PD IEC TR 63082-1:2020

BSI Standards Publication

Intelligent device management

Part 1: Concepts and terminology

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National foreword

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A list of organizations represented on this committee can be obtained on request to its committee manager.

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TECHNICAL REPORT

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Intelligent device management – Part 1: Concepts and terminology

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

INTELLIGENT DEVICE MANAGEMENT –

Part 1: Concepts and terminology

FOREWORD

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IEC TR 63082-1, which is a Technical Report, has been prepared by subcommittee 65E: Devices and integration in enterprise systems, of IEC technical committee 65: Industrial-process measurement, control and automation.

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

Draft TR	Report on voting
65E/653/DTR	65E/677/RVDTR

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

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A list of all parts in the IEC 63082 series, published under the general title *Intelligent device management*, can be found on the IEC website.

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- withdrawn,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.

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INTRODUCTION

The purpose of the IEC 63082 series is to define an environment that enables the effective use of industrial intelligent devices (IID). The documents provide common concepts, terminology, and management activities.

Intelligent device management (IDM) represents activities for managing intelligent devices through the facility lifecycle and does not imply a particular asset management tool or set of those tools. Hardware and software tools are necessary to support work processes and procedures, but specification of the tools is not a part of the IEC 63082 series. IDM can be one of many enterprise programs. IDM activities optimize the value from intelligent devices and supports the concepts of integration of data from the production level with business systems. IDM is consistent with smart manufacturing initiatives.

The IEC 63082 series is not intended to replace or contradict other standards, for example IEC 61511 (all parts) for safety instrumented systems and IEC 62443 (all parts) for cybersecurity.

While the work processes and implementation practices specified in the IEC 63082 series might be used for non-automation equipment with some diagnostic capability, the IEC 63082 series does not cover these equipment types.

The IEC 63082 series will consist of the following parts:

- IEC TR 63082-1: Concepts and terminology (informative);
- IEC 63082-2: Work process requirements (normative).

IEC 63082-1 describes intelligent device management concepts and terminology necessary for in-depth understanding and effective communication. It gives the basic concepts of how intelligent devices can be managed and an overview of how this device management works throughout the facility lifecycle. IEC 63082-1 provides basic knowledge to understand the concepts of intelligent device management necessary to implement an IDM program.

IEC 63082-2 will provide normative requirements for IDM.

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INTELLIGENT DEVICE MANAGEMENT –

Part 1: Concepts and terminology

1 Scope

This part of IEC 63082 describes concepts and terminology necessary to understand and communicate effectively about IDM. This document explains the relationship between IDM and other existing asset management standards.

Additionally, this document provides activity structures and concepts associated with IDM programs. This document also introduces the concept of IDM programs for coordination of multiple stakeholders.

2 Normative references

There are no normative references in this document.

3 Terms, definitions and abbreviated terms

3.1 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

3.1.1
activity
set of actions that consume time and resources and whose performance is necessary to achieve, or contribute to, the realization of one or more objectives

Note 1 to entry: Includes work processes, procedures, and tasks.

[SOURCE: ISO/IEC TR 24766:2009, 3.1, modified – "outcomes" was replaced with "objectives" and the note has been added.]

3.1.2
alarm
notification to the operator of an equipment malfunction, process deviation, or abnormal condition requiring a unique, timely, and documented (predetermined) response from the operator

[SOURCE: IEC 62682:2014, 3.1.7, modified – "an audible and/or visible means of indicating" was replaced with "notification", "timely response" was replaced with "unique, timely, and documented (predetermined) response from the operator".]

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3.1.3
alarm management
work processes and practices for determining, documenting, designing, operating, monitoring, and maintaining alarm systems

[SOURCE: IEC 62682:2014, 3.1.17, modified — "collection of" was replaced with "work".]

3.1.4
alert
notification to a responsible person of an abnormal condition that can require action with a time tolerance much longer than for alarms

Note 1 to entry: A “responsible person” can include: operators, maintenance personnel, or engineering personnel.

3.1.5
apparatus
device or assembly of devices which can be used as an independent unit for specific functions

EXAMPLE Intelligent measuring and control devices, inspection and testing devices, host systems.

[SOURCE: IEC 60050-151:2001,151-11-22, modified — the example was added.]

3.1.6
asset management
coordinated activities of an organization to ensure the intended capability of assets is available

Note 1 to entry: The capability of an asset is dynamic and asset management will respond to satisfy changing objectives.

[SOURCE: ISO 55000:2014, 3.3.1, modified – "to realize value from assets" was replaced with "to ensure the intended capability of assets is available"; the notes were replaced with a new note to entry.]

3.1.7
calibration
procedure of checking or adjusting (by comparison with a reference standard) the accuracy of a measuring instrument

[SOURCE: ISO 15378:2017, 3.3.2, modified – "process" was replaced with "procedure" and the note was deleted.]

3.1.8
commissioning
procedure prior, or related, to the handing over of a product ready for putting into service, including final acceptance testing, the handing over of all documentation relevant to the use of the product and, if necessary, instructing personnel

[SOURCE: IEC 82079-1:2012, 3.3, modified – "procedures" was replaced with "procedure".]

3.1.9
configuration database
structured collection of parameter settings for intelligent devices

3.1.10
corrective action
action to eliminate the cause of a non-fulfilment of a requirement and to prevent recurrence

[SOURCE: ISO 55000:2014, 3.4.1, modified – "nonconformity" was replaced with "non-fulfilment of a requirement" and the note was deleted.]

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3.1.11
covert fault
fault in relation to hardware and software, undetected by the diagnostics, proof tests, operator intervention (for example physical inspection and manual tests), or through normal operation

Note 1 to entry: These are sometimes called latent faults or unknown faults.

