Switchgear and controlgear assembly documentation

Requirements of the documentation in accordance with:
IEC 60204-1 – Electrical equipment of machines
IEC 61439-1 – Low-voltage switchgear and controlgear assemblies
Requirements according to DIN EN 60204-1

The information that is required for setting up, operating, and servicing a machine's electrical equipment must be supplied in a suitable format.

The information must be in an agreed language.

The form of information provided may vary depending on the complexity of the electrical equipment delivered. For very simple equipment, the corresponding information may be contained within a single document, provided that this document shows all the devices of the electrical equipment and enables connections to be established to the power supply.

REMARK: The technical documentation that is provided with parts of the electrical equipment can form part of the documentation for the machine's electrical equipment.
Requirements according to DIN EN 60204-1

- Comprehensive description of the equipment
- Operating manual, manual for servicing
- Parts list
- Notes on setup / mounting / connecting to the power supply
- Where applicable: details on the physical environment, overview (block) circuit diagrams, programming, monitoring intervals, for example
- Circuit diagram
- Description of protective equipment (locked functions for machines coordinated to work together, etc.)
- Technical protective measures
- Information on handling, transport and storage
Switchgear and controlgear assembly documentation

Requirements according to DIN EN 61439-1

- All identifying characteristics of the switchgear and controlgear assembly must be contained within the technical documentation
- Notes on transport, handling, installation, operation, and servicing
- Identification of devices, components, electrical circuits (parts lists, assembly drawings, circuit diagrams, and terminal diagrams)

Note: No separate requirements for power switchgear and controlgear assemblies (DIN EN 61439-2)
Selection of identifying characteristics of a switchgear and controlgear assembly according to DIN EN 61439-1

- Rated values of voltages – such as the rated voltage of a switchgear and controlgear assembly, the rated operating voltage of electrical circuits of a switchgear and controlgear assembly, the rated insulation voltage of a ...
- Rated values for currents ($I_{nA}$, $I_{nc}$, $I_{pk}$, $I_{cw}$, $I_{cc}$)
- Rated Diversity Factor (RDF) (also for groups of electrical circuits)
- Rated frequency $f_N$
- Pollution degree, degree of protection (IP code)
- System after ground connection (line system configuration)
- Classification according to EMC (environmental condition A or B)
- **Type of short-circuit protective device(s)**
- Protection against electric shock
- Overall dimension, weight, etc.
For switchgear and controlgear assemblies with a short-circuit protective device in the infeed, the user should specify the value of the prospective short-circuit current which can arise at the input connections of the switchgear and controlgear assembly.

Result:

The manufacturer must provide a marking or documentation which specifies the short-circuit withstand strength of the switchgear and controlgear assembly for which the short-circuit protective device on the infeed provides protection.
A brief excursion covering the type of short-circuit protective device(s) according to DIN EN 61439-1

For switchgear and controlgear assemblies without an installed short-circuit protective device on the infeed, the manufacturer of the switchgear and controlgear assembly must specify the short-circuit withstand strength in one or more of the following ways:

a) The rated short-time withstand current (Icw) together with the associated duration and the rated peak withstand current (Ipk)

b) The rated conditional short-circuit current (Icc)
(2) A brief foray covering the type of short-circuit protective device(s) according to DIN EN 61439-1

<table>
<thead>
<tr>
<th>Technical specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Standards</strong></td>
</tr>
<tr>
<td>DIN VDE 0660, IEC 60947</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Switches</strong></th>
<th>Type</th>
<th>3LD2 0</th>
<th>3LD2 1</th>
<th>3LD2 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated insulation voltage $U_i$</td>
<td>V</td>
<td>690</td>
<td>690</td>
<td>690</td>
</tr>
<tr>
<td>Rated operational voltage $U_o$</td>
<td>V AC</td>
<td>690</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated frequency</td>
<td>Hz</td>
<td>50 ... 60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated impulse withstand voltage $U_{imp}$</td>
<td>V</td>
<td>690</td>
<td>690</td>
<td>690</td>
</tr>
<tr>
<td>Rated short-time withstand current (1 s current, rms value)</td>
<td>A</td>
<td>340</td>
<td>640</td>
<td>640</td>
</tr>
<tr>
<td>Short-circuit protection, max. back-up fuse ($gL$)</td>
<td>A</td>
<td>20</td>
<td>25</td>
<td>40</td>
</tr>
<tr>
<td>Rated conditional short-circuit current with upstream fuses at AC 50/60 Hz, 690 V</td>
<td>kA</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Maximum permissible let-through $i^2t$ value</td>
<td>kA²s</td>
<td>2.5</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>Permissible let-through current of the fuse</td>
<td>kA</td>
<td>3</td>
<td>3.5</td>
<td>4.5</td>
</tr>
</tbody>
</table>

**SIEMENS catalog extract LV10.1**
Any questions?

Note / exclusion of liability

The typical circuit diagrams and interpretations of the standard are not binding and do not claim to be complete regarding configuration, equipment or any other eventuality. They do not represent any client-specific solutions and are only intended to offer assistance for typical tasks.

