupling device which is intended to be connected directly to the local station earth.

14.19 Emission level (of a disturbing source)

The level of a given electromagnetic disturbance emitted from a particular device, equipment or system, measured in a specified way (IEV 161-03-11).

14.20 Emission limit (from a disturbing source)

The specified maximum emission level of a source of electromagnetic disturbance (IEV 161-03-12).

14.21 Frequency hopping

An electronic counter-countermeasure (ECCM) technique in which the instantaneous carrier frequency of a signal is periodically relocated, according to a predetermined code, to other positions within a frequency spectrum much wider than required for normal message transmission. The receiver uses the same code to keep itself in synchronism with the hopping pattern (5).

14.22 Frequency shift keying; frequency shift modulation

That form of frequency modulation in which the modulating signal shifts the output frequency between predetermined values, and the output wave may have phase discontinuity or may not have phase discontinuity (1).

14.23 Full-duplex transmission

Data transmission in both directions at the same time.

14.24 Immunity (to a disturbance)

The ability of a device, equipment or system to perform without degradation in the presence of an electromagnetic disturbance (IEV 161-01-20).

14.25 Immunity level

The maximum value of a given electromagnetic disturbance incident on a particular device, equipment or system for which it remains capable of operating at a required degree of performance (IEV 161-03-14).

14.26 Interharmonics

Components of the Fourier spectrum positioned between harmonics of the power frequency (50 Hz or 60 Hz).

14.27 Layer (N_), (N+1_), (N-1_)

These prefixes are used to identify any related adjacent layer, e.g.:

N_layer: any specific layer;

N+1_layer: the next higher layer;

N-1_layer: the next lower layer.

14.28 Nominal coupling-side impedance

The impedance which the coupling device is designed to match on the power network side and to which the requirements refer.

14.29 Nominal equipment-side impedance

The impedance which the coupling device is designed to match on the equipment side, and to which the requirements refer.

14.30 Nominal impedance

The value of impedance for which an input or output circuit has been designed and for which the prescribed requirements apply.

14.31 Nominal signal output power

The nominal carrier-frequency power of a DLC terminal is the peak envelope power for which the equipment has been designed, compatible with the requirements for spurious emissions, available at the carrier frequency output across a resistive load equal to the nominal load impedance.

14.32 Peer entity

Entities within the same layer (8).

14.33 Phase shift keying; phase shift modulation; phase shift signalling

Angle modulation in which each significant condition in a modulating discrete signal is represented by a specified phase of a periodic sinusoidal oscillation (3).

14.34 Phase-to-earth coupling

Coupling to the power line effected between the conductor of one phase of the line and earth.

14.35 Phase-to-phase and phase-to-neutral coupling

Coupling to the power line effected between the conductor of one phase and the conductor of another phase or the neutral of the same line.

14.36 Power lines

Lines originating from the power supply alternative or direct voltage. These lines include transport and distribution lines.

14.37 Power line carrier (PLC)

A communications technique which permits the use of high frequency signals to transmit data over transmission lines whose primary purpose is to transport electrical power.

14.38 Power line carrier channel

The use of high-frequency signals to transmit data over power lines. It is also used in a more generic sense.

14.39 Primary terminals

The terminals of the coupling device which are intended to be connected to the conductors of the power line.

14.40 Processing unit

A device capable of accepting and processing information and supplying the results. It usually consists of input, output, storage arithmetic, logic and control units, e.g.:

CPU*: Central Processing Unit;

CMPU*: Central Medium Voltage Processing Unit;

RMPU*: Remote Medium Voltage Processing Unit;

CLPU*: Central Low Voltage Processing Unit;

RLPU*: Remote Low Voltage Processing Unit.

It processes data in order to allow its transfer between the interfaces (to the outside of the DLC system) and the xxCUs.

14.41 Remote Low Voltage Unit (RLVU)*

Electronic device, connected to the metering unit installed at LV customers' premises. It performs energy measurement and consumption data processing.

14.42 Remote Medium Voltage Unit (RMVU)*

Apparatus, located at any MV distribution installation (typically a MV/LV substation or a MV customer). It performs the injection of the transmission signal on the MV power lines and:

– exchanges data with the CLU, when it is installed in a MV/LV substation;

– performs energy measurement and consumption data processing, when it is connected to a MV customer.

14.43 Return loss

The return loss of the quadripole made up of the coupling device, respectively terminated by the nominal coupling-side and equipment-side impedance (IEV 702-07-25).

14.44 Secondary terminals

The terminals of the coupling device which are intended to be connected to the carrier-frequency connection.