[SOURCE: IEC 61508-4:2010, 3.8.9, modified – "fault" and "and software" were added, "diagnostic tests" was replaced with "diagnostics"; the example was deleted and the Note 1 to entry was added.]

3.1.12
criticality
degree of risk represented by a specified set of levels

3.1.13
device
independent physical entity capable of performing one or more specified functions in a particular context and delimited by its interfaces

[SOURCE: IEC 61499-1:2012, 3.29]

3.1.14
device configuration
procedure that loads parameters into an intelligent device to define its function

3.1.15
device lifecycle
period of time over which a device with a specific model code is developed, brought to the market and eventually removed from the market

3.1.16
device template
set of predefined parameters which characterize a specific device release for a particular type of application

Note 1 to entry: Device templates are normally prepared by the device supplier.

3.1.17
diagnostics
automated function which detects faults, malfunctions, deviations, and/or variations of hardware or software

Note 1 to entry: Diagnostics can be initiated manually for off-line diagnostics.

Note 2 to entry: Diagnostic is used as an adjective and as a generic word.

3.1.18
enterprise
group of organizations sharing a set of goals and objectives to offer products or services or both

[SOURCE: ISO 14258:1998, 2.1.1]

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3.1.19
equipment
single apparatus or set of devices or apparatuses, or the set of main devices of an installation, or all devices necessary to perform a specific task

EXAMPLE Intelligent measuring and control devices, inspection and testing devices, and host systems.

[SOURCE: IEC 60050-151:2001, 151-11-25, modified — the note has been deleted and the example added.]

3.1.20
facility
physical entity that is built, constructed, installed or established to perform some particular function or to serve or facilitate some particular end

EXAMPLE Plant, factory, mill, site, or similar production location.

[SOURCE: IEC TR 62066:2002, 3.6, modified — the examples are listed separately.]

3.1.21
facility implementation project
set of activities to put into practice before the facility starts or continues its intended service

3.1.22
failure
<of an item> loss of the ability to perform as required

Note 1 to entry: A failure of an item is an event that results in a fault of that item.

Note 2 to entry: Qualifiers, such as catastrophic, critical, major, minor, marginal and insignificant, can be used to categorise failures according to the severity of consequences, the choice and definitions of severity criteria depending upon the field of application.

Note 3 to entry: Failure could lead to loss of a single function of an item (e.g. secondary function such as diagnostics) not impacting the primary function of the item.

Note 4 to entry: In this definition “an item" refers to "a device".

[SOURCE: IEC 60050-192:2015, 192-03-01, modified – Note 3 to entry was replaced with a new Note 3 and Note 4 to entry was added.]

3.1.23
fault
<of an item> inability to perform as required, due to an internal state

Note 1 to entry: A fault of an item results from a failure, either of the item itself, or from a deficiency in an earlier stage of the lifecycle, such as specification, design, manufacture or maintenance.

Note 2 to entry: Qualifiers, such as specification, design, manufacture, maintenance or misuse, can be used to indicate the cause of the fault.

Note 3 to entry: In this definition “an item" refers to "a device".

[SOURCE: IEC 60050-192:2015, 192-04-01, modified – Note 3 to entry was replaced with a new Note 3 and Note 4 was deleted.]

3.1.24
host system
functions or tools that digitally communicate with intelligent devices

Note 1 to entry: Includes automated fault handling, management of notifications, and configuration management of intelligent devices.

Note 2 to entry: Functions and tools can be provided on one or more platforms.

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3.1.25
incipient fault
imperfection in the state or condition of a device so that a degraded performance or critical failure might eventually be the expected result if corrective action(s) is (are) not taken

[SOURCE: ISO 14224:2016, 3.40, modified – in the term, "failure" was replaced with "fault"; in the definition, "an item" was replaced with "a device", "or critical failure might (or might not)" was replaced with "performance or critical failure might" and "actions are" was replaced with "action(s) is (are)".]

3.1.26
industrial automation control system
IACS
collection of personnel, hardware, software, procedures and policies involved in the operation of the industrial process and that can affect or influence its safe, secure and reliable operation

Note 1 to entry: These systems include but are not limited to: a) industrial control systems, including distributed control systems (DCSs), programmable logic controllers (PLCs), remote terminal units (RTUs), intelligent electronic devices, supervisory control and data acquisition (SCADA), networked electronic sensing and control, and monitoring and diagnostic systems. (In this context, process control systems include basic process control system and safety-instrumented system (SIS) functions, whether they are physically separate or integrated.); b) associated information systems such as advanced or multivariable control, online optimizers, dedicated equipment monitors, graphical interfaces, process historians, manufacturing execution systems, and plant information management systems; c) associated internal, human, network, or machine interfaces used to provide control, safety, and manufacturing operations functionality to continuous, batch, discrete, and other processes.

Note 2 to entry: The IACS may include components that are not installed at the asset owner's site.

Note 3 to entry: Examples of IACSs include Distributed Control Systems (DCS) and Supervisory Control and Data Acquisition (SCADA) systems. IEC 62443-2-4 also defines the proper noun "Solution" to mean the specific instance of the control system product and possibly additional components that are designed into the IACS. The Automation Solution, therefore, differs from the control system since it represents a specific implementation (design and configuration) of the control system hardware and software components for a specific asset owner.

[SOURCE: IEC 62443-2-4:2015, 3.1.8, modified – Note 1 to entry has been added.]

3.1.27
infrastructure
basic physical and organizational structures needed for the operation of an enterprise

3.1.28
inspection
action comprising careful scrutiny of a device and its immediate environment in order to arrive at a reliable conclusion as to the condition of a device

[SOURCE: IEC 60050-426:2008, 416-14-02, modified – "an item" was replaced with "a device" and "carried out either without dismantling, or with the addition of partial dismantling as required, supplemented by means such as measurement," was replaced with "and its immediate environment".]

