



C2/119

Coding of Functional Units intended for use in installations connected to the HV distribution grid of a Belgian DSO

Edition 2 (03.2024)

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Version management C2/119 E (E: English version)

1.0	First edition, published 04.2020
1.1	<p>First edition, major update 11.2022</p> <ul style="list-style-type: none"> • §3.5 FU-P: Addition of the diagrams PB314, PB114, PK38 and PK11 • §3.3 FU-D: Addition of the diagram DwKZ1 • §3.3 FU-D: Addition of the diagram DKG11 • §3.8 FU-S: Addition of the diagram SKO1 • §3.10: Diagram KKN2&MKB2 adapted to KKN2&PK31 • VDS replaced by VDIS
1.2	<p>First edition, minor update 08.2023</p> <ul style="list-style-type: none"> • Chapter 1 <ul style="list-style-type: none"> - Title chapter 1 adapted; 'coding' replaced by 'codes' - Descriptions first identifier adapted - used abbreviations have been added • Chapter 2: <ul style="list-style-type: none"> - adaptation of the descriptions - rearranged some FUs in the table • Chapter 3: <ul style="list-style-type: none"> - adaptations of the descriptions - Paragraph 3.5: PwB31 and PwB32 moved to end of list PBxx
2.0	<p>Second edition, published 02.2024</p> <ul style="list-style-type: none"> • Addition of Object and Scope • Splitting the document C2/119 in two parts: <ul style="list-style-type: none"> - Part 1: Coding of FUs intended for use in installations connected to the public HV distribution loop, with revision of: <ul style="list-style-type: none"> ▪ Chapter 1: FU codes nomenclature ▪ Chapter 2: Legend for FU schemes ▪ Chapter 3: FU codes and schemes - Part 2: Coding of FUS intended for use in DSU installations directly connected to a DSO substation and intended for use in installations for a DSO substation <ul style="list-style-type: none"> ▪ This part is currently under study

Object and scope

This document describes the coding of functional units (FUs) and illustrates the FU codes by means of schemes with an explanatory description.

The purpose of this document is to allow the Applicant to assign a code to the FUs of the switchgear family subject to the Synergrid homologation.

The Applicant shall submit a written request to Synergrid for the creation of a new FU code in case he wishes to homologate a FU for which the code is not available within the present document.

This document shall be read in conjunction with Synergrid documents C2/113-3, -4 and -5 describing the ratings and specific test specifications, specific design and construction requirements as well as the DSO specific requirements for the FUs.

The document C2/119 consists of two parts, considering the installations for which the FUs are intended to use:

- Part 1: Coding of FUs intended for use in installations connected to the public HV distribution loop
- Part 2: Coding of FUS intended for use in DSU installations directly connected to a DSO substation and installations for a DSO substation

Note: this part is currently under study

C2/119

Part 1

**Coding of FUs for use in installations connected to the public
HV distribution loop**

1 FU codes nomenclature

The functional unit (FU) code is based on its main function, its main connection, its position in an installation and its construction.

The FU code consists of three (3) identifiers plus one (1) specific number with the following meanings:

- **1st identifier:**

The following main functions are identified:

- K = feeder with switch-disconnector
- T = feeder with switch-disconnector-fuse combination
- D = feeder with circuit-breaker
- M = HV billing metering function
- P = voltage transformers for either measurement or auxiliary power supply
- R = riser

Remarks:

- FUs with 1st identifier P are only allowed downstream the general protection of a DSU installation
- FUs with 1st identifier R are only allowed downstream the general protection of a DSU installation

- **2nd identifier:**

For FUs type K, T, D, M and R, the second identifier indicates the type of connection of the FU:

- K: connection by cables
- B: connection by busbar

Remarks:

- For HV switchgear connected exclusively by means of screened insulated separable elbow plug connectors, spherical earthing bolts M12 with diameter 20mm according to DIN 48088-1 are not mandatory on cable connections.
- For FU M, the 2nd identifier indicates the type of connection for the inlet of the FU.

For FU P, the 2nd identifier indicates the part of the main circuit to which the voltage transformer(s) is (are) connected:

- K: connection to the cable side
- B: connection to the busbar side

- **3rd identifier:**

This identifier means a series of specific requirements described in C2/113-3 and C2/113-4.

The following identifiers can be distinguished:

- N (N = Network)
The 3rd identifier N may only be associated to FUs with 1st identifier K or D.
FUs with 3rd identifier N are intended for a cable connection to a DSO network.
- G (G = General Protection)
The 3rd identifier G may only be associated to FUs with 1st identifier T or D.
FUs with 3rd identifier G are intended for use as a general protection of a DSU installation.

