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TECHNICAL SPECIFICATION

colour inside

Supplementary requirements for intelligent assemblies

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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SUPPLEMENTARY REQUIREMENTS FOR INTELLIGENT ASSEMBLIES

FOREWORD

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IEC TS 63290 has been prepared by subcommittee 121B: Low-voltage switchgear and controlgear assemblies, of IEC technical committee 121: Switchgear and controlgear and their assemblies for low voltage. It is a Technical Specification.

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

Draft	Report on voting
121B/202/DTS	121B/203/RVDTS

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

The language used for the development of this Technical Specification is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

This document references IEC 61439-1. The provisions of the general rules dealt with in IEC 61439-1 are only applicable to this document insofar as they are specifically cited.

The reader's attention is drawn to the fact that Annex J lists all of the "in-some-country" clauses on differing practices of a less permanent nature relating to the subject of this document.A list of all parts of the IEC 61439 series, under the general title *Low-voltage switchgear and controlgear assemblies*, 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 webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

IMPORTANT – The "colour inside" logo on the cover page of this document 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 drive for sustainability is prompting significant changes to the role of low-voltage switchgear and controlgear assemblies. Rather than being a manually and locally operated type of equipment, increasingly they are at the centre of an automated energy management system requiring intelligence and communications within/out of the assemblies. These functions are in addition to the conventional electromechanical features of assemblies and require supplementary considerations. Low-voltage assemblies are evolving from electromechanical constructions to assemblies including a multitude of digital functions. The low-voltage assemblies can provide the intelligence to manage different functions, for example, remote monitoring, remote control, local intelligence, or interaction with other systems, to bring a well-adapted solution to the customer.

This document gives the requirements for intelligent assemblies to enable it to form an integral part of a connected network (see Figure 1).

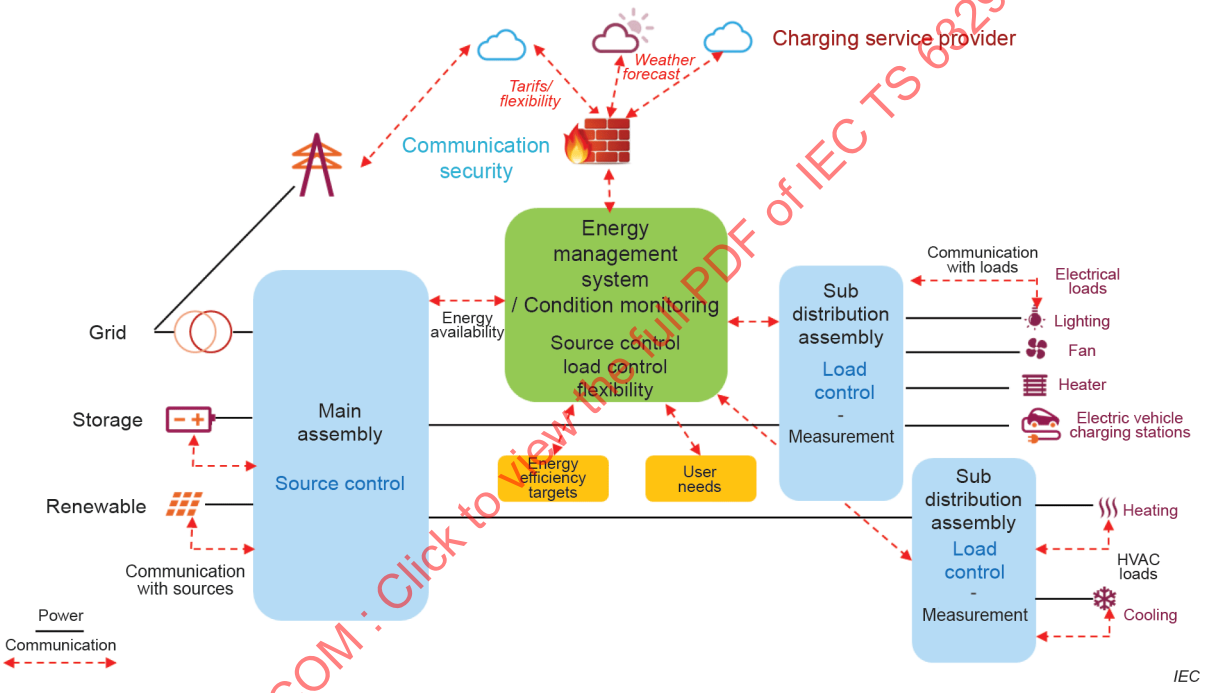


Figure 1 – Example of a connected environment

SUPPLEMENTARY REQUIREMENTS FOR INTELLIGENT ASSEMBLIES

1 Scope

This document provides additional requirements for assemblies in accordance with the product standards of the IEC 61439 series (Part 2 onwards) that incorporate digital functions and communication, in addition to the conventional electromechanical features of assemblies to reflect what is defined within this document as intelligence. It specifies the definitions, service conditions, constructional requirements, technical characteristics and verification requirements that can be carried out in addition to the IEC 61439 series for intelligent low-voltage switchgear and controlgear assemblies.

NOTE Throughout this document, the term assembly is used for low-voltage switchgear and controlgear assembly.

Intelligence within an assembly takes many forms and ranges from the measurement of electrical values with analysis to full automation and monitoring for process, energy management, condition monitoring, etc.

This document is applicable to intelligent assemblies for which the rated voltage does not exceed 1 000 V AC or 1 500 V DC; and designed for a nominal frequency of the incoming supply or supplies not exceeding 1 000 Hz.

This document does not apply to electrical equipment of machines (which is covered by the IEC 60204 series), and also does not apply to electrical equipment for measurement, control, and laboratory use (which is covered by the IEC 61010-2 series).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60255 (all parts), *Measuring relays and protection equipment*

IEC 60364-8-1:2019, *Low-voltage electrical installations – Part 8-1: Functional aspects – Energy efficiency*

IEC 60664-1, *Insulation coordination for equipment within low-voltage supply systems – Part 1: Principles, requirements and tests*

IEC 60947 (all parts), *Low-voltage switchgear and controlgear*

IEC 61010 (all parts), *Safety requirements for electrical equipment for measurement, control and laboratory use*

IEC 61140, *Protection against electric shock – Common aspects for installation and equipment*

IEC 61158 (all parts), *Industrial communication networks – Fieldbus specifications*

IEC 61439 (all parts), *Low-voltage switchgear and controlgear assemblies*

IEC 61439-1:2020, *Low-voltage switchgear and controlgear assemblies – Part 1: General rules*

IEC 61557-12, *Electrical safety in low voltage distribution systems up to 1 000 V AC and 1 500 V DC – Equipment for testing, measuring or monitoring of protective measures – Part 12: Power metering and monitoring devices (PMD)*

IEC 61643-12, *Low-voltage surge protective devices – Part 12: Surge protective devices connected to low-voltage power systems – Selection and application principles*

IEC 61784 (all parts), *Industrial communication networks – Profiles*

IEC 62052 (all parts), *Electricity metering equipment – General requirements, tests and test conditions*

IEC 62053 (all parts), *Electricity metering equipment – Particular requirements*

IEC 62591, *Industrial networks – Wireless communication network and communication profiles – WirelessHART™*

IEC 62601, *Industrial networks – Wireless communication network and communication profiles – WIA-PA*

IEC 62734, *Industrial networks – Wireless communication network and communication profiles – ISA 100.11a*

IEC 62948, *Industrial networks – Wireless communication network and communication profiles – WIA-FA*

IEC TS 63208:2020, *Low-voltage switchgear and controlgear – Security aspects*

IEEE 802.3, *Ethernet LAN*

IEEE 802.11, *Wireless LAN*

IEEE 802.15, *Personal Area Network*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61439-1 and the following apply.

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

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

3.1
intelligent assembly
assembly which includes functions for either operation or maintenance, or both, for the full life cycle of the system by using sensor technology, digital technology, network technology, communication technology or artificial intelligence technology

Note 1 to entry: Intelligent assemblies realise some or all their functions of either local or remote measurement, or both, provision of information, control, adjustment. The following list gives some examples to be considered:

– Supply and load management for system optimisation.
– Remote load management.
– Either local or remote status indication, or both, including, as appropriate, alarms to indicate overheating, overcurrent, earth leakage, etc.
– Intelligent analysis and storage of faults and other statistics.
– Stable communication and secure data through open communication protocols.
– Either remotely or locally managed protection functions, or both.
– Video monitoring of parts or all of the assemblies running state.
– Monitoring of the intelligent assembly's installation conditions, e.g. ambient temperature, humidity.
– Condition monitoring to enable condition based and preventive maintenance.
– Details of components included in the intelligent assembly, e.g. brand, either type or reference, or both, characteristics, manufacturing date, serial number, firmware revision and date.

3.2
gateway
functional unit that connects two networks with different network architectures and protocols

Note 1 to entry: The networks may be local area networks, wide area networks or other types of networks.

Note 2 to entry: Examples of gateways are a LAN gateway, a mail gateway.

[SOURCE: IEC 60050-732:2010, 732-01-17, modified – Deleted the word "computer" from the definition and Note 1 to entry.]