3.1.29
installation
one apparatus or a set of devices and/or apparatuses associated in a given location to fulfil specified purposes, including all means for their satisfactory operation

[SOURCE: IEC 60050-151:2001, 151-11-26]

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3.1.30
intelligent device
industrial intelligent device
IID
configurable device having digital communication with supplemental functions such as diagnostics (3.1.17) in addition to its basic purpose

EXAMPLE 1 Process connected devices, which are in level 1 of the IEC 62264-1 functional hierarchy, such as smart instruments, valves and actuators, analysers, custody transfer meters, electrical breakers, and transformers.

EXAMPLE 2 Control devices, which are in level 2 of the IEC 62264-1 functional hierarchy, such as PLCs, data acquisition subsystems, and dedicated HMI devices.

EXAMPLE 3 Other devices such as RTUs, managed industrial network routers, converters and gateways.

3.1.31
intelligent device management
IDM
formal coordinated business objectives, organizations, work processes, and resources to realize value from intelligent devices

Note 1 to entry: The IDM program is used to achieve setup (provisioning, engineering, configuration and calibration), optimization, diagnostics, maintenance and disposal of intelligent devices over the facility lifecycle based on asset management.

Note 2 to entry: IDM can be applied to multiple facilities of an enterprise or a facility of an enterprise.

3.1.32
intelligent device management program
IDM program
set of coordinated policies, strategies, activities, resources, and organization to achieve IDM objectives

Note 1 to entry: The IDM program is a type of enterprise program.

3.1.33
lifecycle
finite set of generic phases and steps which a system will go through over its entire life history

[SOURCE: ISO 15704:2000, 3.11, modified – “may" was replaced with "will".]

3.1.34
maintenance
activity including supervisory actions, intended to retain an item in, or restore it to, a state in which it can perform a required function

[SOURCE: ISO 14224:2016: 3.49, modified – "combination of all technical and management actions" was replaced with "activity including supervisory actions" and "as required" with "a required function"; the note was deleted.]

3.1.35
management of change
process of controlling and documenting any change in a system to maintain the proper operation of the equipment under control

[SOURCE: IEC 62443-2-1:2010, 3.1.8, modified – "change management" was replaced with "management of change".]

3.1.36
management program
activity that manages a group of related projects and/or work processes in a way that provides benefits and control not available by managing each activity individually and independently

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3.1.37
normal operation
operation of apparatus conforming electrically and mechanically within a design specification and used within the limits specified by the apparatus manufacturer

[SOURCE: IEC 60050-426:2008, 426-04-10, modified – "with its" was replaced with "within a" and "apparatus" was added.]

3.1.38
notification
means of communicating a value, state, condition, or symptom to an intended recipient

3.1.39
off-line diagnostics
diagnostics which is performed while the device is out-of-service

3.1.40
operator
person who monitors and makes changes to the production process of the facility

[SOURCE: IEC 62682:2014, 3.1.63, modified — "process" was replaced with "production process of the facility".]

3.1.41
overt fault
fault in relation to hardware and software, detected by the diagnostics, proof tests, operator intervention (for example physical inspection and manual tests), or through normal operation

[SOURCE: IEC 61508-4:2010, 3.8.8, modified – "fault" and "and software" were added, "diagnostic tests" was replaced with "diagnostics"; the example and note were deleted.]

3.1.42
preventive maintenance
maintenance carried out at predetermined intervals or according to specified criteria and intended to reduce the probability of failure or the degradation of the functioning of an item

3.1.43
proactive maintenance
preventive maintenance (3.1.42) which is carried out based on alerts from the devices

3.1.44
procedure
sequence of tasks with a defined beginning and end that is intended to accomplish a specific objective

3.1.45
prompt
notification that requires the responsible person to take an action that is part of normal operation

3.1.46
resources
people, procedures, software, information, equipment, consumables, infrastructure, capital and operating funds, and time

[SOURCE: ISO/IEC 38500:2015, 2.21]

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3.1.47
risk
combination of the probability of occurrence of harm and the severity of that harm

[SOURCE: ISO/IEC Guide 51:2014, 3.9, modified — the note was deleted.]

3.1.48
risk analysis
systematic use of available information to identify hazards and to estimate the risk

[SOURCE: ISO/IEC Guide 51:2014, 3.10]

3.1.49
risk assessment
overall process comprising a risk analysis and a risk evaluation

[SOURCE: ISO/IEC Guide 51:2014, 3.11]

3.1.50
risk evaluation
procedure based on the risk analysis to determine whether tolerable risk has been exceeded

[SOURCE: ISO/IEC Guide 51:2014, 3.12]

3.1.51
risk management
process of identifying and applying countermeasures commensurate with the value of the assets protected, based on a risk analysis

[SOURCE: IEC TS 62443-1-1:2009, 3.2.89, modified — "risk assessment" was replaced with "risk analysis".]

3.1.52
status notification
notification that helps provide the responsible person situational awareness, is part of normal operation and does not require operator action

3.1.53
task
single piece of work that needs to be done and does not have interacting elements requiring management

[SOURCE: IEC 62304:2006, 3.31, modified – "and does not have interacting elements requiring management" was added.]

3.1.54
testing
determination of one or more characteristics of an object of conformity assessment, according to a procedure

Note 1 to entry: "Testing" typically applies to materials, products or processes.

[SOURCE: IEC 60050-902:2013, 902-03-02]

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3.1.55
toolkit
set of documents and tools that defines and supports: work processes, project management, and typical configuration

Note 1 to entry: Tools can be hardware and/or software.

3.1.56
typical configuration data set
device template (3.1.16) for a particular facility prepared by the personnel performing the host system configuration

3.1.57
turnaround
scheduled activity wherein a facility is taken off-line for maintenance

EXAMPLE Planned shutdown.

