

**Environmental Engineering (EE);
Monitoring and Control Interface for Infrastructure Equipment
(Power, Cooling and Building Environment Systems used in
Telecommunication Networks)
Part 1: Generic Interface**

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Foreword

This ETSI Standard (ES) has been produced by ETSI Technical Committee Environmental Engineering (EE).

The present document is part 1 of a multi-part deliverable covering power, cooling and building environment systems control and monitoring guidance, as identified below:

- Part 1: "Generic Interface";**
- Part 2: "DC power system control and monitoring information model";
- Part 3: "AC UPS power system control and monitoring information model";
- Part 4: "AC distribution power system control and monitoring information model";
- Part 5: "AC diesel back-up generator system control and monitoring information model";
- Part 6: "Air conditioning system control and monitoring information model";
- Part 7: "Other utilities system control and monitoring information model".

1 Scope

The present document applies to monitoring and control of Infrastructure Environment i.e. power, cooling and building environment systems for telecommunication centres and access network locations.

Interoperability of heterogeneous management interfaces and systems with multi-vendor equipment is the key issue. The present document gives a general approach from equipment to management system.

The multi-part deliverable is composed of a generic core part (part 1) and several specific parts for equipment category (part 2 and following).

The core document defines:

- The site equipment map and its division in functional subsets e.g. DC system which introduces part 2 and following.
- The generic set of exchanged information required at the interface of equipment, which is instanced for each equipment subset in part 2 and following.
- The minimum requirement for network architecture allowing some compatibility with old existing interface and the mechanism to exchange data between network element.
- The data interface protocol for remote or local site management (Machine to Machine Interface MMI) and Human Machine Interface HMI for monitoring and controlling.
- Recommendations for sure management network such as dependability, data back-up, data coherence and synchronization all along the management network, response time, fault detection and partial service in case of failure.

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific.

- For a specific reference, subsequent revisions do not apply.
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NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long term validity.

2.1 Normative references

The following referenced documents are indispensable for the application of the present document. For dated references, only the edition cited applies. For non-specific references, the latest edition of the referenced document (including any amendments) applies.

- [1] ETSI ETS 300 132-1: "Equipment Engineering (EE); Power supply interface at the input to telecommunications equipment; Part 1: Operated by alternating current (AC) derived from direct current (DC) sources".
- [2] ETSI EN 300 132-2: "Environmental Engineering (EE); Power supply interface at the input to telecommunications equipment; Part 2: Operated by direct current (DC)".
- [3] ETSI EN 300 132-3: "Environmental Engineering (EE); Power supply interface at the input to telecommunications equipment; Part 3: Operated by rectified current source, alternating current source or direct current source up to 400 V".
- [4] ETSI EN 302 099: "Environmental Engineering (EE); Powering of equipment in access network".
- [5] ITU-T Recommendation M.3010: "Principles for a Telecommunications management network".
- [6] ITU-T Recommendation M.3100: "Generic network information model".
- [7] ITU-T Recommendation X.733: "Information technology - Open Systems Interconnection - Systems Management: Alarm reporting function".
- [8] IEC 60839-5-4: "Alarm systems - Part 5: Requirements for alarm transmission systems - Section 4: Alarm transmission systems using dedicated alarm transmission paths".
- [9] ITU-T Recommendation X.25: "Interface between Data Terminal Equipment (DTE) and Data Circuit-terminating Equipment (DCE) for terminals operating in the packet mode and connected to public data networks by dedicated circuit".
- [10] IETF RFC 2616: "Hypertext Transfer Protocol - HTTP/1.1".
- [11] ISO/IEC 7498: "Open Systems Interconnection (OSI) - Basic Reference Model".
- [12] IEEE 802.series (all parts): "IEEE Standard for Telecommunications and Information Exchange Between systems - Local and metropolitan area networks".
- [13] ISO/IEC 10164 (all parts): "Information technology - Open Systems Interconnection - Systems Management".
- [14] ISO/IEC 8879: "Information processing - Text and office systems - Standard Generalized Markup Language (SGML)".
- [15] ETSI ES 202 336 (all parts): "Environmental Engineering (EE); Monitoring and Control Interface for Infrastructure Equipment (Power, Cooling and Building Environment Systems used in Telecommunication Networks)".
- [16] IEC 61076-2-101: "Connectors for electronic equipment - Product requirements - Part 2-101: Circular connectors - Detail specification for M12 connectors with screw-locking".