3.3
fieldbus
communication system based on serial data transfer and used in industrial automation or process control applications

[SOURCE: IEC 61784-3:2021, 3.1.20]

3.4
industrial Ethernet
area and cell networks based on IEEE 802.3 (Ethernet) prepared for the use of industrial environment

3.5
remote monitoring
continuing procedure for the collection and assessment of pertinent information, including measurements, at a point distant from the controlled switching device, assembly or installation

3.6
remote control
control of an operation at a point distant from the controlled switching device, assembly or installation

[SOURCE: IEC 60050-441:1984, 441-16-07, modified – added: assembly or installation.]

3.7
remote adjustment
adjust parameters remotely by communication

3.8
intelligent device
device where some or all of its operating parameters are either measured or controlled, or both, via digital means

3.9
interface
shared boundary between two functional units, defined by functional characteristics, signal characteristics, or other characteristics as appropriate

Note 1 to entry: The concept of interface includes the specification of the connection of two devices having different functions.

Note 2 to entry: The IEC 61439 series uses the term functional unit in a different meaning.

[SOURCE: IEC 60050-171:2019, 171-01-24]

3.10
electrical energy management system
EEMS
system operating and controlling energy resources and loads of the installations

[SOURCE: IEC 60050-826:2022, 826-19-04]

3.11
smart grid
intelligent 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,
– to efficiently deliver sustainable, economic and secure electricity supplies

[SOURCE: IEC 60050-617:2009, 617-04-13]

3.12
condition monitoring
obtaining information about physical state or operational parameters

Note 1 to entry: Condition monitoring is used to determine when preventive maintenance may be required.

Note 2 to entry: Condition monitoring may be conducted automatically during operation or at planned intervals.

Note 3 to entry: Condition monitoring methods include: vibration analysis, tribology and thermography.

[SOURCE: IEC 60050-192:2015, 192-06-28]

3.13
power metering and monitoring device
PMD
combination in one or more devices of several functional modules dedicated to metering and monitoring electrical parameters in energy distribution systems or electrical installations, used for applications such as energy efficiency, power monitoring and network performance

Note 1 to entry: Under the generic term "monitoring" are also included functions of recording, alarm management, etc.

Note 2 to entry: These devices may include demand side quality functions for monitoring inside commercial/industrial installations.

[SOURCE: IEC 61557-12:2018, 3.1.1]

4 Symbols and abbreviated terms

Clause 4 of the appropriate part of the IEC 61439 series (Part 1 onwards) is applicable, in addition to the following.

Addition:

- EEMS electrical energy management system
- PMD power metering and monitoring device

5 Interface characteristics

Clause 5 of the appropriate part of the IEC 61439 series (Part 1 onwards) is applicable, in addition to the following.

Addition:

The interface characteristics of intelligent assembly may include the following, for more details see Clause 9:

- Communication protocols,
- Media type,
- Communication characteristics (bandwidth, etc.).

6 Information

Clause 6 of the appropriate part of the IEC 61439 series (Part 1 onwards) is applicable, in addition to the following.

6.1 Assembly designation marking

In addition to the marking required by the appropriate part of the IEC 61439 series, the following may be provided:

aa) IEC TS 63290.

6.2.2 Instructions for handling, installation, operation and maintenance

Addition:

If the assembly manufacturer has done relevant changes in software or communication parameters, where applicable, they shall provide all relevant information. The following information including version and cybersecurity related information shall be taken into account:

– type of bus interface;
– measurement functions;
– control function;
– software release;
– communication protocols.

If the assembly manufacturer has not done relevant changes in software or communication parameters, they shall provide available information by the device manufacturer(s) for the intelligent components used in the assembly.

NOTE 1 An example for documentation is included in the informative Annex E of this document.

Appropriate access control for either read or write, or both, shall be in place.

NOTE 2 An example for documentation is included in the informative Annex F of this document.

Caution information shall be added in the documentation to inform the user of the assembly to assess the appropriate security level and take appropriate actions in according to IEC TS 63208.

NOTE 3 The following text gives an example to the caution information:

The user of the assembly shall make a risk assessment in respect of the appropriate security level for data used in this assembly. Then a protection scheme appropriate to the risk of the data shall be implemented by the user of the assembly. IEC TS 63208 gives guidance to the risk assessment.

The documentation shall include warnings to alert the user in respect of critical modifications like updates of software or firmware, change of parameter settings especially in case of protection devices.

NOTE 4 The following text gives an example to the warning.

Implement updates of the software per instructions of the device manufacture. Ensure a procedure to verify for available updates, especially security patches, is put in place by the user.

Change of parameter of protection devices can have an impact to the safety of users and the system itself or allow other to make unauthorized modifications.

7 Service conditions

Clause 7 of the appropriate part of the IEC 61439 series (Part 1 onwards) is applicable.

8 Intelligent assembly profile

8.1 General

Intelligent assemblies are generally designed to achieve one of three profiles, see Figure 2:

– measurement, see Figure 2a;
– control, see Figure 2b;
– management, see Figure 2c.

Examples of connected buildings with intelligent assemblies are shown in Annex G.

8.2 Intelligent assembly for measurement

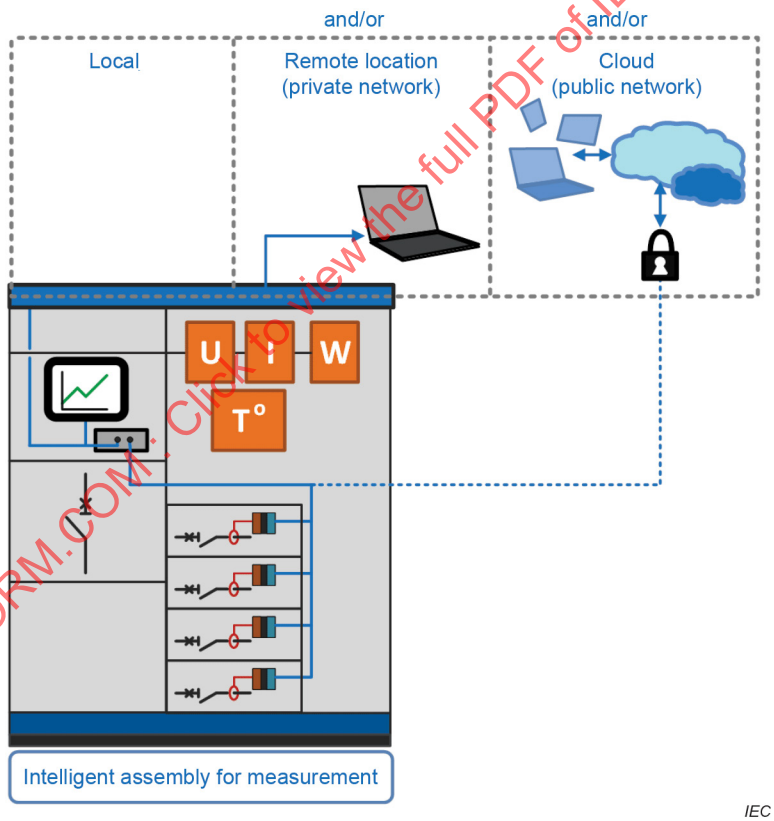
An intelligent assembly for measurement is an assembly incorporating low-voltage switchgear and controlgear devices and intelligent devices for the purpose to provide electrical measurements with or without communication. The requirements of these intelligent assembly for measurement are described in 9.2.2.

8.3 Intelligent assembly for control

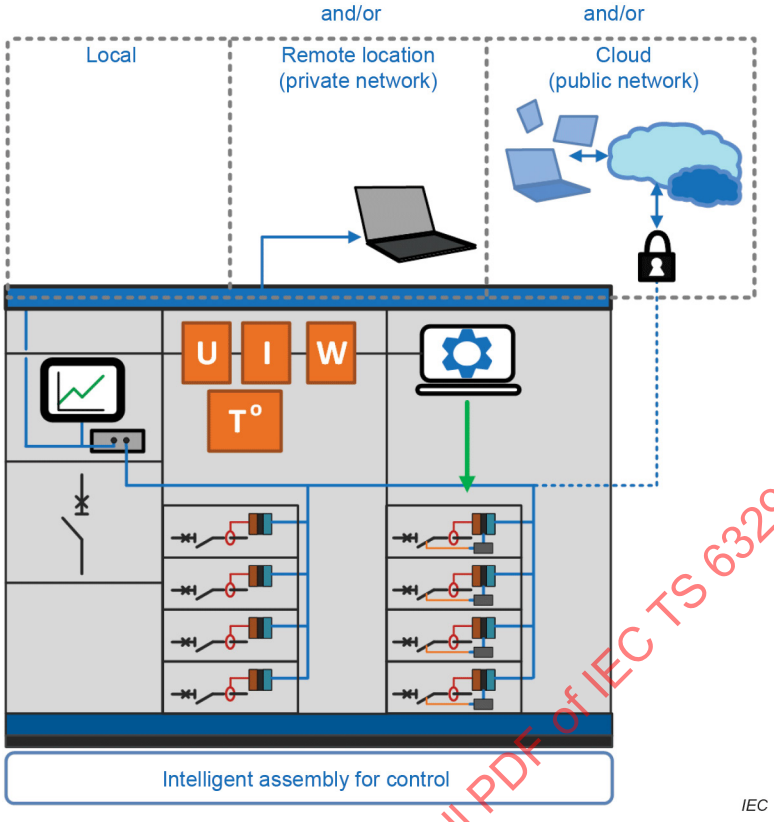
An intelligent assembly for control is an assembly incorporating intelligent devices and electrical control systems for predefined operations based on measurements performed either locally or remotely. The requirements of these intelligent assembly for control are described in 9.2.3.

