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TECHNICAL SPECIFICATION

colour inside

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

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INDUSTRIAL-PROCESS MEASUREMENT, CONTROL AND AUTOMATION SYSTEM INTERFACE BETWEEN INDUSTRIAL FACILITIES AND THE SMART GRID

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

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

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

Enquiry draft	Report on voting
65/590/DTS	65/598/RVC

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

A review of this Technical Specification 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 publication will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- transformed into an International standard,
- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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INTRODUCTION

The World Energy Outlook 2013 [13][1] reported that industry consumed over 40 % of world electricity generation in 2011. 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 may be used to refer to all of the elements, including internal industrial energy elements, which work together to optimize energy generation and use.

Standards are already being developed for home and building automation interfaces to the grid; however the requirements for industrial facilities differ significantly and are addressed in this Technical Specification. Specifically excluded from the scope of this Technical Specification are 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.

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

INDUSTRIAL-PROCESS MEASUREMENT, CONTROL AND AUTOMATION SYSTEM INTERFACE BETWEEN INDUSTRIAL FACILITIES AND THE SMART GRID

1 Scope

This Technical Specification 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.

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 which can also 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 Technical Specification. For industry, the operation of energy resources within the facility will remain the responsibility of the facility 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.

Specifically excluded from the scope of this Technical Specification are the protocols needed for the direct control of energy resources within a facility where the control and ultimate liability for such direct control is delegated by the industrial facility to an 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, *Enterprise-control system integration - Part 1: Models and terminology*

IEC 62264-3, *Enterprise-control system integration - Part 3: Activity models of manufacturing operations management*

IEC TS 62443-1-1, *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.

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: IEC/ISO TR 10000-1:1998, 3.1.4, modified – reference to international standard profiles has been removed]

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]

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
manufacturing 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]

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 input to output

[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 and ISO 20140-1:2013. The European Commission adopts a similar understanding in the directive "Ecodesign requirements for energy-related products". In the context of this Technical Specification, 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
utility grid
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 Technical Specification, smart grid is the counterpart system to which FEMS is connected.

[SOURCE: IEC 60050-617:2009, 617-04-13, modified by adding 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 Technical Specification 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 smaller size, operated by the utility to augment the local supply of energy

Note 1 to entry: In this Technical Specification, 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
facility energy management system
FEMS
system providing the functionality needed for the effective and efficient operation of energy generation, storage and consumption within the industrial facility, and which provides the necessary information interface with the smart grid

[SOURCE: IEC TS 61968-2, 2.101:2011, modified – factory is replaced by facility in the term and in the definition “computer” is removed and “to the electrical grid” is replaced by “with the smart grid”]

3.3.9
utility gateway
UG
function within FEMS responsible for the connection with the smart grid

Note 1 to entry: It is a function within FEMS.

3.3.10
energy generation system
EGS
energy resource capable of creating electric energy from other sources of energy or process wastes

EXAMPLE combined heat and power systems, photo voltaic cells, wind power generators.

3.3.11
energy storage system
ESS
energy resource capable of storing energy for later use

EXAMPLE batteries, flywheels, pumped hydro storage, electrical vehicles, fuel cells.

3.3.12
facility power line
network, which distributes energy to individual industrial equipment within a facility

3.3.13
schedulable processing task
task for which energy demand can be scheduled among multiple operating modes, where each mode has a different production rate and energy demand, such as heating, cooling, packaging, etc.

3.3.14
non-schedulable processing task
task for which energy demand must be satisfied immediately, such as rolling in steel manufacturing, assembling in automobile industry, etc.

3.3.15
monitor and control agent
MCA
agent that monitors and controls processing operations of a task