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Documentation in line with LVD

Documentation requirements in line with the Low Voltage Directive 2006/95/EC
Documentation in line with the low-voltage directive

- Process for the CE – Declaration of Conformity and marking in line with LVD 2006/95/EC
  1. Method
  2. Declaration of Conformity
  3. CE marking
- Example for the Declaration of Conformity and the CE marking
Path to CE marking
Conformity assessment procedure

Conformity must be assessed by the manufacturer or someone authorized by them and based within the Community. The conformity assessment procedure incorporates 3 main steps.

1. Compiling the technical documentation

2. Declaration of Conformity

3. CE marking

These obligations (methods) do not apply to the importer, who will generally have no detailed knowledge regarding which directives have been taken into account or which technical specifications have been applied.
1. Compiling the technical documentation

Scope (corresponding to Annex IV of the LVD – internal production monitoring)

The technical documentation incorporates the following:

- General description of the electrical switching devices and components
- Design and production plans and circuit diagrams showing how components, modules, and circuits, etc. are arranged
- Descriptions and explanations to help people understand these plans and circuit diagrams and operate the electrical switching devices and components (Objective: third-parties must be able to understand)
- A list of standards applied (in full or in part) or, if no standards have been applied, a description of the means by which the safety requirements of the directive have been satisfied
- The results of the design calculations, tests performed, etc.
- Test reports (available test reports from the manufacturer or third parties)

Before a product is brought into circulation the manufacturer needs to compile the various technical documentation to verification that the products satisfies the directive.
1. Compiling the technical documentation

Retention of technical documentation:

- For **at least 10 years** by the manufacturer or authorized party
- Readily accessible (e.g. in electronic form too)
- Importer or party bringing product into circulation is responsible for documentation retention if the manufacturer or their authorized party is not based within the Community.
- Must be made available within a reasonable period of time if requested by the authorities (e.g. within 2 weeks)
2. Declaration of Conformity

Content

The Declaration of Conformity must contain:

- Name and address of the manufacturer or someone authorized by them and based within the Community
- Description of the electrical switching devices and components
- The harmonized standards applied
- Reference to the specifications on which conformity is based where no harmonized standards have been applied
- Identity of the manufacturer or their authorized signatory based within the Community
- The last two digits of the year when the CE marking was applied
2. Declaration of Conformity

Retention

The Declaration of Conformity must be made available and retained by the

- Manufacturer or
- someone authorized by them

Based within the Community (EEA)

If neither are based within the Community, a copy needs to be retained by

- The importer or
- For the party responsible for bringing the product into circulation

The authorities responsible for supervising the market can request a copy of the Declaration of Conformity at any time if necessary.

The Declaration of Conformity must be drafted in at least one of the official European languages.

Official languages within the EU: 23   Working languages: 3 (English, French, German)
3. CE marking

- **Marking** of electrical switching devices and components with CE marking before it is brought into circulation by the manufacturer only or someone authorized by them and based within the Community

- **CE marking applied to the electrical switching devices and components** themselves or, if this is not possible, to the packaging, the user instructions, or the warranty certificate

- Marking must be clearly visible, legible, and permanent.

- **Minimum height 5mm** with proportions retained if enlarged

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3. CE marking

The **CE marking** indicates that an electrical switching device or component:

- **Satisfies the main requirements**
- Has been through the conformity assessment process as defined in the Low Voltage Directive and the other directives applicable to the product
- And whose **free movement within the EEA** may only be limited/denied if there are well grounded suspicions (presumption of effectiveness)

It is forbidden to apply markings whose meaning or design may be confused with the meaning or design of CE marking.
Examples of the declaration of conformity, rating plate, and the CE marking

- Declaration of conformity for a SIVACON power distribution board

- Example rating plate of a low-voltage switchgear and controlgear assembly – according to DIN EN 61439-2

Manufacturer: Musterschalschrankbau GmbH
Serial number: Power distribution board: 12345
Date of manufacture: September 2012
Switchgear and controlgear assembly complies with IEC 61439-2
Any questions?