Remark:

- FUs DKNx are also allowed for use as DKGx
- U (U = User)
The 3rd identifier U may only be associated to FUs with 1st identifier K, T or D and is applicable to FUs with 2nd identifier K.

FUs with 3rd identifier U are intended for use as an individual feeder installed downstream the billing metering function in a DSU installation. FUs with 3rd identifier U are only allowed downstream the billing metering function in a DSU installation.

Remark:

- FUs **KKNx** are also allowed for use as **KKUx**
 - FUs **TKGx** are also allowed for use as **TKUx**
 - FUs **DKNx** are also allowed for use as **DKUx**
 - FUs **DKGx** are also allowed for use as **DKUx**
- Z (Z = without earthing function)
The 3rd identifier Z means FU without earthing function on the side of the connection. It may only be associated to FUs with 1st identifier R. For FU R, the 3rd identifier is always Z.
 - B, K
The 3rd identifier B or K may only be associated to FUs with 1st identifier M.

Remark:

The 3rd identifier indicates the type of connection for the outlet of FU M.

- 1, 3
The 3rd identifier 1 or 3 may only be associated to FUs with 1st identifier P.

Remark:

The 3rd identifier indicates the number of voltage transformers.

- **4th identifier:**

The 4th identifier is a specific number which corresponds to a single line diagram and a specific construction of the FU. It is applicable for all types of FUs.

If one FU includes several functions, its identification code shall indicate all of those, following the same logic, beginning by the main function, and separating the different functions by a special character:















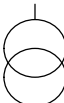



- “&”: if the 2nd function is located inside the FU
- “-”: if the 2nd function is located on top of the FU

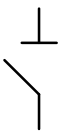
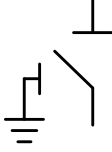
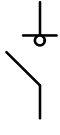
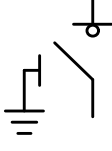
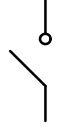
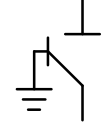

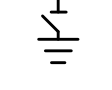
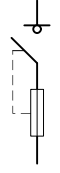
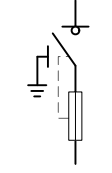
Examples:

- MBB1 & PB37
 - Main function MBB1: billing metering function with busbar input and busbar output
 - Second function PB37: busbar voltage metering function with 3 phase-to-earth voltage transformers located inside the HV metering compartment of FU MBB1
- RBZ1 – PB310
 - Main function RBZ1: busbar riser without earthing-switch
 - Second function PB310: busbar voltage metering function with 3 plug-in phase-to-earth voltage transformers located on top of FU RBZ1

2 Legend for FU schemes

The legend below is applicable for the schemes of the FU codes given in Chapter 3.

	Device or circuit with full peak/short-time current withstand and device with full short-circuit making capacity (except for disconnectors)		Mechanical link
	Device or circuit with limited peak/short-time current withstand and device with limited short-circuit making capacity		Mechanical link between the operation of an earthing-switch and the operation of the earthing-switch of a 3-positions switching device
	Withdrawable circuit		Bidirectional mechanical interlock between an earthing-switch and a (switch-)disconnecter. If one of the devices is in closed position, the other cannot be closed
	Pluggable circuit		Mechanical interlock. The disconnector can only be operated if the circuit-breaker is in opened position
	Cable connection		Mechanical interlock. The 2-positions disconnector can only be operated if the switch is in opened position
	Fuse		Removable conductor (link)
	VDIS (Voltage Detection and Indicating System)		Spherical earthing bolt
	Phase-to-phase voltage transformer (VT)		Phase-to-earth voltage transformer (VT)
	3-phase auxiliary power transformer		Current transformer (CT)

	Disconnector		3-position disconnector, with a closed position, an open position and an a earthed position of the underlying circuit
	Switch-disconnector		3-position switch-disconnector, with a closed position, an open position, and an earthed position of the underlying circuit
	Switch		2-position disconnector, with a closed position and an earthed position of the underlying circuit
	Circuit-breaker		Earthing switch
	Switch-disconnector-fuse combination		3-positions switch-disconnector-fuse combination, with a closed position, an open position and an earthed position of the underlying circuit,

Abbreviations used in this document:

- AIS = (Ambient) Air Insulated switchgear
- GIS = Gas Insulated switchgear

Convention used in this document:

- The main busbar (connecting several FUs together) is always represented on top in the scheme for every FU except for FU M as it has no main busbar system.
- The use of the term “upstream” regarding a protection device (i.e. circuit breaker, fuse) corresponds to the side of the main busbar.
- The use of the term “downstream” regarding a protection device (i.e. circuit breaker, fuse) corresponds to the side of the lower connection of the FU¹.