8.4 Intelligent assembly for management

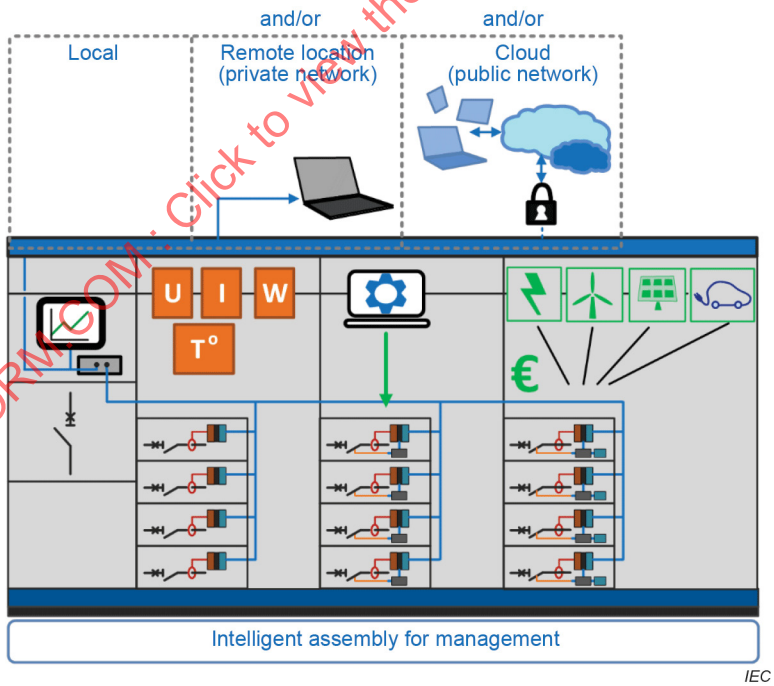
An intelligent assembly for management is an assembly, or is a part of the system, incorporating the necessary interfaces and computing resources either to manage locally or to communicate with a remote intelligent system. The requirements of these intelligent assembly for management are described in 9.2.4.



a) Intelligent assembly for measurement



b) **Intelligent assembly for control**



c) **Intelligent assembly for management**

Figure 2 – Intelligent assembly profile

9 Constructional requirements

Clause 8 of the appropriate part of the IEC 61439 series (Part 1 onwards) is applicable, in addition to the following.

Addition:

9.1 Constructional requirements of intelligent assembly

9.1.1 General rules

Intelligent assemblies shall satisfy the structural and electrical performance requirements as defined in the applicable part of the IEC 61439 series of standards taking into account the multiple interactions that can be generated between electrical power, distribution and digital equipment. Automation system installation and adjustment, dependability of operation shall be considered. The space between parts of the fieldbus communication and parts of the main circuit(s) shall also be considered.

9.1.2 Cable compartment

An intelligent assembly should have an auxiliary cable compartment or an independent space in the cable compartment to lay all types of control cables and if necessary, a tunnel for communication cables, in order to meet the EMC requirements specified in 9.4 of IEC 61439-1:2020. If applicable, an auxiliary cable compartment should have space for installing communication connectors, connector terminals, power modules, etc. Communication cables, should be laid separate from other control signal cables if required i.e. the use of screened wire type. For more information about measures to reduce the effects of electromagnetic influences, see Annex C.

A specific compartment should be considered for control devices such as, PLCs, switch mode power supplies, etc, considering dedicated requirements stated by the standard product or manufacturer's instructions, where applicable.

9.2 Functional requirements

9.2.1 General

To be declared as an intelligent assembly, it shall include the different functions given in 9.2.2 to 9.2.4 according to the selected profile.

The overall accuracy of active energy measurement shall comply with Table 2 of IEC 60364-8-1:2019.

Any local protection functions (e.g. short circuit protection, overload protection, residual current protection) shall be independent of, and take precedence over, any remote control functions.

9.2.2 Intelligent assembly for measurement

An intelligent assembly for measurement shall include the following minimum parameters:

- Measure the energy on a sufficient number of circuits to enable the energy used to be known and analysed
  - Ea – active energy
  - Er – reactive energy

- Measure electrical characteristics
  - Either U – line-to-line voltage or V – line to neutral voltage, or both
  - I – current
  - P – active power
  - Q – reactive power
  - S – apparent power
  - f – frequency
  - PF – power factor.

The intelligent assembly shall provide and can be able to record the electrical values above.

Additional parameters can be added as required:

- Measurement of information from devices (operating time, number operation, temperature, humidity, etc.).

9.2.3 Intelligent assembly for control

An intelligent assembly for control shall include one or more of the following functions:

- Predefined automatism to ensure power availability (for example, load shedding, back-up, transfer switch, etc.);
- Protection setting adjustment according to sources electrical characteristics;
- Operation control.

The intelligent assembly shall provide, and can be able to record, control activities and events, e.g. fault.

Examples for possible control functions to be incorporated:

a) Main incoming circuit: switch on/switch off of the device;
b) Outgoing circuit: switch on/switch off of the device;
c) Motor control circuit: start/stop operation of motor;
d) Fault management;
e) Load management.

9.2.4 Intelligent assembly for management

An intelligent assembly for management shall include one or more of the following functions:

- Management of the interaction with the supply network
  - Grid connection;
  - Island mode;
  - Stand-alone mode.
- Energy consumption optimization
- Multiple sources management
- Cost optimisation based on tariff
- Demand response management system. For example, this could be a Distributed Energy Resources Management System (DERMS).

Provide relevant information on the system, for example:

a) Communication status (Active/Inactive), device status (On/Off/Trip), alarm/fault status;
b) Operation times/running time of motor circuit, temperature, humidity and other data;
c) The requesting, recording and reporting of the information required by the user;
d) Power energy management, power quality and load analysis.

Intelligent assemblies may incorporate remote adjustment functions. Only an authorized person(s) are allowed to adjust settings according to the calculation results of the supply network, characteristic curves and control rights remotely through a host computer or by dedicated applications. For example, set parameters of a circuit-breaker. Such changes should be stored in a traceable way.

Further, the remote operation shall consider dedicated requirements already stated by the product standard or manufacturer's instructions, where applicable.

WARNING – Remote adjustment is only possible if settings are verified by authorized person(s).

9.2.5 Communication modes

9.2.5.1 General

The intelligent assembly can operate in one or more of three communication modes, L – local, R – remote location and C – cloud. Each of these communication modes implies different requirements in terms of security protection see IEC TS 63208.

9.2.5.2 L – local

An intelligent assembly L shall display locally the electrical measurements and status of actions operated by the control or management system of the assembly.

9.2.5.3 R – remote location

An intelligent assembly R shall be able to remotely communicate the electrical measurements and status of actions operated by the control or management system with the other parts of a private network located in one or several sites, designed as an intranet network.

9.2.5.4 C – cloud

An intelligent assembly C shall be able to communicate the electrical measurements and status of actions operated by the control or management system with the other parts of a public network, designed as an internet network.

9.3 System requirements

9.3.1 General rules

The assemblies which form a part of the overall system shall be designed according to the rules provided by the original manufacturer and those given in this document. For wired communication, each intelligent assembly shall have one or more communication connection ports.

All fieldbus connectors shall be suitable for the selected baud rates.

The intelligent assemblies may use communication by different mediums and protocols, not limited to existing technology, such as:

– Wired mode (by twisted pair or optical fibre)
  - fieldbus in accordance with the IEC 61158 series and the IEC 61784 series;
  - industrial Ethernet in accordance with the IEC 61158 series and the IEC 61784 series.
– Wireless mode
  - wireless fieldbus in accordance with IEC 62591, IEC 62601, IEC 62734, IEC 62948;
  - Wi-Fi in accordance with IEEE 802.11;
  - ZigBee in accordance with IEEE 802.15;
  - Cellular networks (3G, 4G, 5G).

NOTE Due to the fast evolution of radiocommunication technology, see IEC 63404 which proposes a method updating the radiocommunication devices.

For more information about communication network media and protocols, see Annex D.

9.3.2 Selection of components

9.3.2.1 General rules

The selected components shall meet the functional requirements of the system, and the appropriate standards, e.g. switching devices selected in accordance with the IEC 60947 series. A circuit-breaker with a trip unit having a communication interface can be selected in accordance with IEC 60947-2. When the circuit-breaker trip unit does not include communication, an additional module with communication can be installed to monitor either the circuit or the circuit-breaker, or both.

Devices with communication interfaces require due care in respect of cybersecurity. With input from the user or specifier, a risk assessment according to 6.2 of IEC TS 63208:2020 shall be performed. Devices shall be selected to meet the resulted risk profile (result obtained from risk assessment). If the devices do not meet the appropriate risk profiles, the requirements in 7.3 and Clause 9 of IEC TS 63208:2020 shall be used.

Devices often use different protocols. Where possible, it is recommended that devices using the same protocols are selected to facilitate the communication.

9.3.2.2 Selection of component for measurement

The voltage measuring components shall be selected in accordance with the overvoltage category following their position in the electrical installation.

Surge protective devices (SPDs) shall be installed as per the device manufacturer's instructions, at the incoming supply if the overvoltage category of the voltage inputs of the used devices does not reach or exceed the overvoltage level of the grid may provide where the intelligent assembly will be installed.