Note / Exclusion of liability

The typical circuit diagrams and interpretations of the standard are not binding and do not claim to be complete regarding configuration, equipment or any other eventuality. They do not represent any client-specific solutions and are only intended to offer assistance for typical tasks.

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Switchgear and controlgear assembly marking

- Requirements according to IEC 60204-1
- Requirements according to IEC 61439-1
Switchgear and controlgear assembly marking

**General**

Markings, rating plates, and warning signs must:

- be of sufficient durability
- attached so as to be legible

**Standards: (assorted samples)**

IEC 60445 - terminals, conductor terminations and conductors
IEC 60417 - graphical symbols for use on equipment
Additional requirements according to IEC 60204-1 (16.4)

A rating plate is to be put on the control panel which should be easily recognizable following installation. The rating plate must be attached to the enclosure around the infeed.

- Name or company sign of the manufacturer / supplier
- If necessary, approval symbols
- Serial number / type designation
- Rated voltage, number of phases, frequency (with alternating voltage), full load current for the infeed(s)
- **Short-circuit coordination of the equipment**
- Number of the main documentation

**Note:** Full load current under normal operating conditions (be aware of the rated diversity factor (RDF))
Switchgear and controlgear assembly marking

Requirements according to IEC 61439-1

The manufacturer of the control panel must place one or several permanent inscriptions on each control panel so that these are legible when the control panel is connected and in operation:

- Name or trademark of the manufacturer of the control panel
- Type designation / identification number, with which necessary information can be requested from the manufacturer of the control panel
- Marking for determining the date of manufacture
- IEC 61439-X (the applicable part is to be specified)

**Note:**
The applicable control panel standard may determine whether further details must be specified on the identification plate
Switchgear and controlgear assembly marking

Requirements according to IEC 61439-2
Details on the identification plate for power switchgear and controlgear assemblies

- Name or trademark of the manufacturer of the control panel
- Type designation / identification number, with which necessary information can be requested from the manufacturer of the control panel
- Marking for determining the date of manufacture
- IEC 61439-2

Example:

Manufacturer: Musterschaltschrankbau GmbH
Serial number: Power distribution board: 12345
Date of manufacture: September 2012
Switchgear and controlgear assembly complies with IEC 61439-2
Any questions?

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Tools for assisting with documentation

- SIMARIS software tools
- "My Documentation Manager"
- CAX online generator
SIMARIS software tools

**SIMARIS design:**
- Network calculations and calculating short-circuit currents

**SIMARIS curves:**
- Visualizing and evaluating characteristic curves

Download: www.siemens.com/simaris
SIMARIS design
Functionality

- **Dimensioning electrical networks** based on real products from medium-voltage through to consumer-level, including an automatic selection of suitable equipment
- Dimensioning is conducted according to **the recognized rules of technology and applicable standards (VDE, IEC)**
- Open definition of the types of mains operation and switching states
- Calculation of the **short circuit current, load flow, voltage drop and energy balance**
- Consideration of the required **personal, short-circuit, and overload protection**
- Consideration of the required **lightning and surge protection** possible
- Representation of the **busbar trunking systems** for power transmission and distribution
- Different output versions for **documentation**
<table>
<thead>
<tr>
<th>SIMARIS design Professional</th>
<th>All functions for the dimensioning of the electrical power distribution</th>
<th>Special electrotechnical functions</th>
<th>Online registration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>✓</td>
<td>✓</td>
<td>For a nominal charge</td>
</tr>
<tr>
<td>SIMARIS design</td>
<td>✓</td>
<td></td>
<td>Free of charge</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
SIMARIS curves
Functions

- Visualization and evaluation of the *tripping characteristics* of low-voltage protective devices and fuses (IEC), including an option for the *simulation of device settings*
- Visualization of *cut-off current and cut-off energy characteristics*
- Product selection overview per order number or selection guide
- Saving of selected devices as *favorites*
- Saving of several characteristic curves including settings as a complete project
- Consideration of *country-specific product portfolios*
- User-friendly *documentation*
SIMARIS curves
SIMARIS curves 2.x characteristic curves display

- Product search using order number or catalog
- Display of tripping, cut-off current, and cut-off power characteristics
- Simulation of device settings
Initial situation:
A single part number or a list of Siemens order numbers (MLFBs) for an application or project.

Challenge:
Individual information requirements – product information of a technical or commercial nature; e.g.
- Product photo
- Data sheet (multilingual)
- Certificates / approvals / declarations of conformity
- Characteristic curves
- Engineering data for CAD or CAE systems
- etc ...