¹ For FU P, it corresponds to the side of the VTs in this FU

3 FU codes and schemes

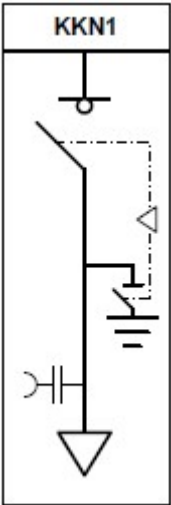
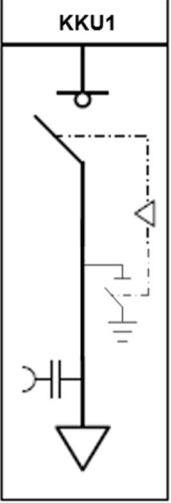
3.1 Introduction

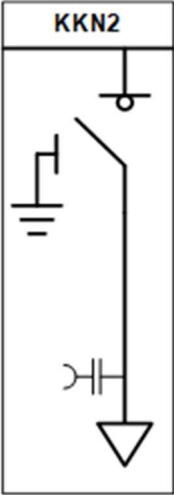
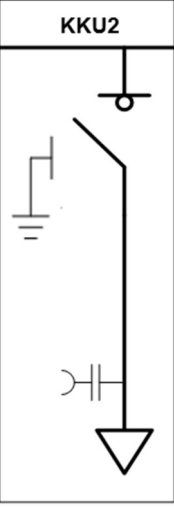
This chapter illustrates the FU codes by means of schemes with an explanatory description.

Centrelines represent mechanical links or interlocks between switching devices.

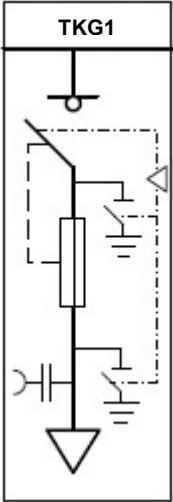
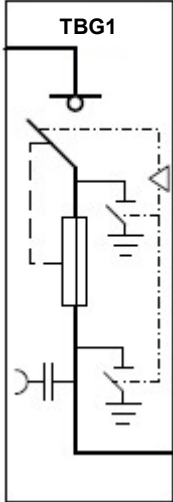
The type of accessibility and the door interlocks are neither described nor represented on the schematic diagrams. They shall comply with the requirements described in document C2/113-4 even if some applications of the accessibility and interlocking rules are reminded within the description of the FU schemes here below.

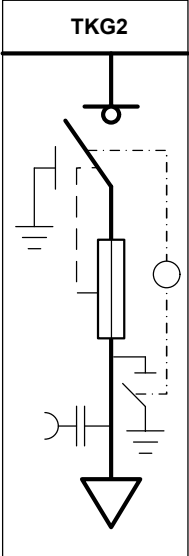
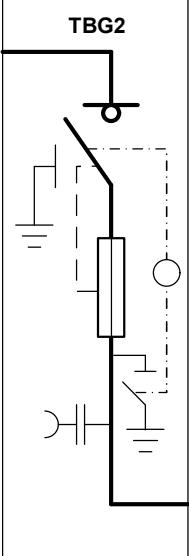
3.2 F.U. type K

	<p>KKN1 FU feeder with a switch-disconnector, a cable connection, an earthing-switch and a VDIS on the cable side. The earthing-switch has the full short-circuit making capacity. The closing operation of the switch-disconnector is interlocked with the position of the earthing-switch and reversely.</p>
	<p>K KU1 FU feeder with a switch-disconnector, a cable connection, an earthing-switch and a VDIS on the cable side.</p>