The rating of the surge protective devices shall be selected according to IEC 61643-12 to ensure that the attenuation of the transient overvoltage will be reduced to a level the measuring devices are able to withstand.

For billing purposes, the assembly manufacturer shall select the measuring devices in accordance with local legal requirements based on the specifiers information.

Applicable standards for some measuring devices are as follows:

– Power metering and monitoring devices shall be in accordance with IEC 61557-12 and the IEC 62053 series;
– Energy meters shall be in accordance with the IEC 62052 series and the IEC 62053 series;
– Multi-meters shall be in accordance with IEC 61010 series;
– Protection devices or relays which are used to generate measurement values shall be in accordance with the appropriate product standards i.e. the IEC 60947 series and the IEC 60255 series.

9.3.2.3 Circuit with high availability

Depending on the required availability of the circuits connected to the intelligent assembly, the type of current measurement, direct or semi-indirect shall be considered, in particular for calibration purposes of the measurement device.

When high availability of circuits is required, solutions such as withdrawable units or components (e.g. current transformer operated meters which will allow easy calibration) should be used accordingly.

9.3.3 Installation of devices with communication interface

Devices with communication interface shall be installed and wired in the intelligent assembly in accordance with instructions provided by their manufacturers, conforming with product standards requirements, where available, and in such a manner that their correct functioning is not impaired by interaction, such as switching of protection or control devices in the intelligent assembly, or electromagnetic fields which are present in normal operation.

In particular, care shall be taken in selecting the type of wire used in order to achieve the required performance and the placement of any termination resistors.

9.3.4 System configuration

For typical configurations of intelligent assemblies, refer to Annex A.

A system may have a human-machine interface (HMI), so that operators can achieve the functions required in 9.2 via the HMI.

If there are soft starters, speed regulating devices and other drive equipment installed within an intelligent assembly, these can be controlled by using a communication system. The selected bus in the system shall be compatible with the requirements of drive equipment.

When a system requires multiple remote relay interlocks and controls, the selected distribution of I/O's shall be compatible with the fieldbus or use the same bus system.

For cloud communication, a communication gateway may be used, with consideration for cybersecurity aspects according to IEC TS 63208.

9.3.5 System software

The system configuration may use software, e.g. system parameter software, configuration software, monitoring software. Typical software should be able to support the following:

a) Bus unit address;
b) Set transmission rate;
c) System configuration;
d) Mobile device application (APP).

9.3.6 Control power supply for intelligent devices

Measures shall be taken to ensure the capability (e.g. autonomy, current rating) and availability of the control power supply required by the network communication system considering the application requirements.

The control power supply can be supplied directly from a busbar system of the intelligent assembly. Accordingly, the power supply shall be selected in accordance with the overvoltage category according to their connection in the electrical installation. See IEC 60664-1. The rated impulse withstand voltage of all directly supplied devices shall meet the rated impulse withstand voltage of the assembly.

Some electronic devices are very sensitive to overvoltages. The installation of surge protective devices will attenuate the transient overvoltages to a level the electronic devices are able to withstand.

The installation of the SPD shall respect the instructions of the SPD manufacturer, for example, type of SPD, coordination between SPDs, protection of SPD, the total length of conductors between the terminals of the SPD to the line and earth, as applicable.

9.3.7 Interfaces

9.3.7.1 Interface to EEMS

The intelligent assembly can be interfaced to an EEMS to satisfy the requirements specified in IEC 60364-8-1.

9.3.7.2 Interface to sub-distribution assembly

The intelligent assembly can be interfaced to an intelligent sub-distribution assembly to collect additional data or to give information about the actual state (e.g. power available, source used).

9.3.7.3 Interface to smart grid

In order to interact with a smart grid the intelligent assembly communication system shall be compatible with that of the smart grid. When required, the intelligent assembly can be arranged to respond to under/over frequency, connect reactive power, etc.

9.3.8 Reliability and response time for control functions

The requirement for reliability and response time shall be in accordance with the relevant specification for the protocol being used, for example IEC 61784.

9.3.9 Network and system security

The intelligent assembly shall comply with the network and system security requirements and security levels specified in IEC TS 63208.

As for the user of the intelligent assembly, it is necessary to perform a risk assessment based on IEC TS 63208 to specify the control system exposure level (E1 – E5). The result of this assessment should be the basis for the selection of the relevant devices and the communication structure to support the defined level.

The components with their communication interfaces including their applicable countermeasures should be selected in accordance with the defined control system exposure level (ELx) as specified in IEC TS 63208.

9.4 Assembly and wiring

9.4.1 General

The intelligent assembly shall comply with special installation specifications and relevant safety guidelines provided by fieldbus equipment suppliers or other digital control equipment suppliers.

9.4.2 Arrangement of components

The arrangement of components of main circuits and electronic components in the intelligent assemblies shall meet the EMC requirements specified in J.9.4 of IEC 61439-1:2020. The clearance and creepage distances between electronic components and power components shall be in accordance with the requirements in IEC 61439-1.

9.4.3 Wiring rules

9.4.3.1 Wiring inside the low-voltage assembly

If system data is transmitted over a communication cable, the cable and its connection shall comply with relevant requirements of communication network profiles. Communication cable construction may consist of a screen layer for protection against adverse electromagnetic disturbance.

The position of any communication cable, control cable and power cable or busbar within the assembly shall meet the EMC requirements specified in J.9.4 of IEC 61439-1:2020. Examples of mitigation measures to reduce the EMC risks are described in Annex B.

9.4.3.2 Screening and earthing

If there is anticipated critical interference in the service conditions, which can jeopardize the quality of the communication in the copper wired network, suitable precautions shall be taken and the use of optical fibres is recommended.

The screen layer of the communication cable shall be earthed at one or both ends of the cable. It depends on the frequency of the interference such that the low-frequency interference is only connected once to prevent loops and high-frequency interference is connected at both ends.

In assemblies, the cable screen layer shall be connected to communication network equipment according to the requirements of device manufacturer or protocol standard and connected to earth conductor or rail in accordance with IEC 61140.

Screened communication cables shall be connected with 360° connection clamp to ensure an effective conduction and low impedance at high frequencies (see examples in B.3.3).

Electromagnetic Interference (EMI) shall meet the EMC requirements (according to IEC 61439-1) to not to influence the bus components.

9.4.3.3 Repeater or gateway

Depending on the selected communication method, the use of appropriate repeaters or gateways shall be considered. Repeater(s) or gateway(s) shall be in conformance with the specifications of the device manufacturer and intended environment.

10 Design considerations

10.1 General

The original manufacturer of the intelligent assembly shall provide installation rules for the integration of electronic devices inside the intelligent assembly, according to the following criteria and the indications given in the following subclauses:

- The internal air temperature mapping or equivalent (see 10.2);
- The EMC sensitive areas (e.g. proximity to high current conductors) (see 10.3.2);
- The functional unit compartment dimensions and position (see 10.3.3);
- The wiring rules (see 9.4 and Annex B for details).

An intelligent assembly compliant to the IEC 61439 series (Part 2 onwards), manufactured according to the above criteria and the indications given in the following subclauses is deemed to be compliant to the appropriate standard and to this document, not affecting the performances of the reference design.

NOTE See the IEC 61439 series for further requirements, e.g.:

– Distance to ground level;

– Mounting space for power cables;

– Protecting switchgear from conductive dust.

10.2 Incorporation of electronic devices, thermal aspects

It is possible that electronic devices do not support the high temperatures present in some areas of the assemblies which could lead to unexpected operation of the device, and accelerated ageing.

The original manufacturer shall provide guidelines for the installation of electronic devices based on temperature rise tests of the assembly in a typical configuration.

The selection of electronic devices to be installed within a section of the intelligent assembly shall be carried out according to the internal operating temperature including the impact of the electronic devices (e.g. by calculation or test). Such a selection is to be repeated for each sub-section or section depending on the installation of the electronic equipment.

A method to show the internal air temperature mapping (2D or 3D as available) is given in Annex H. Annex H provides examples of IEC 61439-2 configurations and temperature mappings.

10.3 Incorporation of electronic devices, EMC aspects

10.3.1 General

Electronic devices shall be selected with an appropriate emission and immunity level considering their location within the assembly. It is possible that electronic devices do not have the necessary EMC characteristics to prevent unexpected operation when they are, for example located close to busbars or disturbing sources.

In addition to the requirements in J 9.4.2 b) of IEC 61439-1:2020, the original manufacturer of the assembly shall define design guidelines about the location of electronic devices in the assembly in respect of EMC.

10.3.2 Device location considering EMC constraints

Power devices can generate EMC disturbances and busbars can propagate them, therefore the installation of sensitive components, such as communication devices, shall take into account the location of disturbance sources and the existence of metallic separations which can act as shielding for high frequency noise. Magnetic disturbances resulting from current lower than 250 A are negligible and can be disregarded.

NOTE Electric grounded sheet metal does not effectively protect against low frequent magnetic fields.

Some examples of EMC aspects are given in Annex I.

The location of electronic components is provided in Table I.1.