2.2 Informative references

The following referenced documents are not essential to the use of the present document but they assist the user with regard to a particular subject area. For non-specific references, the latest version of the referenced document (including any amendments) applies.

- [i.1] ETSI TR 102 121: "Environmental Engineering (EE); Guidance for power distribution to telecommunication and datacom equipment".
- [i.2] ETSI TR 102 336: "Environmental Engineering (EE); Power and cooling system control and monitoring guidance".

[i.3] REST.

NOTE: Described in: <http://en.wikipedia.org/wiki/REST>,
http://www.ics.uci.edu/~fieling/pubs/dissertation/rest_arch_style.htm (Ref article from Roy Thomas)
 and <http://www.peej.co.uk/articles/rest.html>.

[i.4] IETF RFC 2516: "A Method for Transmitting PPP Over Ethernet (PPPoE)".

[i.5] IETF RFC 1191: "Path MTU discovery".

[i.6] IETF RFC 871: "Perspective on the ARPANET reference model".

[i.7] IETF RFC 1662: "PPP in HDLC-like Framing".

[i.8] IETF RFC 1994: "PPP Challenge Handshake Authentication Protocol (CHAP)".

[i.9] IETF RFC 2364: "PPP Over AAL5".

[i.10] IETF RFC 2615: "PPP over SONET/SDH".

[i.11] IETF RFC 1661: "The Point-to-Point Protocol (PPP)".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

NOTE: Terms referring to energy interface, equipment and distribution are described in power distribution guidance and standards ETS 300 132-1 [1], EN 300 132-2 [2], EN 300 132-3 [3] for ac and dc interface and EN 302 099 [4] for access network equipment powering.

alarm: any information signalling abnormal state, i.e. different to specified normal state of hardware, software, environment condition (temperature, humidity, etc.)

NOTE: The alarm signal can be understood by itself by an operator and have at least one severity qualification or codification (colour, level, etc.).

alarm loop: electrical loop which open or closed state correspond to alarm start (set) or end (clear) state

alarm message: text parts of the alarm structure

alarm structure: organized set of information fields in an alarm data frame (time stamp, set/clear, text, etc)

battery: complete arrangement of battery cells or blocks in one string or more in parallel

battery cell: basic electrochemical element (e.g. 2 V for lead acid battery)

battery string: a number of serially interconnected battery blocks or cells

client post: any device (laptop, PDA, console, etc.) connected to servers via the operation system networks to perform maintenance or supervision operations

NOTE: It is independent of object class and object properties. The most common functions are GET and SET, equivalent to monitor and control.

Common Management Information Protocol (CMIP): protocol using CMIS service to obtain remote monitoring and control

NOTE: CMIP is much richer than SNMP but much more complex to implement.

Common Management Information Service (CMIS): generic services to handle objects (operation and notification of results)

Control Unit (CU): integrated unit in an equipment to monitor and control this equipment through sensors and actuators

Control form Style Sheet (CSS): simple mechanism for adding style (e.g. fonts, colours, spacing) to Web documents. Tutorials, books, mailing lists for users, etc.

Data Gathering Unit (DGU): functional unit used for several functions:

- collect serial, digital, and analogue data;
- option to send (output) serial or digital commands;
- forward/receive information to/from the Local/Remote Management Application via agreed protocols;
- mediation between interfaces and protocols.

NOTE: This function may be integrated as part of specific equipment.

Dynamic Host Configuration Protocol (DHCP): protocol used for self configuration of TCP/IP parameters of a workstation assigning IP address and a sub network mask

NOTE: DHCP may also configure DNS.