3.1.58
user
hardware, software or human entity that is the initiator and/or target of content consumption

[SOURCE: ISO/IEC 14496-13:2004, 3.18]

3.1.59
vendor
one who sells and/or delivers equipment and/or engineering services

[SOURCE: ISO 35101:20173.16]

3.1.60
work process
set of interrelated or interacting procedure(s) which transforms inputs into outputs

[SOURCE: ISO 55000:2014, 3.1.19, modified – in the term, "work" was added, in the definition "activities" was replaced with "procedures".]

3.2 Abbreviated terms

CR	criticality ranking
EDDL	electronic device description language
EPC	engineering procurement construction
FAT	factory acceptance test
HMI	human machine interface
IACS	industrial automation control system
IDM	intelligent device management
IID	industrial intelligent device
KPI	key performance indicator
MOC	management of change
MTBF	mean time between failures
MTTR	mean time to repair
PLC	programmable logic controller
PPE	personal protective equipment
PSSR	pre-start-up safety review

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PV	process value
RAM	risk assessment matrix
RTU	remote terminal unit
SAT	site acceptance test
SIS	safety instrumented system
SIT	site integration test
UML	unified modelling language
WDT	watch dog timer

4 Background and motivation of intelligent device management

4.1 General

Success of monitoring and controlling the physical processes in IACS is built on the appropriate selection of technologies for devices for each application. Aside from input from its direct sensors, a non-intelligent device cannot perceive any other process information. Intelligent devices can have diagnostics that can detect faults in the installation or problems with the application. Each fault or problem could compromise the quality and/or reliability of the measurement and control. Intelligent devices are able to communicate by responding to inquiries or by pushing this information over a network to other intelligent devices. Intelligent devices can also respond to inquiries or push condition information to the balance of the industrial automation control system.

As devices evolve to transmit more data digitally, they deliver more benefits to users as well as the potential for simpler deployment, improved operation and reduced costs. The proliferation of intelligent devices has resulted in an increase in the volume and complexity of data, requiring standards for identifying errors, diagnostic codes, and critical configuration parameters. Intelligent device data delivery standards define what each data point looks like in terms of descriptors and terminology. Process industry standards currently in use for accessing device data, descriptors and terminology in predefined format include IEC 61804 (all parts), IEC 62453 (all parts), and IEC 62769 (all parts).

Other communication channels can be used to link the intelligent device directly to applications such as process monitoring, equipment monitoring, environmental monitoring, energy management, asset management, predictive maintenance, and advanced diagnostics. In some instances, the device data can bypass the real-time control system, reducing the load on the control system and simplifying the overall automation and information system architecture.

Many of the same technologies used in enterprise business systems such as Ethernet have been adapted to automation platforms. As a result, many of the same security and safety concerns found in these systems should be addressed before connecting critical process devices to non-process control networks.

Combining these technology advances will result in better integration of intelligent devices into facility automation and associated information systems. This will make it practical for users to realize the advantages that intelligent devices offer: better process control, higher efficiency, lower energy use, reduced downtime, and higher quality products.

4.2 Established business practices

Business practices are developing or adapting to better support the capabilities of intelligent device technology. These include maintenance, cybersecurity, cost reduction, improved safety and quality, emission reduction, etc. Established maintenance procedures have not yet incorporated intelligent device capability. Organizations' reluctance to change established work processes that were optimized for non-intelligent devices results in forgoing the benefits of built-in diagnostics and digital communications capabilities of intelligent devices.

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Established maintenance practices for field devices were sufficiently effective given the limitation of the technology available. In general, these maintenance practices were applied in the following contexts:

- run to failure – used to manage failure modes which were sudden, hidden, or deemed of low impact such that their failure would not impact reliable process operations;
- time based inspection and testing – used to manage failure modes which were both gradual and predictable, such as the mechanical integrity of devices;
- demand maintenance – used to manage failure modes that were either sudden or gradual but unpredictable.

Most intelligent devices contain configuration and diagnostics data that can be used to optimize maintenance practices. In many cases, the promise of intelligent devices in the facility remains unrealized. This is not so much a technology issue as a lack of management understanding of the importance of shifting to new work process appropriate for intelligent devices and addressing the shortage of skilled personnel.

4.3 Objectives of IDM

To use intelligent devices effectively, the following objectives should be achieved:

- required functions;
- basic functions;
- supplementary functions;
- communication functions;
- expected performance;
- accuracy;
- stability;
- response time;
- throughput;
- maximum availability;
- lower failure rate (MTBF);
- shorter repair time (MTTR).

IDM objectives should be achieved with:

- acceptable risk;
- lower likelihood for critical consequences resulting in lower cost of operation;
- minimum deployment cost;
- device, engineering, installing procedures;
- minimum maintenance cost;
- device replacement, spare parts, inspection, testing, calibration, repair;
- computing and logic functions providing key variables for maintenance.

To achieve the above objectives, intelligent devices should be:

- correctly selected, installed, and configured;
- continuously monitored;
- periodically tested;
- maintained at the expected performance level.

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Additionally:

- personnel involved should be trained appropriately;
- procedures used should be specified and documented;
- work processes should be clearly defined and documented in the context of IDM programs.

4.4 Conditions for achieving IDM

IDM is best supported in a structured environment that is established during the design and before operation of a facility. Facilities without IDM infrastructure can require hardware and software upgrades. Facilities without IDM infrastructure can use a gap analysis to determine the need for hardware and software modification, new work processes and retraining of personnel. Once the IDM infrastructure is in place, old facilities can be made to perform better with lower risk, and new facilities can be designed, constructed, and operated in a more efficient fashion.

With the implementation of intelligent devices, IDM, and diagnostics based maintenance, significant benefits can be realized as described in 4.5, 4.6, and 4.7 below.