14.45 Signal-frequency range

The total band approved by international authority for DLC use.

14.46 Signal-frequency working range

The range of carrier frequencies within which the available bandwidth of a DLC device can be set.

14.47 Spread spectrum

A communication technique in which the modulated information is transmitted in a bandwidth considerably greater than the frequency content of the original information.

NOTE – This technique affords advantages in interference avoidance and multiple access.

14.48 Spurious emission

Any electromagnetic emission on a frequency or frequencies which are outside the necessary emission bandwidth, the level of which may be reduced without affecting the corresponding transmission of information.

NOTE – Spurious emission includes harmonic emission, parasitic emission, and intermodulation products, but excludes emission in the immediate vicinity of the necessary bandwidth, which are the results of the modulation process for the transmission of information.

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* These terms are used in some countries.

15 Quality

15.1 Quality

The totality of characteristics of an entity that bear on its ability to satisfy stated and implied needs (11).

15.2 Quality assurance

All the planned and systematic activities implemented within the quality system, and demonstrated as needed, to provide adequate confidence that an entity will fulfil requirements for quality (11).

NOTE 1 – There are both internal and external purposes for quality assurance.

a) Internal quality assurance: within an organisation quality assurance provides confidence to management.

b) External quality assurance: in contractual or other situations, quality assurance provides confidence to the customers or others.

NOTE 2 – Some quality control and quality assurance actions are interrelated.

NOTE 3 – Unless requirements for quality fully reflect the needs of the user, quality assurance may not provide adequate confidence.

15.3 Quality control

The operational techniques and activities which are used to fulfil requirements for quality (11).

NOTE 1 – Quality control involves operational techniques and activities aimed both at monitoring a process and at eliminating causes of unsatisfactory performance all stages of the quality loop in order to result in economic effectiveness.

NOTE 2 – Some quality control and quality assurance actions are interrelated.

15.4 Quality improvement

The actions taken throughout the organization to increase the effectiveness and efficiency of activities and process to provide added benefits to both the organization and its customers (11).

15.5 Quality management

All activities of the overall management function that determine the quality policy, objectives and responsibilities and implement them by means such as quality planning, quality control, quality assurance and quality improvement, within the quality system (11).

NOTE 1 – Quality management is the responsibility of all levels of management but must be driven by top management. Its implementation involves all members of the organisation.

NOTE 2 – In quality management, consideration is given to economic aspects.

15.6 Quality manual

The typical form of the main document used in drawing up and implementing a quality system (11).

NOTE – The primary purpose of a quality manual is to provide an adequate description of the quality management system while serving as a permanent reference in the implementation and maintenance of that system. In large companies, the documentation relating to the quality management system may take various forms, including the following:

a) a corporate quality manual;

b) divisional quality manuals;

c) specialized quality manuals (e.g. design, procurement, project, work, instructions).

15.7 Quality planning

The activities that establish the objectives and requirements for quality and for the application of quality system elements (11).

NOTE – Quality planning covers:

a) product planning: identifying, classifying and weighting the characteristics for quality as well as establishing the objectives, requirements for quality and constraints;

b) managerial and operational planning: preparing the application of the quality system including organizing and scheduling;

c) the preparation of quality plans and making of provisions for quality improvement.

15.8 Quality plans

For projects relating to new products, services or processes, management should prepare, written quality plans consistent with all other requirements of a company's quality management system (11).

NOTE: Quality plans should define:

a) the quality objectives to be attained;

b) the specific allocation of responsibilities and authority during the different phases of the project;

c) the specific procedures, methods and work instructions to be applied;

d) suitable testing, inspection, examination and audit programmes at appropriate stages (e.g. design, development);

e) a method for changes and modifications in quality plan as projects proceed;

f) other measures necessary to meet objectives.

15.9 Quality policies and procedures

All the elements, requirements and provisions adopted by a company for its quality management system should be documented in a systematic and orderly manner in the form of written policies and procedures. Such documentation should ensure a common understanding of quality policies and procedures (i.e. quality programmes/plans/manuals/records) (11).

15.10 Quality policy

The overall quality intentions and direction of an organization with regard to quality, as formally expressed by top management (11).

NOTE – The quality policy forms one element of the corporate policy and is authorized by top management.

15.11 Quality system

The organizational structure, responsibilities, procedures, processes and resources needed to implement quality management (11).

NOTE 1 – The quality system should only be as comprehensive as needed to meet the quality objectives.

NOTE 2 – The quality system of an organization is designed primarily to satisfy the internal managerial needs of the organization. It is broader than the requirements of a particular customer, who evaluates only that part of the quality system.