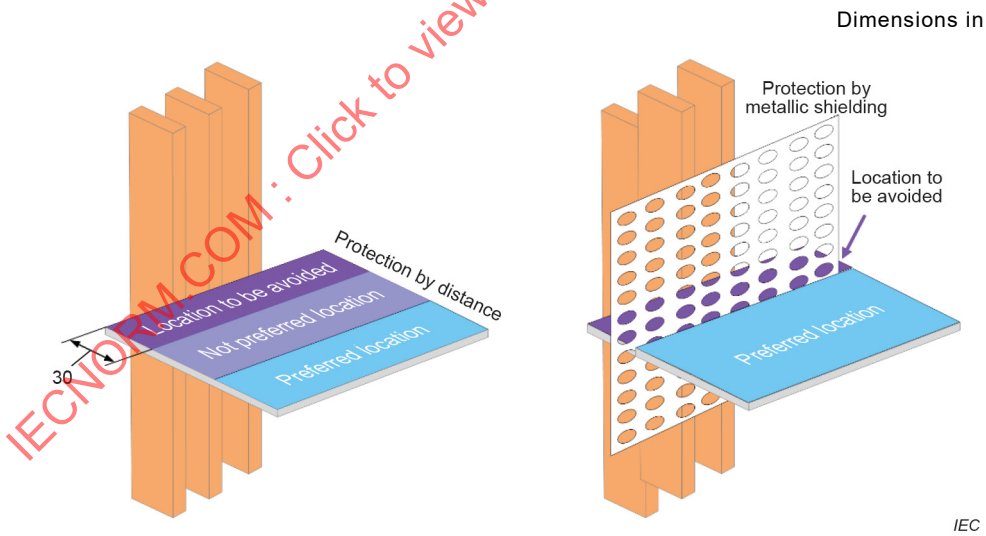
10.3.3 Recommended dimension of the functional unit compartment

The original manufacturer shall recommend adaptations to each functional unit used to integrate the different type of communication devices, e.g. the addition of a vertical metallic plate fixed on the horizontal barrier plate.

EMC affected area: due to the proximity with circuit-breakers, busbar and electronic devices the original manufacturer shall provide any useful information to install communication device(s) in a compatible area, for example: only the first half of the metallic plate is suitable for devices installation.

NOTE Not only devices carrying high currents can lead to interferences, but any other devices generating strong electromagnetic fields (e.g. coils) as well.

Other examples of locations in respect of EMC for a large assembly, see Figure 3.



NOTE The maximum dimension of the holes within the metallic shielding is determined by the maximum frequency of the disturbing source.

Figure 3 – Locations in respect of EMC for a large assembly

10.4 Integration of radio communication devices in an intelligent assembly

Radio communicating devices integration into assemblies shall be in accordance with IEC 63404:2024.

Where the considerations in IEC 63404 are exceeded, ensure coordination so that the operation of the assembly isn't adversely affected.

11 Design verification

Clause 10 of the appropriate part of the IEC 61439 series (Part 1 onwards) is applicable, in addition to the following.

Addition:

All devices including communicating devices should be suitable for the thermal stress at its location within the intelligent assembly.

12 Routine verification

Clause 11 of the appropriate part of the IEC 61439 series (Part 1 onwards) is applicable, in addition to the following.

Addition:

12.1 Construction

12.1.1 Assembly structure

Compliance with the design requirements of 9.1 for intelligent assembly structure shall be confirmed by the assembly manufacturer's inspection as applicable, based on the documentation provided by the original manufacturer.

12.1.2 System configuration

Compliance with the design requirements of 9.3 for system configuration shall be confirmed by the assembly manufacturer's inspection as applicable, based on the documentation by the original manufacturer. All the selected components, communication components in the system shall be reviewed to confirm conformance with the necessary EMC requirements.

12.2 Wiring, operational performance and function

Replacement of 11.10 in IEC 61439-1:2020:

It shall be verified that the information and markings specified in Clause 6 are complete.

The wiring need to be inspected and functional test need to be carried out. This shall include interlocks, sequence control facilities if provided.

According to the requirements of the system configuration, the components and communicating devices shall meet the requirements of selected communication method. The component installation, wiring inside the intelligent assembly, etc. shall meet the requirements of 9.4. For further details refer to Annex B.

It is recommended to test the equipment without load or with simulated load to verify that the electrical performance of the equipment and the functional requirements of 9.2 meet the specified requirements of the user, if available.

System function test shall confirm the correct operation of all equipment including the following, as applicable:

- Proper data communication of communicating devices, such as router, repeater, devices with integrated communication modules or any type of fieldbus module;
- Correct wired or wireless connections;

- Measuring devices provide appropriate signals;
- Verification of devices operation to command via control signals;
- Remote adjustment function correctly.

For additional routine test requirements on intelligent assembly, see Table 1.

Table 1 lists supplementary routine verifications based on the different clauses from the IEC 61439-1:2020. This supplementary list of routine verifications complements those in the relevant part of the IEC 61439 series and ensures reliability and compatibility between the different types of products installed in an intelligent assembly.

Table 1 – Supplementary routine verification list

N°	Characteristics	References IEC 61439-1:2020	Verification
1.	Internal electrical circuits and connections	11.6	The communication, signalling and Ethernet connections shall be checked on a random basis. Screwed connections shall be checked for the correct tightness. Plug connections shall be checked for correct and secure insertion.
2.	The incorporated devices and components are in compliance with the requirements for EMC for the stated environment	J.9.4.2 a)	Verify the EMC conformity
3.	The internal installation and wiring is carried out in accordance with the devices and components' manufacturer's instructions (arrangement with regard to mutual influences, cable, screening, earthing, etc.).	J.9.4.2 b)	Verification of technical documentation related to products installation criteria regards mutual influence, Verification of the internal installation and wiring is carried out in accordance with the devices and components manufacturer's instructions (arrangement with regard to mutual influences, cable, screening, earthing, etc.).
4.	Wiring, operational performance and function	11.10	Verification of the information and markings of assembly, including all products installed. Single line electrical diagram, functional verification test list, witness test specification, identification list of either products or components, or both, identification of each circuit and related protection (information from Clause 6 of IEC 61439-1:2020) The verification of the proper installation of all electronic components shall be done as verification by assessment based on the information given by the original manufacturer to the internal air temperatures and the maximum additional power loss and volume of this component and the technical parameters of the implemented components. Other types of verification are accepted.
5.	Effective functional earth continuity between communication devices and the earth reference	11.4	It shall be verified that the different communication devices of the assembly are effectively connected to the functional earthing reference point. The verification can be done by a connectivity test per 10.5.2 of IEC 61439-1:2020. A current level for this test is not defined.
6.	Installation of measurement devices close to (as shown in Figure 3 to be further improved) power conductors (busbars, cables, products, etc.).		Verification shall be made to ensure that measurement devices are not installed close to power conductors to avoid influencing their measurement values.
7.	Segregation between conductors.		Check that conductors for analog signals, communication buses (RS 232-422-485, CAN, Ethernet, etc.) are shielded and segregated from relays and power conductors.

In some cases, it can be necessary to make or repeat this test on site before putting the installation into operation.

Annex A
(informative)

System configuration

Figure A.1 provides an example of system configuration for intelligent assemblies. For further information see Annex J of IEC 61439-1:2020 and IEC TS 63208.

NOTE See IEC TR 63216 for additional information.

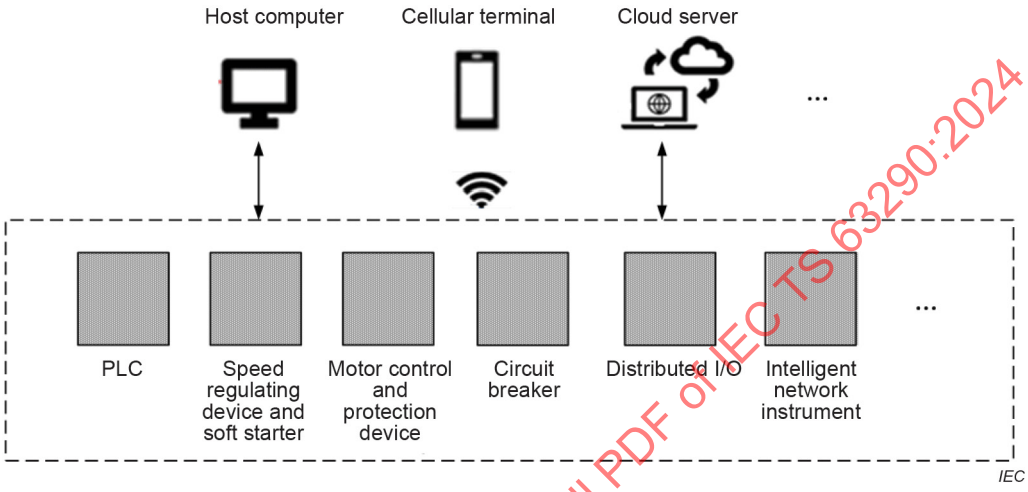


Figure A.1 – Example of system configuration

Annex B
(informative)

Installation and wiring rules

B.1 General rules for cabling

The aim of this annex is to provide a brief overview of the cabling rules that should be respected to avoid a reduction in robustness, performances, communication stability or cause a malfunction, not only at device level, but more significantly at the overall system level.

B.2 To segregate sensitive cables from power cables

Where EMC is likely to be an issue, for example, where high current circuits or power converters such as drives or switch mode power supplies are present, the evaluation based on IEC 60364-4-44, IEC 61000-6-1 or IEC 61000-6-2 or any relevant standard should be referenced to ensure the expected operational robustness of the intelligent assembly.