4.5 Benefits and justification of IDM

If intelligent devices are used correctly, they can provide a significant improvement compared to traditional non-intelligent devices in functionality, accuracy, reliability, and total cost of ownership. These benefits include:

- more stable and safer operation of the facility;
- potential efficiencies and saving;
- prevention of lost production by reducing unscheduled shutdowns from equipment failures;
- higher quality product;
- prolonged life of equipment, including the device itself and related apparatus;
- reduction of operating cost to maintain the devices;
- reduction of effort and cost to check the functionalities of the devices;
- reduction of maintenance costs;
- reduction of manual inspection and testing (including safety and compliance benefits).

Intelligent device management has a strong economic value proposition. IDM can produce efficiencies and savings in all phases of a facility lifecycle. The largest incentives for implementing IDM are in the operations and maintenance phase. Detecting and resolving problems before they proceed to failure with associated process impact can reduce unplanned shutdowns. Depending on the application, one savings event provided by the capability of intelligent devices can pay for an entire IDM program investment. Effective use of intelligent devices results in higher accuracy measurements that lead to greater utilization of a facility's capacity. In addition, when device status is incorporated into control algorithms improved process control which results in higher process throughput with reduced variability also leads to better quality products.

The potential to cut maintenance costs is also significant. Many maintenance activities like periodic testing or checking of devices result in "no problem found." These activities traditionally force personnel to enter hazardous areas, climb to areas with poor access, and spend time on unnecessary tests. Device diagnostics as well as the surrounding environment can confirm proper operation without increasing the expense while reducing risk, thus leading to a quicker resolution of operational issues. IDM can significantly reduce manual inspection and testing by using diagnostics – therefore IDM can leave personnel free to optimize existing processes to improve safety and efficiency of the process.

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If IDM is implemented appropriately, technicians do not have to go to the place where the intelligent device is installed to get relevant information. Instead, information is provided directly to software tools that organize and present the information to the appropriate personnel in an actionable form. Remote software tools enable maintenance from any location when required.

In addition, because each time a change is made to any piece of equipment it adds stress to the components, by taking corrective action only when required, the device itself will have a longer lifespan.

The new IDM based work processes also provide opportunities to improve:

- data management, the integrity of the resulting signals, the device configuration and settings, and all stages of the signal processing, in addition to accessing the information related to only the process;
- workers' knowledge and knowledge management, which will enable development of best practices and optimization of work processes, through capturing all changes to the individual devices and the resulting analysis;
- maintenance work processes through better understanding of the root causes of device deterioration to focus activities on the source of the reduction in signal integrity;
- the implementation of diagnostic messaging, routine scheduled testing, and inspection procedures.

NOTE Tools and work processes that use the device's built-in diagnostics can improve testing and inspection thus reducing risks to the facility.

4.6 Challenges for implementing IDM

The primary challenge of IDM is its perceived complexity. Unfortunately, the majority of intelligent devices are only used to perform their primary function of providing the process variable. Digital communication and auxiliary functions can maximize the value of the device.

The lack of standardized work processes and available skills at a site are a challenge for dealing effectively with the potential complexity of IDM.

To meet the challenges and capture the benefits of IDM, all stakeholders, such as engineering firms, enterprises, and service providers need to understand their role in proper implementation and use of the tools and support systems for intelligent devices through this set of documents and related standards.

When local support is not available, intelligent devices present an opportunity to provide remote support. Digital networks with appropriate cybersecurity make it possible to access the information needed to troubleshoot a problem remotely without the cost and time of bringing the expertise to the facility.

Intelligent devices can have their functionality altered electronically either locally or remotely. Therefore, the analysis and classification processes in IEC 62443 (all parts) apply to all intelligent devices.

NOTE Rules appropriate for applicable security levels are found in IEC 62443-3-3.

4.7 Relationship of IDM to asset management

IDM is based on asset management concepts that are outlined in ISO 55000 and specified by ISO 55001. Therefore, IDM aligns with the basic requirements specified by ISO 55001.

As mentioned in ISO 55000, the nature and purpose of an organization and its operating environment all have a strong influence on the type of assets that the organization needs to achieve its objectives. An organization's and its stakeholders' intents are translated into design criteria for asset management.

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Figure 1 shows the relationship between intelligent device management and intelligent devices in the context of asset management. (An overview and conventions of UML class diagrams are described in Annex A.) Figure 1 through to Figure 8, except Figure 2 are duplicated as an equivalent UML class diagram in Annex B.