Solution: Use our CAx online generator – here you will quickly and easily find all available information in a selection process
MDM
My Documentation Manager – Function

Compile product documentation effectively and appropriately in a separate structure and manage it comfortably

1. Select a contribution – e.g. select a manual (configurable) using the search
2. Call a contribution in MDM – e.g. select a particular chapter of a manual
3. Create / expand a separate library – add, compile, rename or delete separate folders / subject areas
4. Transfer a contribution to a separate composition – integrate contents into a separate structure using "drag and drop"
5. Export function – export a separate library wholly or partially as a file (.pdf, .xml, .rtf, etc.)
MDM
My Documentation Manager – Call up options
Benachrichtigungsfunktion ist von besonderer Bedeutung, hat der Kunde sich ein individuelles Garantie aus konfigurierbaren Handbüchern erstellt, so erhält er eine automatische E-Mail. Benachrichtigung sobald sich etwas am konfigurierbaren Handbuch geändert hat. So kann der Kunde sein individuelles Handbuch immer auf dem aktuellen Stand halten.
Any questions?

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Example of internal documentation in accordance with the LVD and DIN EN 61439-1 using a sample panel

- Sample panel and specification
- Verifications acc. to IEC 61439-1-2
- Documentation notes in accordance with IEC 61439-1
- Documentation notes in accordance with LVD 2006/95/EC
Documentation as per European LVD 2006/95/EC

1. Compiling the technical documentation

2. Declaration of conformity

3. CE marking

These obligations (methods) do not apply to the importer, who will generally have no detailed knowledge regarding which directives have been taken into account or which technical specifications have been applied.
A test report must be created for the conducting of verifications as per DIN EN 61439-1.

Chapter 10.1

"The reference design, the number of switchgear and controlgear assemblies used for the verifications, or parts of these, the choice of verification methods, providing they are applicable, and the sequence of verifications are the responsibility of the original manufacturer.

The data used, the calculations, and the comparisons conducted when verifying the switchgear and controlgear assemblies are to be documented in a test report."
Examples of documentation:

You will receive the following suggestions for documentation conforming to standards and guidelines at the end of this seminar:

<table>
<thead>
<tr>
<th>General declaration of conformity</th>
<th>EC declaration of conformity</th>
<th>Example of a plant document</th>
<th>Design verification checklist</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="General declaration" /></td>
<td><img src="image" alt="EC declaration" /></td>
<td><img src="image" alt="Plant document" /></td>
<td><img src="image" alt="Design verification checklist" /></td>
</tr>
</tbody>
</table>

Routine verification test report
Low-voltage switchgear and controlgear assemblies in accordance with IEC 61439-1 & -2

Project: Siemens example project PLC 2012

- Rated current: InA = 100 A
- Installation altitude ≤ 1,000 m
- Pollution degree: 3
- Overvoltage category: 3
- Ambient temperature: T = 20°C
- IP degree of protection: IP54
- Prospective short-circuit current on the input terminals: Icp ≤ 10 kA
- ...

Specification by the ordering party as per IEC 61439-0; the "Specifier's Guide".
Sample panel – specification
General declaration of conformity according to ISO/IEC 17050

A *declaration of conformity* from a supplier is a form of confirmation of conformity, which:

- fulfills the requirements *of the market and*
- *government bodies*

in a way that inspires *confidence*.

Acceptance of a supplier's declaration of conformity could be further assisted if *the details*

- on which the supplier bases his declaration
- *are kept ready in the form of a document and*
- *are made available upon request*

**Recommendation if there is an export outside the EEA (European Economic Area).**
Example of an EC Declaration of Conformity:

- In accordance with **low-voltage directive 2006/95/EC**
- In accordance with **EMC directive 2004/104/EC**
- In accordance with **IEC 61439-1 & -2/EN 61439-1 & -2/ VDE 0660 parts 600-1 & -2**
Circuit diagrams

Example of internal documentation using a sample panel
Quick and simple gathering of necessary technical data with the CAx online generator from SIEMENS
Data sheet
Example with the compact starter 3RA6