NOTE 3 – For contractual or mandatory quality assessment purposes, demonstration of the implementation of identified quality system elements may be required.

16 DLMS vocabulary

16.1 Application – VDE

Each communicating metering equipment must contain at least one application VDE (see 16.10).

16.2 Companion specification

A “companion specification” document details an application from the communication point of view. It corresponds to a VDE description with DLMS objects such as static VAAs, variables, one Data Set and optionally some Task Invocations.

16.3 Companion standard

A companion standard document details extensions to the DLMS kernel not altering the spirit of the model (e.g. extension rules on the scope of access).

16.4 Data Set (DS)

The DS is a loadable subset of both the executable programs and the DLMS variables.

16.5 Distribution Line Message Specification (DLMS)

An application layer specification designed to support messaging communications to and from distribution devices in a computer integrated environment (16).

16.6 DLMS Profile

Set of choices foreseen by the DLMS model and mandatory for interoperability. It includes the conformance block and some other non-negotiated options.

16.7 Management – VDE

Specific VDE for protocol handling.

16.8 Supervision – VDE

For complex metering equipment implementing several application VDEs. This VDE is in charge of the services common to the application VDE.

16.9 Virtual Application Association (VAA)

The VAA is an object which represents both:

– a number of the DLMS initiator;

– a view of the DLMS objects sharing the same scope of access.

16.10 Virtual Distribution Equipment (VDE)

The VDE object represents the main abstract entity of the DLMS specification. It contains all the other DLMS objects and defines the application from the point of view of communication. Each independent communicating application of a real piece of equipment is to be seen as a VDE.

A VDE is characterized by a local communication address.

16.11 Static VAA – Objects

– billing (reserved for the entity in charge of billing);
– calibration (reserved for calibration);
– customer (reserved for consultation by the customer);
– operator (reserved for network operation by the utility);
– management (reserved for protocol management);
– maintenance (reserved for equipment technical maintenance);
– manufacturing (reserved for manufacturers' purposes).

This list is an example and is non-exhaustive.

16.12 Task Invocation (TI)

A TI is a hardware resource which most closely corresponds to the capability of executing a program in a multitask environment. The TI is an optional and predefined object.

The programs which may be executed by the TI are not DLMS objects.

16.13 Variable (Var)

A variable is an abstract element of VDE, capable of providing or accepting a typed data value.

A variable is the most common VDE object.

17 Pre-payment electricity metering

17.1 Accountancy back-up

The process of reconciliation of the energy consumption against customer payments.

17.2 Accounting process

The financial methods required to support the system, encompassing the payments made by, or on behalf of, a specific customer, consolidated against the supply of energy and services taken by the customer.

17.3 Accounting register

An electronic device that stores and enables the display of the value of available credit in the payment meter. The accounting register may have a monetary or energy value.

17.4 Agreed debt

The debt amount agreed between the customer and supplier.

17.5 Algorithm code

A number that is used to identify uniquely a cryptographic algorithm used in the transfer of information within the system (12).

17.6 Audit process

A process which reconciles the payments made against the due charges.

17.7 Automatic interruption

Interruption of the load by the payment meter as a function of the payment system status.

17.8 Automatic restoration

Restoration of the load by the payment meter as a function of the payment system status.

17.9 Available credit

The sum of credit transferred to the meter less charges deducted by the meter accounting process, less any reserve credit. (Available credit may be positive, negative or zero.)

17.10 Budget mode

A subset of the prepayment mode in which a portion of the purchased credit may be reserved by the customer, in the payment meter, for future use.

17.11 Change out

The process of replacing a payment meter with another payment meter.

17.12 Commissioning

The process of making a decommissioned payment meter available for use by the customer. This process resets the meter's accounting registers and starts the meter accounting process.

17.13 Common vending system (CVS)

A system that comprises equipment that is able to vend to more than one type of specified payment meter (12).

17.14 Credit amount

The credit that is purchased by a customer, expressed in terms of currency units or energy units (in kilowatt-hours), or both (12).

17.15 Credit limit mode

A payment mode in which automatic interruption occurs when debt registered by the payment meter exceeds an agreed limit.

17.16 Credit mode

A payment mode in which the payment meter operates as a normal credit meter.

17.17 Credit verifier

A device that verifies the amount of credit carried by a token after a purchase from a POST.

17.18 Cryptographic key

A string of data that is used to secure and authenticate information.

17.19 Cryptographic key management

The management process that ensures the security of the generation and distribution of cryptographic keys (12).