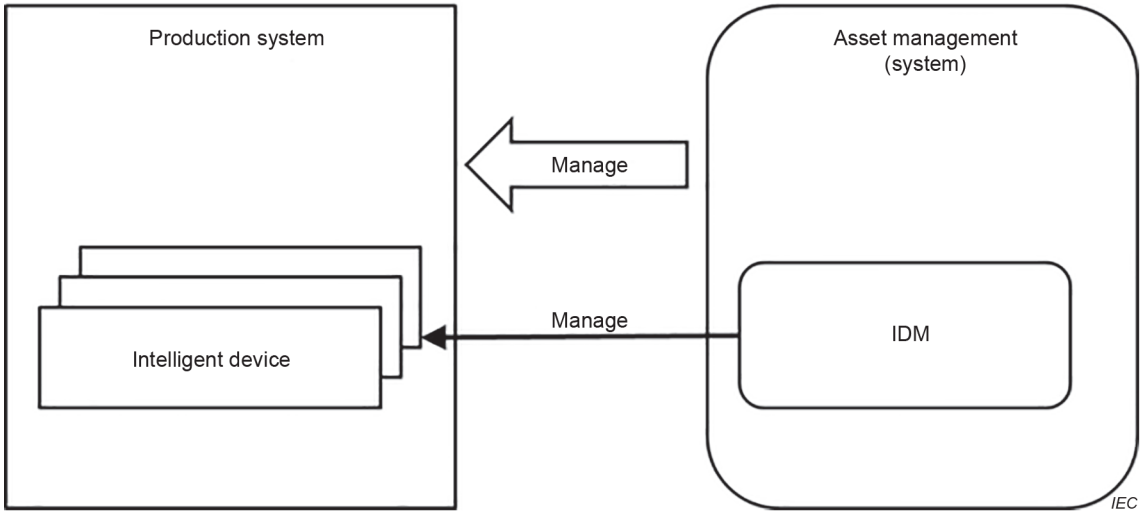

Figure 1 – IDM and intelligent device in the context of asset management

The asset management of the enterprise manages its assets. An intelligent device is one form of asset that is managed by IDM following the principles of asset management, as illustrated in Figure 1.

5 Structure of IDM

5.1 Overview

The objective of IDM is to achieve required functions, expected performance, and availability of intelligent devices with acceptable risk at minimum cost by utilizing features of intelligent devices.

IDM consists of several interactive and interdependent activities. To accomplish IDM goals, the management of these activities requires formal structure and the structure needs to be clearly documented.

Clause 5 provides an introduction to the organizational structures and activities necessary for IDM. This document only introduces concepts and terminology.

NOTE The details of the work processes and the roles of personnel performing these activities are not covered in this document.

The IDM structure can be implemented for both existing facilities and new facilities.

5.2 Organizational structure

5.2.1 Overview

Subclause 5.2 describes an organizational structure to support IDM activities.

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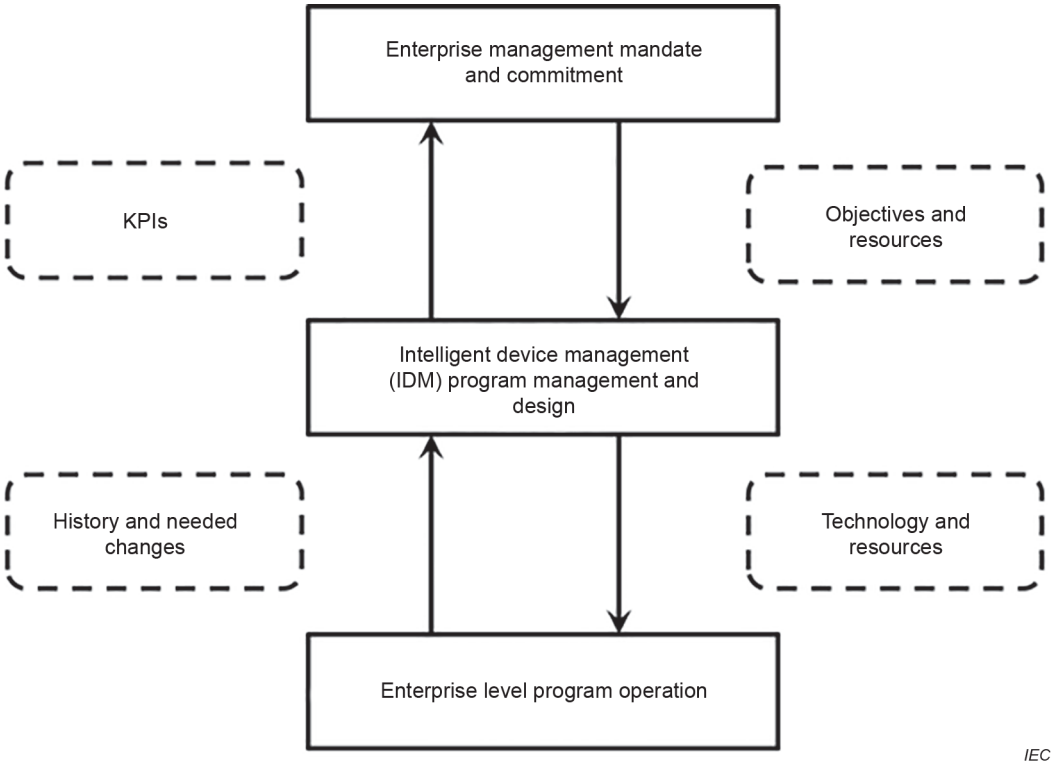

Key

Arrows represent information flow.

Dashed and rounded boxes indicate typical information being transferred.

NOTE IDM coordinates business, engineering, operation and maintenance.

Figure 2 – Positioning of IDM program

Figure 2 shows the positioning of IDM in the context of enterprise business management and IDM work processes. An IDM program translates objectives provided by higher levels of the organization such as business management processes into requirements of technology and resources then passes them to IDM work processes. Similarly, the IDM program translates performance history recorded by work processes into KPIs and passes them to higher or other levels of the organization.

Implementation methods for enterprise business management are non-technical and depend on each enterprise's operating practices. Many enterprise business management stakeholders can impact on the success of IDM. Most enterprise business management processes are created for larger purposes and are not structured to directly manage IDM. A technical and business focus for IDM and a mid-level management structure that can focus on IDM can provide valuable coordination between the IDM work processes and higher-level management.

IDM programs are implemented and supported via IDM work processes. The IDM program requires a well-defined functional structure, but the structure can be tailored to the enterprise's needs.

5.2.2 Structure of IDM activities

IDM programs contain multiple work processes that contain or utilize procedures and tasks. This structure is illustrated in Figure 3 below.

