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Edition 1.0 2019-06

TECHNICAL SPECIFICATION

colour inside

Industrial-process measurement, control and automation – Part 1: system interface between industrial facilities and the smart grid

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Industrial-process measurement, control and automation – Part 1: system interface between industrial facilities and the smart grid

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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INDUSTRIAL-PROCESS MEASUREMENT, CONTROL AND AUTOMATION –

Part 1: system interface between industrial facilities and the smart grid

FOREWORD

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- the subject is still under technical development or where, for any other reason, there is the future but no immediate possibility of an agreement on an International Standard.

Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC TS 62872-1, which is a technical specification, has been prepared by IEC technical committee 65: Industrial-process measurement, control and automation.

This first edition edition cancels and replaces IEC TS 62872, published in 2015. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to IEC TS 62872:

- Normative references, Terms and definitions, and Abbreviations were updated;
- Subclause 5.1 was reformulated with price-based and incentive-based demand response;
- Subclause 5.8.3 “Example of data and data type” was added;
- New actors were added in Annex A;
- Use cases FG-7xx and FG-8xx were added in Annex A;
- Annex B “Use cases of incentive-based DR programs” was added.

The text of this Technical Specification is based on the following documents:

Enquiry draft	Report on voting
65/731/DTS	65/743/RVDTS

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

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A review of this document will be carried out not later than 3 years after its publication with the options of: extension for another 3 years; conversion into an International Standard; or withdrawal.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

The World Energy Outlook 2017 [19][1] reported that industry consumed over 40 % of world electricity generation in 2015. Furthermore, industry itself is a significant generator of internal power, with many facilities increasingly implementing their own generation, co-generation and energy storage resources. As a major energy consumer, the ability of some industries to schedule their consumption can be used to minimize peak demands on the electrical grid. As an energy supplier, industries with in-house generation or storage resources can also assist in grid load management. While some larger industrial facilities already manage their use and supply of electric power, more widespread deployment, especially by smaller facilities, will depend upon the availability of a readily available standard interface between industrial automation equipment and the “smart grid”.

NOTE In this document “smart grid” is used to refer to the external-to-industry entity with which industry interacts for the purpose of energy management. In other documents this term can be used to refer to all of the elements, including internal industrial energy elements, which work together to optimize energy generation and use.

Industry is a major consumer of electric power and in many cases this consumption can be scheduled to assist in minimizing overall peak demands on the smart grid. In addition, many industrial facilities have in-house generation or storage resources. These facilities can assist in smart grid load and supply management. For example, in-house generation can supply energy to the smart grid and to the facility. Furthermore, storage resources can assist in smart grid load management. While some larger industrial facilities already manage their use and supply of electric power, more widespread deployment, especially by smaller facilities, will depend upon the availability of readily available standard automated interfaces.

Standards are already being developed for home and building automation interfaces to the smart grid; however, the requirements of industry differ significantly and are addressed in this document. For industry, the planning of energy resources and production processes are under the responsibility of the facility energy planner and production planner and the operations are under the responsibility of the facility energy operator and production operator.

Incorrect operation of a resource could impact the safety of personnel, the facility, the environment or lead to production failure and equipment damage. In addition, larger facilities may have in-house production planning capabilities which might be co-ordinated with smart grid planning, to allow longer term energy planning.

[1] Numbers in square brackets refer to the Bibliography.

INDUSTRIAL-PROCESS MEASUREMENT, CONTROL AND AUTOMATION –

Part 1: system interface between industrial facilities and the smart grid

1 Scope

This part of IEC 62872 defines the interface, in terms of information flow, between industrial facilities and the "smart grid". It identifies, profiles and extends where required, the standards needed to allow the exchange of the information needed to support the planning, management and control of electric energy flow between the industrial facility and the smart grid.

The scope of this document specifically excludes the protocols needed for the direct control of energy resources within a facility where the control and ultimate liability for such control is delegated by the industrial facility to the external entity (e.g. distributed energy resource (DER) control by the electrical grid operator).

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 62264-1:2013, *Enterprise-control system integration – Part 1: Models and terminology*

IEC 62443 (all parts), *Industrial communication networks – Network and system security*

IEC TS 62443-1-1:2009, *Industrial communication networks – Network and system security – Part 1-1: Terminology, concepts and models*

IEC 62443-2-1, *Industrial communication networks – Network and system security – Part 2-1: Establishing an industrial automation and control system security program*

IEC TR 62443-3-1, *Industrial communication networks – Network and system security – Part 3-1: Security technologies for industrial automation and control systems*

IEC 62443-3-3, *Industrial communication networks – Network and system security – Part 3-3: System security requirements and security levels*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1 General

3.1.1
profile
set of one or more base standards and/or other profiles and, where applicable, the identification of chosen classes, conforming subsets, options and parameters of those base standards, or profiles necessary to accomplish a particular function

[SOURCE: ISO/IEC TR 10000-1:1998, 3.1.4, modified – "ISPs" has been replaced by "profiles".]