EMC separations as shown in Figure I.1 to I.3 and Figure 3 (e.g. distance, compartments with metal separations and cables shielding) are examples of the instructions that shall be provided by the original manufacturer.

It is important to remember that this segregation concerns:

Power circuits:

- Main power (e.g. 400 V AC);
- Auxiliary power (e.g. 24 V DC);
- Power outputs.

Sensitive circuits:

- Communication cables (whatever the protocol);
- Analog signal cables (0 to 10 V, 4 mA to 20 mA, etc.);
- Control cables.

Avoid routing cables from two of the above categories together.

To avoid disturbances, when power cables cross sensitive cables, respecting the right angle rule, ensuring the cables cross at right angles to each other.

In all the cases, clearances and creepage distances or relevant insulation shall be respected.

Figure B.1 sums up this fundamental rule.

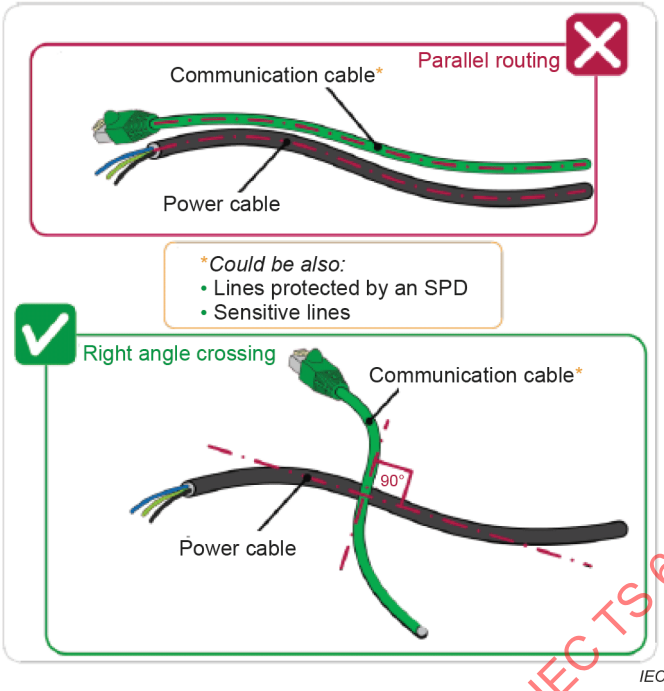


Figure B.1 – Rules for arrangement of communication cable and power cable

If it is necessary for sensitive signals and power cables to be routed side-by-side (lack of space), it is possible to use the metallic frame, enclosure and internal separation plates of an assembly providing shielding between both, as shown in Figure B.2.

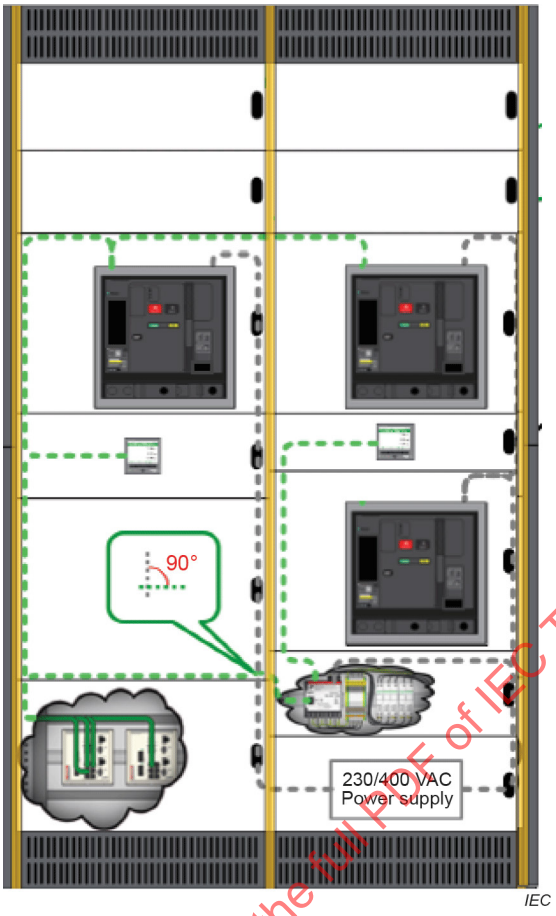


Figure B.2 – Example of shielding

B.3 Cables length

B.3.1 Power cables

A common mistake during installation is to use cables too long in order to be more flexible with device integration. This has a huge impact on the system immunity against electromagnetic fields, but also on the robustness of the installation. Moreover, by installing cables too long, the situation of parallel routing and non-90°-angle crossing will be more frequent.

As shown in Figure B.3, cables manufactured too long are overlapped inside the electrical trunking.

To avoid this situation, adapt cables lengths to the physical location of the devices.

Figure B.3 shows a typical installation with correctly sized cables lengths.

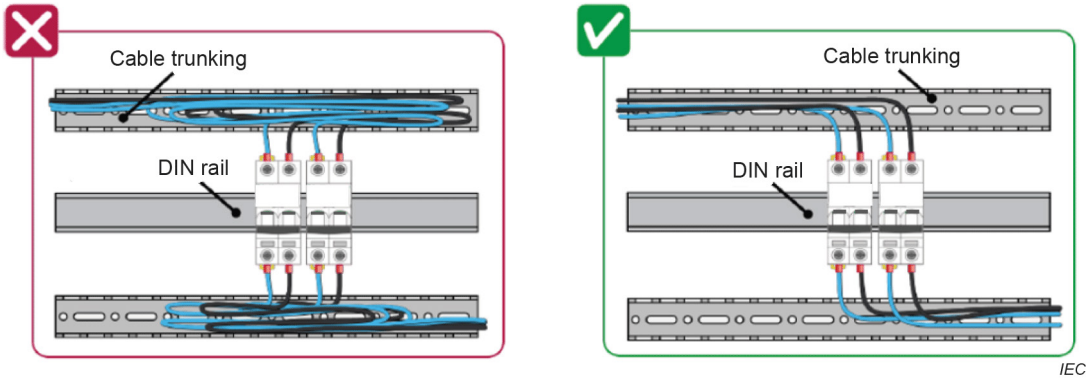


Figure B.3 – Typical installation with and without appropriate cables lengths

B.3.2 Communication cables

The above rules shall also be applied to the communication cables i.e. lengths shall be adapted. In case where this solution is not feasible the remaining length shall be installed (at least 20 cm) away from all kinds of signals and laid on the metallic frame of the enclosure without making a loop. See Figure B.4.

NOTE If screened wires are used, it can be acceptable to loop their excess length.

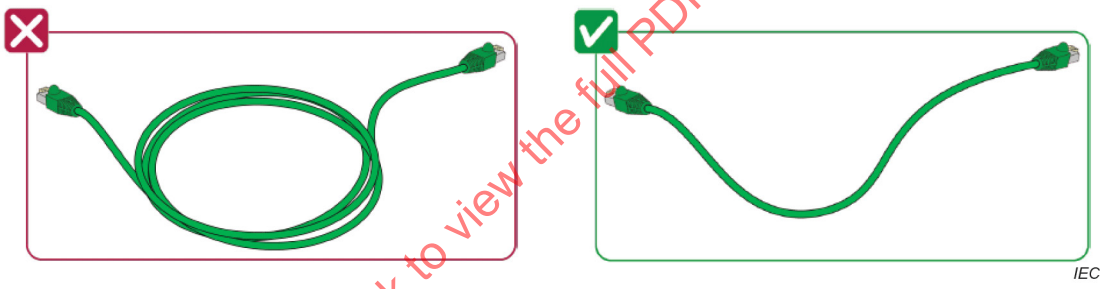


Figure B.4 – Examples of communication cables

B.3.3 Earth continuity

B.3.3.1 General

Different mechanical systems exist. See Figure B.5 and Figure B.6.

B.3.3.2 Earthing clip

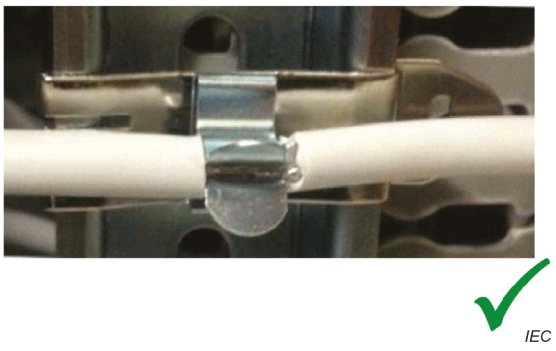
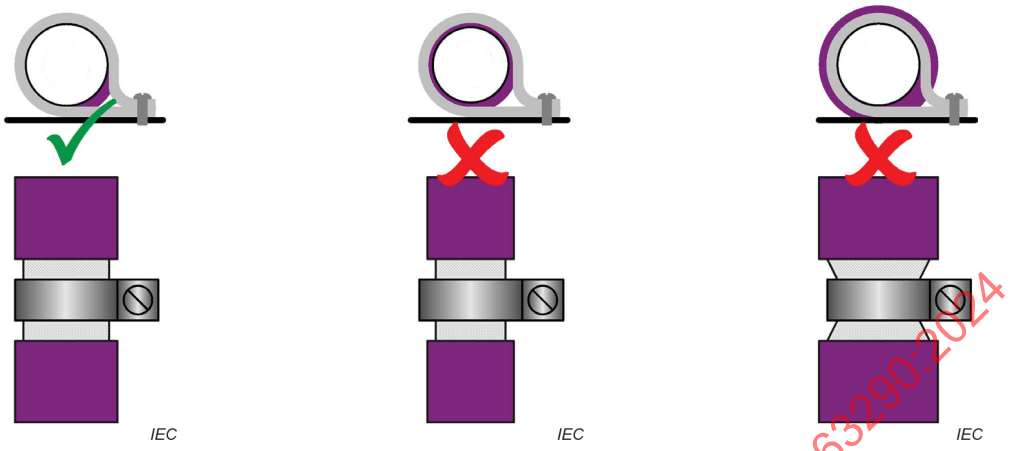


Figure B.5 – Earthing clip

B.3.3.3 Earthing clamp

Clamp diameter shall be adapted to the cable screen diameter (avoid aluminium clamps).



a) Clamp adapted to screen diameter

b) Clamp too large

c) Clamp too small

Figure B.6 – Examples of clamp diameter

B.4 Rules for communication network

B.4.1 Ethernet network

Communication cables shall be compatible with the speed of communication of devices included in intelligent assembly and those of wider installation.