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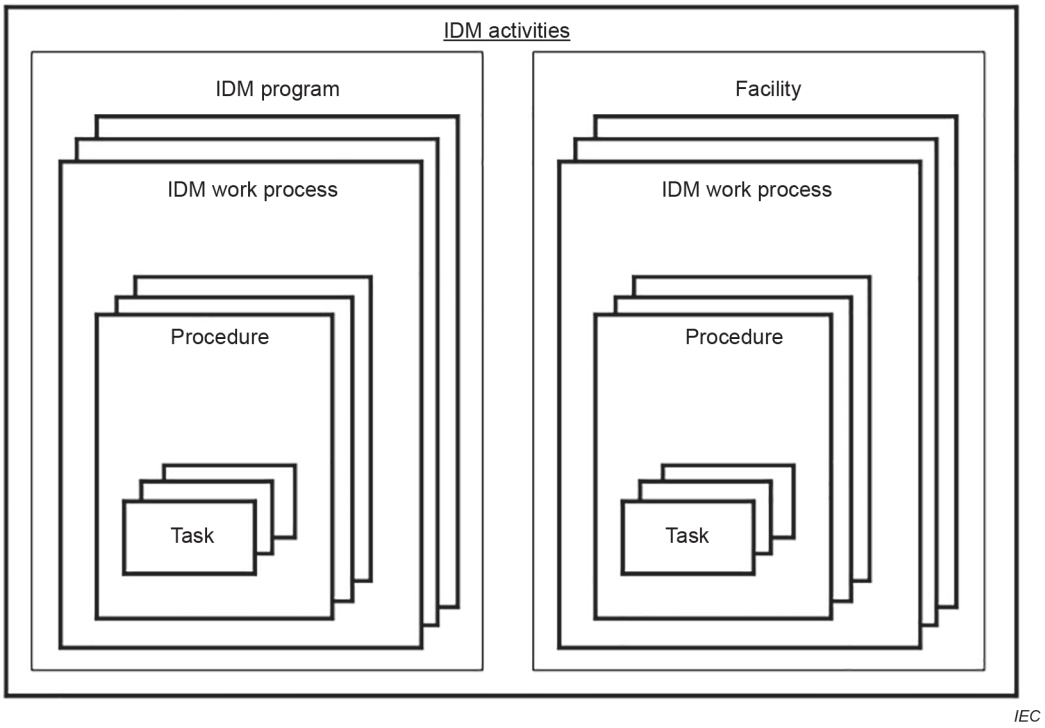

Figure 3 – Structure of IDM activities

5.3 Relationship between IDM program and work processes

IDM contains a large number of activities at several organizational levels and possibly in several internal business units in an enterprise. The activities can be done in house or by contractors. The activities are expected to be performed over several decades of a facility's lifecycle. Documentation explaining how activities fit together and how they are performed should be prepared to coordinate all of these activities by multiple parties over long periods of time.

The following provides a brief outline of an IDM document structure:

- IDM policy;
- IDM risk assessment report;
- IDM objectives including ensuring that intelligent devices are:
  - selected correctly,
  - installed correctly,
  - configured correctly,
  - monitored continuously,
  - tested periodically,
  - maintained at required performance and reliability levels,
  - replaced quickly when they fail,
  - maintained and used by personnel who are trained appropriately,
  - maintained and used with procedures that are properly developed, maintained, and continuously improved,
- IDM program.

Figure 4 depicts an overview of the relationship between the IDM program and work processes. Refer to Annex C which further summarizes IDM objectives and associated work processes.

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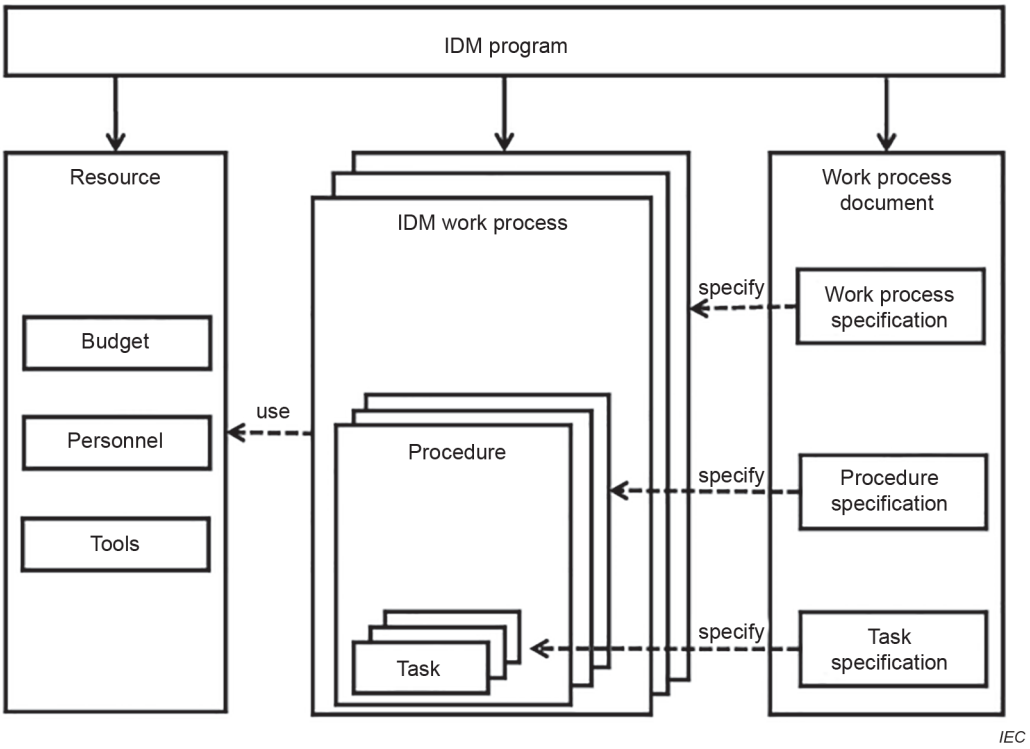

Figure 4 – Structure of IDM program

Since IDM is a part of asset management, the IDM policy is consistent with the asset management policy of the enterprise. The IDM policy is established by the leadership of top management based on the organizational context.