Dynamic Name Server (DNS): associates a single domain name to an IP address

dynamic synoptic: dynamic display of geographical maps, networks, installations and equipment

Ethernet: LAN protocol

NOTE: Equivalent to IEEE 802.1 to 11 [12].

event: any information signalling a change of state which is not an alarm: e.g. battery test, change of state of battery charge

NOTE: The alarm signal can be understood by itself by an operator and have at least one severity qualification or codification (colour, level, etc.). It is transmitted in a formatted structure with text message and other fields like for alarm, e.g. an event can be coded as an alarm with severity "0".

eXtensible Mark-up Language (XML): application profile or restricted form of SGML

NOTE: By construction, XML documents are conforming SGML the Standard Generalized Markup Language (ISO/IEC 8879 [14]). documents.XML is designed to describe data and focus on what data is. XML is different from the well known Hypertext Transfer Mark-up Language (HTML) which was designed to display data and to focus on how data looks.

Guidelines for Definition of Managed Objects (GDMO): syntax specification for the classification of objects and properties

NOTE: Associated to ASN.1 language for object definition.

infrastructure equipment: power, cooling and building environment systems used in telecommunications centres and Access Networks locations

EXAMPLE: Cabinets, shelters, underground locations, etc.

Intranet: internal company network generally using Ethernet protocol and extended IP addresses

logbook: chronological file that contains alarm and event messages may be paper or electronic

Management Information Base (MIB): dynamic data base that gathers all objects and should evolve to include automatic and manual configuration tools with self coherence tests

menu: list of possible input command choices that may be presented in different ways on a display

NOTE: Selection is normally made by a keyboard, a pointing device, a mouse or directly by finger on a sensitive screen.

object: class description of items that accept a set of properties or functions

NOTE: Generic objects can include more specific items and inherit from their properties. If correctly structured, object programming can allow the system to evolve, i.e. be more future-proof. The code should intrinsically be open and structured.

PHP: powerful tool for making dynamic and interactive Web pages

pop-up: information or command screen that appears when a menu choice is selected

NOTE: For example this may be a pop-up menu when the pointer is on a title button.

REpresentational State Transfer (REST): way to build an application for distributed system as www

Simple Object Access Protocol (SOAP): way to communicate between applications running on different operating systems, with different technologies and programming languages

NOTE: SOAP communicates over HTTP, because HTTP is supported by all Internet browsers and servers, SOAP traffic is not blocked by firewalls and proxy servers (see W3C).

Systems Management Function (SMF): object properties or classes with projection on CMIS application context communication

NOTE: Set of ISO system management functions according to ISO/IEC 10164 [13].

warning: low severity alarm

windows: virtual area on the display that corresponds to a specific application

web: common name for the Internet or Intranet

World Wide Web Consortium (W3C): consortium founded in October 1994 to develop common interoperable protocols and promote World Wide Web

NOTE: See <http://www.w3c.org>.

XCU: CU enabled to communicate using XML interface as defined in the present document

XHTML: stricter and cleaner version of HTML. XHTML consists of all the elements in HTML 4.01 combined with the syntax of XML

NOTE: It can be read by all XML browser (see W3C).

XML Schema Definition (XSD): new more detailed XML description compared to the previous one, the DTD

Extensible Style sheet Language (XSL): language for expressing style sheets

NOTE: It consists of two parts, a language for transforming XML documents, and an XML vocabulary for specifying formatting semantics. An XSL style sheet specifies the presentation of a class of XML documents by describing how an instance of the class is transformed into an XML document that uses the formatting vocabulary.

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

AC	Alternative Current
ADSL	Asynchronous Digital Subscriber Line
API	Application Programming Interface
ASN.1	Abstract Syntax Notation One
ATM	Asynchronous Transfer Mode
CHAP	Challenge-Handshake Authentication Protocol
CIM	Common Information Model
CMIP	Common Management Information Protocol (OSI)
CMIS	Common Management Information Service (OSI)