It is highly recommended to use category 5e S/FTP Ethernet cables at least, and preferably category 6a S/FTP.

This is the best way to protect the system against external disturbances, and to avoid malfunctions or communication issues.

B.4.2 Ethernet connector

When a low-voltage switchgear and controlgear assembly is equipped with an RJ45 bulkhead crossing, it is important to ensure that the connector has the following characteristics:

The connector shall ensure the shield continuity. The frame surface shall be clean and any contamination shall be removed (grease, paint, etc.). A spray or special grease can be used to avoid corrosion near the contact surface after the installation.

The connector shall be suitable for its temperature at the point of installation.

B.5 Auxiliary power supply wiring installation

Figure B.7 highlights the rules to be followed in order to implement an efficient earthing.

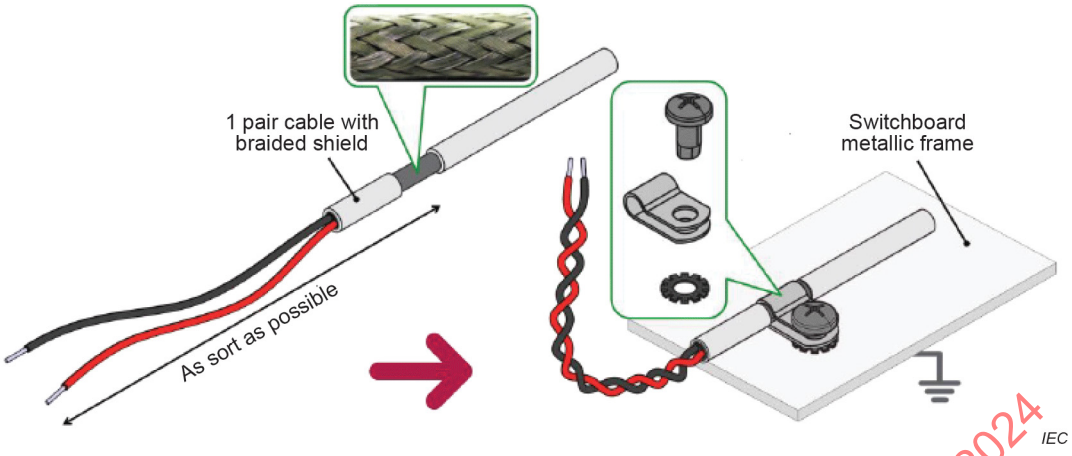


Figure B.7 – Guidance for power supply wiring installation

Cable rules:

- 1 pair cable, with braided shield if required;
- Flexible wires (not necessary for twisted pair cable);
- Cross-section from 0,4 mm^2 to 2,5 mm^2 (24 AWG to 14 AWG);
- Max length: shall be adapted to respect a maximum voltage drop of 10 %;
- The wires shall be manually twisted before being connected to the device;
- Use a 360° steel earthing clamp (do not use aluminium clamps) with the distance between device connection and shield connection as short as possible.

B.6 Installing devices

B.6.1 General

The devices shall be installed in such a way as to prevent interference from other sources.

NOTE Conducted and radiated precautions (filter, distance or shielding) suitable for either the environment or signal, or both, can improve the EMC performance.

Disturbances can be caused by devices generating high frequencies or due to magnetic fields caused by high currents.

Examples of devices carrying high current that may cause disturbances:

- Transformers;
- Switchgears;
- Thermal relays;
- Contactors;
- Circuit-breakers;
- Soft starters;
- Speed drive;
- Insulation monitor;
- Relays.

Examples of sensitive devices operating with low currents:

- Modules with digital output;
- HMI screen;
- Insulation Monitoring Device (IMD);
- Control circuit supply;
- PLC backup battery;
- Auxiliary contact;
- PLC.

Examples of highly sensitive devices are:

- Modules with analogue output
- Sensors.

The device manufacturer defines the basic rules for installation of devices. The original manufacturer of the assembly should support the assembly manufacturer or the customer (for retrofit) with additional installation rules for the implementation of devices in its specific intelligent assembly system. See Figure B.8 for an example.

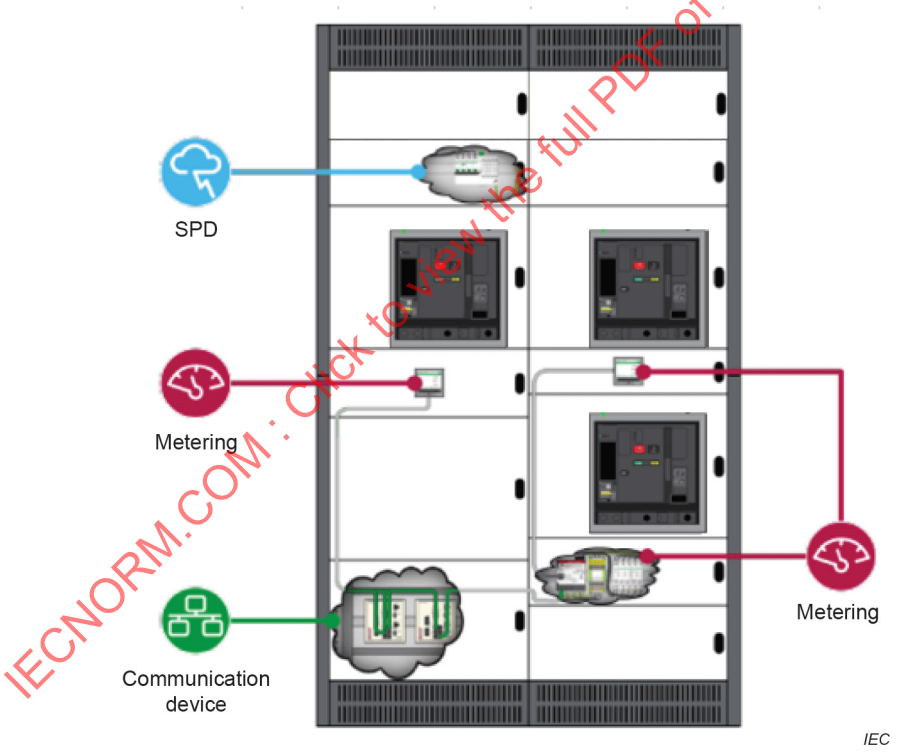


Figure B.8 – Example of device installation

B.6.2 Installation of power meter and accessories – Display location

Based on ergonomic rules and display angle capacity of displays, the original manufacturer should define the height from the floor of integrated displays according to IEC 61439-1.

NOTE In some countries, local regulation can require different distances.

B.7 Installation of trunking

The trunking allows the main, auxiliary and communication circuits to be separated from each other. This is essential for protection against electromagnetic disturbances between circuits when required.

Annex C
(informative)

Measures to reduce the effects of electromagnetic influences

C.1 General

This Annex C provides recommendations to improve electromagnetic immunity and reduce electromagnetic disturbances. For EMC purposes, electrical equipment for machinery is deemed to be either apparatus or fixed installations. Electromagnetic Interference (EMI) can disturb or damage process monitoring, control and automation systems. Currents due to lightning, switching operations, short-circuits and other electromagnetic phenomena can cause overvoltages and electromagnetic interference.

These effects can occur for example:

- where large conductive loops exist,
- where different electrical wiring systems are installed in common cable trunking, e.g. power supply, communication, control or signal cables. Cables carrying large currents with a high rate of change of current (di/dt) can induce overvoltages in other cables, which can influence the operation of, or damage, the connected electrical equipment.

C.2 Mitigation of electromagnetic interference (EMI)

C.2.1 General

Consideration should be given, in the design of the electrical equipment to the measures described below for reducing the electromagnetic influences on electrical equipment. Only electrical equipment which meets the requirements of the appropriate EMC standards, or the EMC requirements of the relevant product standard, should be used.