The IDM objectives for each level of the enterprise are developed based on the IDM policy and IDM risk assessment report. The objective of IDM is set appropriately considering the objectives of other management systems. Each IDM objective is translated into the IDM program.

The IDM documents are planned, implemented, and improved by an appropriate document management process.

Table 1 provides an overview of IDM program documents and contents.

Table 1 – IDM documents

IDM document	Description	Contents
IDM policy	Intentions and direction of an enterprise for IDM based on its context as formally expressed by its top management	Scope of IDM Framework for setting IDM objectives Commitment to satisfy IDM requirements Commitment to continual improvement of IDM
IDM risk assessment report	Result of systematic use of available information to identify hazards and to estimate the assessed risk	Potential consequence of failure of the assets Hazards, harms, harmful events Result of device failure analysis

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IDM document	Description	Contents
IDM objective	Specific target for an activity of IDM	KPI of IDM and its target Assets covered by the IDM Performance objectives for the assets Strategic plan
IDM program	Set of interrelated or interacting work processes for achieving a particular objective defined by intelligent device management	Resource assignment Work process specifications Procedure specifications Task specifications

5.4 IDM programs

5.4.1 Overview

The IDM program specifies activities to realize the objective. An IDM program is developed for each enterprise based on its IDM policy and IDM objective(s) taking into account its individual organizational context.

IDM programs require:

- balancing multiple and sometimes conflicting goals;
- direct involvement of managers;
- support from technical and maintenance personnel.

An IDM program ensures budget, technical tools, and skills are supplied, and ensures accountability based on quantitative metrics. IDM programs coordinate multiple lifecycles and multiple work processes.

5.4.2 Relational structure of IDM program documents

The IDM program is documented by:

- IDM role assignment;
- work process specifications;
- procedure specifications;
- task specifications.

The IDM role assignment includes organizational roles, responsibilities and authorities specified in ISO 55001:2014, 5.3.

A role that is often utilized for achieving success in an IDM program is a technical, maintenance, and/or business lead that can lead technical efforts and bridge the gap between technical and management functions. This leadership role is a very useful organizational feature for IDM and can be key for successful implementation of this initiative.

A work process specification specifies an IDM work process.

A procedure specification specifies a procedure, which is a part of an IDM work process.

A task specification specifies a task, which is a part of a procedure. A same task can be utilized by different procedures.

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NOTE Since specifications of work processes, procedures and tasks are specific to the particular models of equipment, IEC 63082 (all parts) does not intend to specify those particular procedures but it intends to specify generic methodology to specify procedures for intelligent device management.

Figure 5 shows the structure of an IDM program for an enterprise.

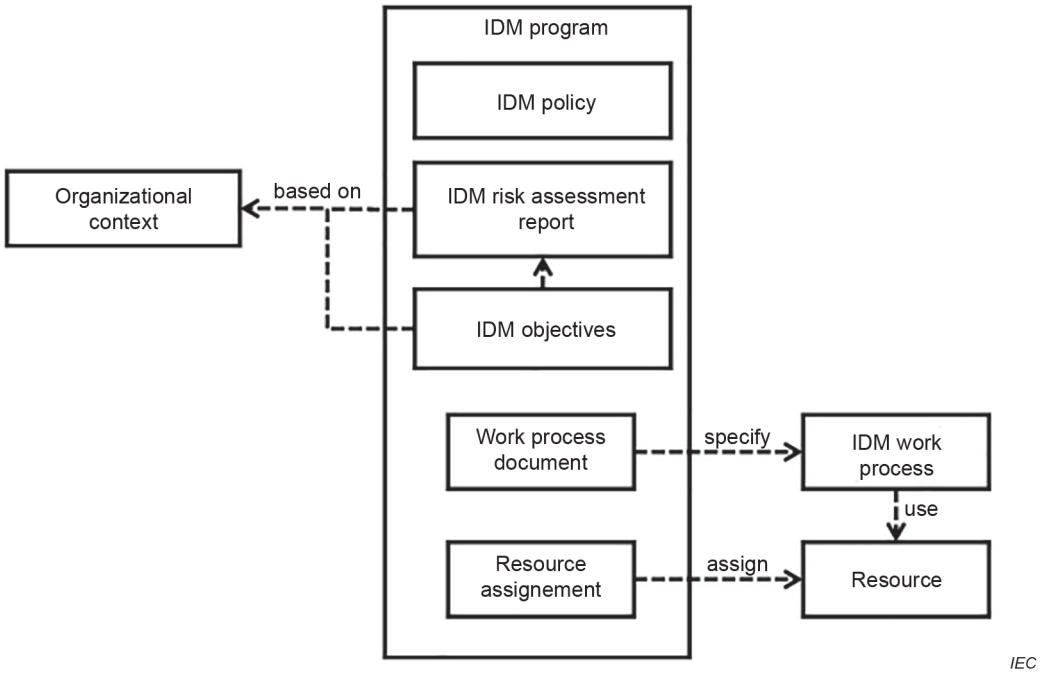

Figure 5 – Structure of IDM program for an enterprise

5.5 IDM work processes

5.5.1 Overview

IDM work processes are technical in nature and are generally directed toward managing or performing a single goal. An IDM work process coordinates procedures of multiple groups of personnel for related activities. An IDM work process is basically expected within a phase of the facility lifecycle.

5.5.2 IDM work processes specification

Every significant IDM work process in every lifecycle phase is specified by an IDM work process specification.

Figure 6 shows the structure of an IDM work process. It includes the following elements:

- work process owner;
- objectives;
- outputs of the work process;
- inputs of the work process;
- start timing;
- procedures;
- interactions among procedures.

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