3.1.2
level
group of functions categorized with the functional hierarchy model of production systems defined in IEC 62264-1

Note 1 to entry: The highest level, Level 4, typically includes enterprise resource planning and similar functions, while the lowest level, Level 0, represents the physical industrial process itself.

3.1.3
level 4
functions involved in the business-related activities needed to manage a manufacturing organization

[SOURCE: IEC 62264-1:2013, 3.1.16]

3.1.4
level 3
functions involved in managing the work flows to produce the desired end-products

[SOURCE: IEC 62264-1:2013, 3.1.17]

3.1.5
level 2
functions involved in monitoring and controlling of the physical process

[SOURCE: IEC 62264-1:2013, 3.1.17]

3.1.6
level 1
functions involved in sensing and manipulating the physical process

[SOURCE: IEC 62264-1:2013, 3.1.18]

3.1.7
level 0
actual physical process

[SOURCE: IEC 62264-1:2013, 3.1.19]

3.1.8
enterprise
one or more organizations sharing a definite mission, goals and objectives which provides an output such as a product or service

[SOURCE: IEC 62264-1:2013, 3.1.10]

3.1.9
area
physical, geographical or logical grouping of resources determined by the site

[SOURCE: IEC 62264-1:2013, 3.1.2, modified – The example has been removed.]

3.1.10
site
identified physical, geographical, and/or logical component grouping of a manufacturing enterprise

[SOURCE: IEC 62264-1:2013, 3.1.39]

3.1.11
facility
industrial facility
site, or area within a site, that includes the resources within the site or area and includes the activities associated with the use of the resources

[SOURCE: IEC 62264-1:2013, 3.1.20, modified – The preferred term facility and the admitted term industrial facility have been replaced by facility.]

3.1.12
planner
facility energy planner

entity responsible for the advanced planning of facility energy use, storage and generation, taking into account the requirements of future production and the overall operation of the facility

Note 1 to entry: The facility energy planner is responsible for defining the overall future energy plan for the facility, to include both the energy requirements of production and the overall needs and capabilities of the facility to generate, store, and consume energy.

Note 2 to entry: Plans developed by the facility energy planner will typically be made at least a day prior to intended use.

Note 3 to entry: The facility energy planner will assemble the overall energy plan based on the individual plans developed by production planners and the non-production requirements and capabilities of the facility.

3.1.13
production planner
entity responsible for developing, monitoring and modifying the production plan based on facility requirements and the availability of inputs

Note 1 to entry: Example of inputs are equipment, labour, raw materials and energy.

3.1.14
facility energy operator
entity responsible for the minute by minute supply of energy to support current production and current facility operation

Note 1 to entry: The facility energy operator monitors facility energy use, generation and storage, and makes adjustments in response to changes related to shifting energy supplies, material disruptions, and equipment breakdowns.

3.1.15
production operator
entity responsible for the minute by minute use of energy to carry out production plans, and authorized to respond to real-time changes based on feed-back from the process and other internal or external event

Note 1 to entry: The production plan is given from production planner.

3.2 Models in automation

3.2.1
asset
physical or logical object owned by or under the custodial duties of an organization, having either a perceived or actual value to the organization

Note 1 to entry: In the case of industrial automation and control systems the physical assets that have the largest directly measurable value may be the equipment under control.

[SOURCE: IEC TS 62443-1-1:2009, 3.2.6]

3.2.2
automation asset
asset with a defined automation role in a manufacturing or process plant

Note 1 to entry: It would include structural, mechanical, electrical, electronics and software elements (e.g. controllers, switches, network, drives, motors, pumps). These elements cover components, devices but not the plant itself (machine, systems). It would not include human resources, process materials (e.g. raw, in-process, finished), or financial assets.

3.2.3
process
set of interrelated or interacting activities that transforms inputs into outputs

[SOURCE: ISO 14040:2006, 3.11]

3.2.4
product
result of labour or of a natural or industrial process

Note 1 to entry: This term is defined by "any goods or service" in IEC 62430 [11] and ISO 20140-1 [18]. The European Commission adopts a similar understanding in the directive "Ecodesign requirements for energy-related products". In the context of this document, the term "product" does not cover the automation assets but only the output of the manufacturing or process plant.