C.2.2 Measures to reduce EMI

The following measures reduce electromagnetic interference:

a) The installation of either surge protection devices or filters, or both, for equipment sensitive to electromagnetic influences is recommended to improve electromagnetic compatibility with regard to conducted electromagnetic phenomena;

b) Conductive sheaths (e.g. armouring, screens) of cables should be bonded to the protective bonding circuit;

c) Inductive loops should be avoided by selection of common routes for power, signal and data circuits wiring while maintaining circuit separation;

d) Power cables should be kept separate from signal or data cables, where applicable;

e) Where it is necessary for power and signal or data cables to cross each other they should be crossed at right-angles;

f) Use of cables with concentric conductors to reduce currents induced into the protective conductor;

g) Use of symmetrical multicore cables (e.g. screened cables containing separate protective conductors) for the electrical connections between motors and converters;

h) Use of signal and data cables according to the EMC requirements of the manufacturer's instructions;

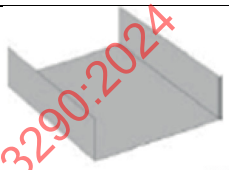
i) Where screened signal or data cables are used, care should be taken to reduce current flowing through the screens of signal cables, or data cables, which are earthed. It can be necessary to install a by-pass conductor.

C.2.3 Separation and segregation of cables

Power cables and data cables which share the same cable trunking or similar should be installed according to the requirements of this Annex.

Where no other information is available, then the cable separation distance between the power and data cables should be in accordance with Table C.1.

Table C.1 – Cable separation distance

Separation without metallic containment	Mesh metallic containment [a]	Perforated metallic containment [b]	Solid metallic containment [c]
	 IEC	 IEC	 IEC
⩾200 mm	⩾150 mm	⩾100 mm	0 mm

[a] Screening performance (DC-100 MHz) equivalent to welded mesh steel basket of mesh size 50 mm x 100 mm (excluding ladders). This screening performance is also achieved with steel tray even if the wall thickness is less than 1 mm or the evenly distributed perforated area is greater than 20 %, or both.

[b] Screening performance (Dc-100 MHz) equivalent to steel tray of at least 1 mm wall thickness and no more than 20 % evenly distributed perforated area. This screening performance is also achieved with screened power cables.

No part of the cable within the metallic containment should be less than 10 mm below the top of the metallic containment.

[c] Screening performance (DC-100 MHz) equivalent to a steel conduit of at least 1 mm wall thickness.

Separation specified is in addition to that provided by any divider/screen.

Annex D
(informative)

Communication network media and protocols

D.1 General

As a complement to the IEC 61439 series, which deals with electrical safety and power availability of the assembly, this Annex D highlights the necessary aspects to be considered for an intelligent assembly.

The choice of the network media (physical layer) and protocol internal to the assembly is one of the key elements to secure the exchange of measurement and control information satisfactorily.

Network media used within assemblies for transmission of measurement and control information are currently based on recognized and well-established technologies (copper wires, optical fibres, radio frequency).

However, some technologies within assemblies can have some drawbacks due to:

– The increase of the number of digital devices to be integrated in the intelligent assembly;
– The reduction of the size of the digital devices which require smaller connectors;
– The growing amount of data to be circulated;
– The growing need to communicate with the cloud (IP compatibility);
– The time necessary for the setting of all digital devices within the intelligent assembly;
– The time required for maintenance or upgrades during the device lifecycle.

D.2 Multi-vendor interoperable communication system

D.2.1 General

To serve the growing customer's needs to optimise the energy performance and advanced maintenance of assemblies/installations, more digital devices and digital services are being integrated into assemblies. Such intelligent assemblies require interoperability across different platforms and multiple vendors' systems. This can be achieved with open, unified, standards-based communication system.

D.2.2 Ethernet and IP standard solution

Well-known Ethernet-based solution help to guarantee a large interoperability with wide, multi-sector adoption. Industrial Ethernet protocols are more widely used in electrical distribution and automation domains, due to:

– The Standard physical layer;
– The Standard IP (Internet Protocol);
– The compatibility to several communication protocols like Ethernet/IP, PROFINET, IEC 61850, OPC UA, Modbus TCP, etc.

D.2.3 OPC UA – Open Platform Communication Unified Architecture

End users, device suppliers, assembly manufacturers and several standard organizations have chosen OPC UA (IEC 62541) as the future communication protocol, to easily link IT and the OT domains.

NOTE 1 IT (Information Technology) is the common term for the entire spectrum of technologies for information processing, including software, hardware, communications technologies and related services.

NOTE 2 OT (Operational Technology) represents hardware and software that detects or causes a change to physical processes, through either the direct monitoring or control of industrial equipment, assets, processes and events, or both.

As a consequence, OPC UA is being recognised as a multi-vendor communication technology, designed for semantics interoperability, ensuring data consistency from sensor to cloud and simplifying gateways.

D.2.4 Ethernet, the targeted physical layer

Multi-Pair Ethernet cable is used for high bandwidth applications, as a traditional four wire Ethernet physical layer, that is already widely deployed.

The evolution towards Single Pair Ethernet cable (SPE) technology meets the growing market requirements. It transmits data over only one pair of copper wires at speeds of 10 Mbit/s to 1 GBit/s. Previously, this required two pairs for Fast Ethernet (100 MB) and four pairs for Gigabit Ethernet.

Single Pair Ethernet multi-drop allows an easy, economic and environmental friendly connection of devices within the intelligent assembly, between sensors, actuators and any other digital devices.

This emerging Single pair Ethernet multi-drop technology improves efficiency, cost and sustainability due to:

– Reduced use of copper material in the intelligent assembly for connectivity;
– Smaller and standardized connectors;
– Cable length easily adjusted to the need, and no special tools are required;
– Power supply and communication both supported by the 2 wires;
– Standard cable with unshielded twisted pair.

See Figure D.1 for examples of Multi pair Ethernet and Single pair Ethernet.

IEC

a) Multi pair Ethernet

IEC

b) Single pair Ethernet

Figure D.1 – Examples of Ethernet cables

D.3 Alternatives to the Ethernet solutions

For low data flow usage communicating devices within an intelligent assembly, other technologies of communication such as ZigBee or Bluetooth can be utilized.

Annex E
(informative)

Documentation of software and firmware revisions

The Original manufacturer has done no changes to any software installed on controllers within this intelligent Assembly.

OR

The Original manufacturer has done the following changes to any software installed on controllers within this intelligent Assembly.

Hardware # (drawing item#)	Type of device	Brand	Catalog #	Firmware/ Software version	Firmware/ Software date	Modification
PLC 001	PLC	A	A1	V0.2.3.1.0	Sept 23, 2023	Update to latest version
Dr002	VFD	B	B1	V 10.2.3.1.6	Aug 12, 2023	Parameters updated Password updated
PLC5	Sensor Interface	C	C1			Additional Modbus Interface added (Port xyz opened)
PLC 213	Controller	D	D1			Updated Cybersuite to Cipher Suite

The Assembly manufacturer has done no changes to any software installed on controllers within this intelligent Assembly.

Hardware # (drawing item#)	Type of device	Brand	Catalog #	firmware/ Software version	Firmware/ Software date	Modification	Any validation or certification available for the software [yes/no] [ref #][a]
PLC 001	PLC	A	A1	V0.2.3.1.0	Sept 23, 2023	N/A	
Dr002	VFD	B	B1	V 10.2.3.1.6	Aug 12, 2023	N/A	
PLC5	Sensor Interface	C	C1	V 2.3	Mai 2021	N/A	
PLC 213	Controller	D	D1	V.3.1.56.	April 1999	N/A	

[a] Typically provided by the Manufacturer of that component. That may be in hardcopy, softcopy or link to the Internet. Add the link in the table as appropriate (e.g. as QR Code).

Or

The Assembly manufacturer has done the following changes to any software installed on controllers within this intelligent Assembly.

Hardware # (drawing item#)	Type of device	Brand	Catalog #	Firmware/ Software version	Firmware/ Software date	Modification
PLC 001	PLC	A	A1	V0.2.3.1.0	Sept 23, 2023	Update to latest version
Dr002	VFD	B	B1	V 10.2.3.1.6	Aug 12, 2023	Parameters updated Password updated
PLC5	Sensor Interface	C	C1			Additional Modbus Interface added (Port xyz opened)
PLC 213	Controller	D	D1			Updated Cybersuite to Cipher Suite

NOTE During Operation Modifications like Upgrade should be documented by the installer, commissioner or User in the following Logbook

1) The User/Operator/Owner/Commission responsible has done no changes to any software installed on controllers within this intelligent Assembly.

OR

2) The User/Operator/Owner/Commission responsible has done the following changes to any software installed on controllers within this intelligent Assembly.

Hardware # (drawing item#)	Type of device	Brand	Catalog #	Firmware/ Software version	Firmware/ Software date	Modification
PLC 001	PLC	A	A1	V0.2.3.1.0	Sept 23, 2023	Update to latest version
Dr002	VFD	B	B1	V 10.2.3.1.6	Aug 12, 2023	Parameters updated Password updated
PLC5	Sensor Interface	C	C1			Additional Modbus Interface added (Port xyz opened)
PLC 213	Controller	D	D1			Updated Cybersuite to Cipher Suite

Annex F
(informative)

Documentation of access control

The following Access Control measurements have been put into place by (Name, Company, Date)

Hardware # (drawing item#)	Type of device	Brand		Catalog #	Users [a]	Password set [yes/no]	Comments
PLC 001	PLC	A		A1			
Dr002	VFD	B		B1			
PLC5	Sensor Interface	C		C1			
PLC 213	Controller	D		D1			
R001	Router	E		E1			
[a] Definition of User type see table 3 of IEC 62351-8:2020.							