Technical data

9.1 3RA6 compact starter

9.1.1 General technical data

General technical data

<table>
<thead>
<tr>
<th>Order number</th>
<th>3RA61</th>
<th>3RA64</th>
<th>3RA65</th>
</tr>
</thead>
<tbody>
<tr>
<td>Declaration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of poles</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Permissible ambient temperature</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage</td>
<td>According to IEC 60439-1-1</td>
<td>55 to 40 °C</td>
<td></td>
</tr>
<tr>
<td>Handling</td>
<td>According to IEC 60439-1-2</td>
<td>-65 to +80 °C</td>
<td></td>
</tr>
<tr>
<td>Operation</td>
<td>According to IEC 60439-1-3</td>
<td>-25 to +60 °C</td>
<td></td>
</tr>
<tr>
<td>Internal control cabinet temperature, up to +40 °C</td>
<td>% R.H.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Humidity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relative strength of humidity</td>
<td>10 to 90%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. demagnetization attack</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjustment range of release and initial operation current</td>
<td>0.1...34 A</td>
<td>A</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>0.3...1.25 A</td>
<td>A</td>
<td>1.25</td>
</tr>
<tr>
<td></td>
<td>1...4 A</td>
<td>A</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>5...12 A</td>
<td>A</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>8...32 A</td>
<td>A</td>
<td>8</td>
</tr>
</tbody>
</table>

Page 11 01/2013 Example of internal documentation using a sample panel
Data sheet
Example with the SINAMICS G120 converter

Technical specifications

Common performance ratings of the Power Module

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line operating voltage</td>
<td>3 AC 380 V ... 480 V ± 10%</td>
</tr>
<tr>
<td>Input frequency</td>
<td>47 Hz ... 63 Hz</td>
</tr>
<tr>
<td>Modulation depth</td>
<td>87% (The maximal output voltage is 87% of the input voltage)</td>
</tr>
<tr>
<td>Power factor α</td>
<td>0.9</td>
</tr>
<tr>
<td>Overload capability (HD)</td>
<td>1.5 x Nominal output current (150% overload) for 5 s every 300 s</td>
</tr>
<tr>
<td>Overload capability (LO)</td>
<td>2 x Nominal output current (200% overload) for 3 s every 300 s</td>
</tr>
<tr>
<td>Overload capability (CO)</td>
<td>1.1 x Nominal output current (110% overload) for 5 s every 300 s</td>
</tr>
<tr>
<td>7.5 kW ... 90 kW</td>
<td>1.5 x Nominal output current (150% overload) for 3 s every 300 s</td>
</tr>
<tr>
<td>Insulated current</td>
<td>Less than rated input current</td>
</tr>
<tr>
<td>Pulse frequency</td>
<td>4 kHz standard</td>
</tr>
<tr>
<td>Electromagnetic compatibility</td>
<td>Power Modules with unregulated class A filters according to EN 55011 available</td>
</tr>
</tbody>
</table>
Data sheet
Example with the TS8 control panel enclosure
System documentation

Individual creation of system documentation for end customers with the SIEMENS tool "My Documentation Manager"
Tests, calculations (verifications acc. to DIN EN 61439-1 & -2)

Design verifications

according to IEC 61439-1 and IEC 61439-2

Test report for low-voltage switchgear and controlgear assemblies

Original manufacturer: ____________________________
Manufacturer of the switchgear and controlgear assembly: ____________________________
Project: ____________________________
Customer: ____________________________
Place, date: ____________________________

Routine verifications

according to IEC 61439-1 and IEC 61439-2

Test report for low-voltage switchgear and controlgear assemblies

Original manufacturer: ____________________________
Manufacturer of the switchgear and controlgear assembly: ____________________________
Project: ____________________________
Customer: ____________________________
Place, date: ____________________________

Standard:
IEC 61439-1: 2011
IEC 61439-2: 2011

The routine verifications listed below have been conducted in accordance with IEC 61439-1 and IEC 61439-2.
Checklists for design and routine verifications

**CHECKLIST FOR DESIGN VERIFICATIONS**
as per IEC 61439-1-2 for power switchgear and controlgear assemblies

Ordering party/Customer: _________________________
Project: ______________________________________
Switchgear and controlgear assembly: _____________
Date, location: _________________________________
Remarks: ______________________________________

A.) Verification of constructional requirements
1.) Strength of materials and parts
2.) Degree of protection of the enclosure
3.) Clearances and creepage distances
4.) Protection against electric shock and integrity of protective circuits
Performed / Comment Name

**CHECKLIST FOR ROUTINE VERIFICATIONS**
as per IEC 61439-1-2 for power switchgear and controlgear assemblies

Ordering party/Customer: _________________________
Project: ______________________________________
Switchgear and controlgear assembly: _____________
Date, location: _________________________________

Time of testing: After manufacture During manufacture

A.) Checking constructional requirements
1.) Degree of protection of enclosure
2.) Clearances and creepage distances
3.) Protection against electric shock and integrity of protective circuits
4.) Incorporation of switching devices and components
Comment Result Tested by
Any questions?

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