[SOURCE: IEC TR 62837:2013, 3.7.7]

3.3 Models in energy management system and smart grid

3.3.1
smart grid
SG
electric power system that utilizes information exchange and control technologies, distributed computing and associated sensors and actuators, for purposes such as to integrate the behaviour and actions of the network users and other stakeholders, and to efficiently deliver sustainable, economic and secure electricity supplies

Note 1 to entry: In this document, smart grid is the counterpart system to which FEMS is connected.

[SOURCE: IEC 60050-617:2011, 617-04-13, modified by adding abbreviation and Note 1 to entry]

3.3.2
smart meter
SM
embedded-computer-based energy meter with a communication link

Note 1 to entry: In this document smart meters are used to measure both the consumption and supply of energy by the facility. They may also be deployed within the facility to measure internal energy flows.

3.3.3
utility smart meter
USM
smart meter deployed by the utility company to measure energy consumption and supply by the facility

Note 1 to entry: This meter typically forms part of the advanced metering infrastructure of smart grid.

3.3.4
facility smart meter
FSM
smart meter deployed and used by the facility to measure energy flows

Note 1 to entry: This meter will normally communicate with the FEMS.

3.3.5
distributed energy resource
DER
energy resource, often of a small size, operated by the utility to augment the local supply of energy

Note 1 to entry: In this document, DER, in contrast to FER, is used to refer to resources under the direct control of the utility. Such resources may include generation and/or storage capabilities.

3.3.6
facility energy resource
FER
energy resource, operated by the facility, which is used to supply energy to the facility and which may also be used to provide energy to the grid

Note 1 to entry: This terminology, rather than distributed energy resource (DER) terminology, is used to emphasize that the FER is operated by the facility and not under the direct control of the utility. Such resources may include generation and/or storage capabilities.

3.3.7
demand response
DR
mechanism to manage customer load demand in response to supply conditions, such as prices or availability signals

3.3.8
price-based demand response
PBDR
mechanism that give customers time-varying rates that reflect the value and cost of electricity in different time periods

Note 1 to entry: Armed with this information, customers tend to use less electricity at times when electricity prices are high.

3.3.9
time of use
TOU
rate with different unit prices for usage during different blocks of time, usually defined for a 24-hour day

Note 1 to entry: TOU rates reflect the average cost of generating and delivering power during those time periods.

3.3.10
day-ahead price
DAP
rate notified on a day-ahead basis, in which the price for electricity fluctuates hourly reflecting changes in the wholesale price of electricity

3.3.11
real-time price
RTP
rate notified on hourly-ahead basis, in which the price for electricity fluctuates hourly reflecting changes in the wholesale price of electricity

3.3.12
incentive-based demand response
IBDR
mechanism supported by soliciting demand response behaviour, commitment to agreed demand response and programs that pay participating customers to reduce their loads at times requested by the program sponsor

Note 1 to entry: The no-participation in solicited demand response behaviour does not incur any penalty; examples are DLC and EDRP.

Note 2 to entry: The no-participation in committed agreed demand response behaviour entails a penalty; examples are I/C, DB, CMP and ASM.

3.3.13
direct load control
DLC
one of IBDR programs, in which the SG operator remotely shuts down the load of a facility to address system reliability contingencies, in exchange of paying the facility participation payment in advance

3.3.14
interruptible/curtailable load
I/C
one of IBDR programs, in which the SG operator issues “incentive” to a facility for agreeing to reduce load during system contingencies, a facility will be penalized if it does not reduce load

3.3.15
emergency demand response program
EDRP
one of IBDR programs, in which the SG operator provides incentive payment to a facility for measured load reduction during a reliability-triggered event, no penalty is imposed if the facility does not respond

3.3.16
demand bidding
DB
one of IBDR programs, in which the SG operator allows a facility to bid load reduction into the energy market, a facility with accepted bid shall reduce load as contracted, otherwise it faces a penalty

3.3.17
capacity market program
CMP
one of IBDR programs, in which the SG operator provides a facility with guaranteed payment for committing to provide predefined load reduction as the system capacity, a facility will face a penalty if it does not reduce load during a DR event

3.3.18
ancillary service market
ASM
one of IBDR programs, in which the SG operator allows a qualified facility to bid load reduction into the ancillary market as operating reserves, a facility with accepted bid shall curtail load when called by the SG operator, otherwise it faces a penalty