CSMA/CD	Carrier Sense Multiple Access with Collision Detection
CSS	Control form Style Sheet
CU	Control Unit
DC	Direct Current
DCF	Data Communication Function in TMN
DEG	Diesel Engine Generator
DGU	Data Gathering Unit
DHCP	Dynamic Host Configuration Protocol
DNS	Dynamic Name Server
DSL	Digital Subscriber Line
DTD	Document Type Definition
EMC	Electro Magnetic Compatibility
EP	Exploitation Post
FCS	Frame Check Sequence
FTP	File Transfer Protocol
GDMO	Guidelines for Definition of Managed Objects
GSM	Global System for Mobile
HMI	Human-Machine Interface
HTML	HyperText Transfer Mark up Language
HTTP	HyperText Transfer Protocol
HTTPS	HyperText Transfer Protocol Secure
IEM&C	Infrastructure Equipment Monitoring & Control (mediation agent)
IP	Internet Protocol
IPCP	Internet Protocol Control Protocol
ISDN	Integrated Service Digital Network
LCP	Link Control Protocol
LED	Light Emitting Device
LLC	Logical Link Control
LMA	Local Management Application
LON	Local Operated Network
M&C	Monitoring and Control
MAC	Media Access Control address
MCF	Management Communication Function (in TMN)
MEP	Mobile Exploitation Post
MF	Mediation Function (in TMN)
MIB	Management Information Base

NOTE: In SNMP for example.

MMC	Maintenance Management Computer
MMI	Machine-Machine Interface
MTTR	Mean Time To Repair
MTU	Maximum Transmission Unit
NEF	Network Element Function (in TMN)
NEM	Network Element Management
OLE	Object Linking and Embedding
OPC	OLE for Process Control
OSF	Operating System Function (in TMN)
OSI	Open Service Interconnexion (in TMN)
PAP	Password Authentication Protocol
PDA	Personal Digital Assistant
PHP	PHP: Hypertext Preprocessor
POTS	Plain Old Telephone Service
PPPoE	Point-to-Point Protocol over Ethernet
PSTN	Public Switched Telephone Network
REST	REpresentational State Transfer
RFC	Request For Comments
RMA	Remote Management Application
RPC	Remote Procedure Calls
SCTP	Stream Control Transfer Protocol
SDH	Synchronous Data Hierarchy

SGML Standard Generalized Markup Language

NOTE: See ISO/IEC 8879 [14].

SMF Systems Management Functions
 SMS Short Message System
 SMTP Simple Mail Transfer Protocol
 SNMP Simple Network Management Protocol
 SOAP Simple Object Access Protocol
 TCP Transmission Control Protocol for IP
 TMN Telecommunications Management Network

NOTE: See ITU-T Recommendation M.3010 [5].

UDP Use Datagram Protocol
 UPS Uninterruptible Power Supply
 URI Uniform Resource Identifier
 URL Uniform Resource Locator
 USB Universal Serial Bus
 VPN Virtual Private Network
 WSF Work Station Function
 WAN Wide Array Network
 W3C World Wide Web Consortium
 xDSL Digital Subscriber Line
 XCU XML enabled CU
 XML eXtensible Mark-up Language (see W3C)
 XHTML eXtended HTML
 XSD XML Schema Definition
 XSL Extensible Stylesheet Language
 XSLT eXtensible Stylesheet Language Transformation
 XSLTb eXtensible Style Language Transformation (attribute b)

4 Monitoring and Control (M&C) overview

Monitoring and control of power, cooling and building environment systems are used to simplify operation, to reduce maintenance time and site intervention, to reduce human error risk, to give useful data for statistical analysis and management (i.e. operation cost, reliability or quality management, power consumption estimation).

To achieve this purpose, monitored information and control are needed:

- The information are alarms, events, measurements, data recordings and events logs.
- The controls are commands to the equipment, alarm acknowledge, configuration and settings.

Several management levels are possible for telecommunication installations and equipment. They are described considering complexity of the system, response time and required level of details from basic alarms to complex analysis level. In many cases, the same basic information is needed from the equipment-monitoring interface but address different services that prepares information as requested by users categories.

4.1 Infrastructure equipment management network general description

Infrastructure Equipment (powering, cooling, building facilities) management network is a subset of TMN.

The infrastructure equipment management network can be defined by functional interfaces between network elements.

Referring to ITU-T Recommendation M.3010 documents for nomenclature [5] and [6], the element can be understood as generic part of Telecommunication Management Network (TMN):

- The Control Unit (CU) is dedicated to control one or more equipment in a site.