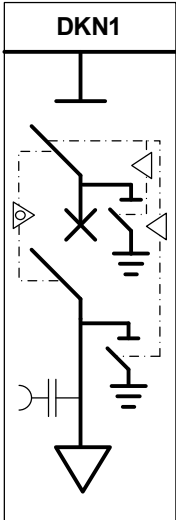
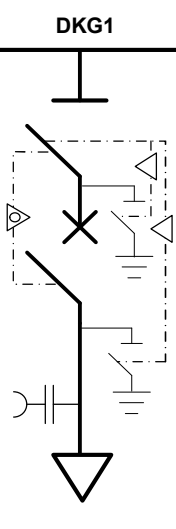
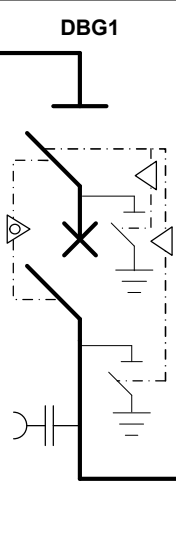
 <p style="text-align: center;">KKN2</p>	<p>KKN2 FU feeder with a 3-positions switch-disconnector, a cable connection and a VDIS on the cable side. The earthing-switch has the full short-circuit making capacity The closing operation of the switch-disconnector is by design interlocked with the position of the earthing-switch and reversely.</p>
 <p style="text-align: center;">KKU2</p>	<p>KKU2 FU feeder with a 3-positions switch-disconnector, a cable connection and a VDIS on the cable side.</p>

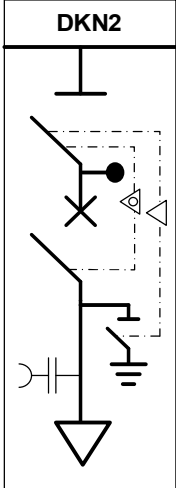
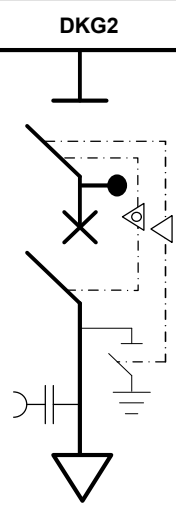
3.3 F.U. type T

	<p>TKG1</p> <p>FU feeder with a switch-disconnector-fuse combination, a cable connection, 2 earthing-switches (one upstream and one downstream the fuses) and a VDIS on the cable side.</p> <p>Both earthing-switches are operated together by one common mechanism.</p> <p>The closing operation of the switch-disconnector is interlocked with the position of the earthing-switches and reversely.</p>
	<p>TBG1</p> <p>FU feeder with a switch-disconnector-fuse combination, with upper busbar section, a lower busbar connection, 2 earthing-switches (one upstream and one downstream the fuses) and a VDIS downstream the fuses.</p> <p>Both earthing-switches are operated together by one common mechanism.</p> <p>The closing operation of the switch-disconnector is interlocked with the position of the earthing-switches and reversely.</p>

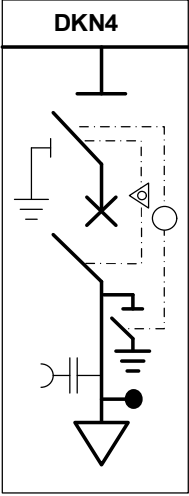
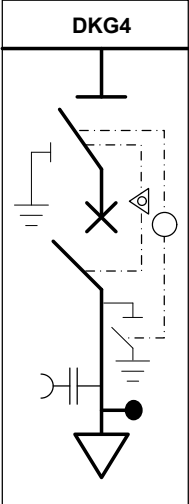
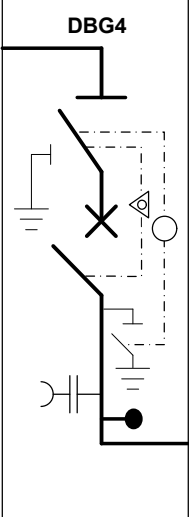
<p style="text-align: center;">TKG2</p> 	<p>TKG2</p> <p>FU feeder with a 3-positions switch-disconnector-fuse combination, a cable connection, a 2nd earthing-switch downstream the fuses and a VDIS on the cable side.</p> <p>Both earthing-switches are operated together by one common mechanism.</p> <p>The closing operation of the switch-disconnector is by design interlocked with the position of the earthing-switches and reversely.</p>
<p style="text-align: center;">TBG2</p> 	<p>TBG2</p> <p>FU feeder with a 3-positions switch-disconnector-fuse combination, with upper busbar section, a lower busbar connection, a 2nd earthing-switch downstream the fuses, and a VDIS on the lower busbar side.</p> <p>Both earthing-switches are operated together by one common mechanism.</p> <p>The closing operation of the switch-disconnector is by design interlocked with the position of the earthing-switches and reversely.</p>

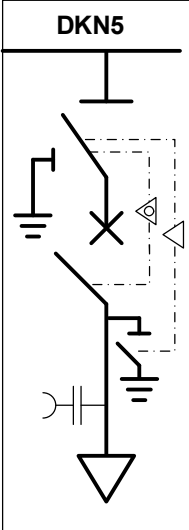
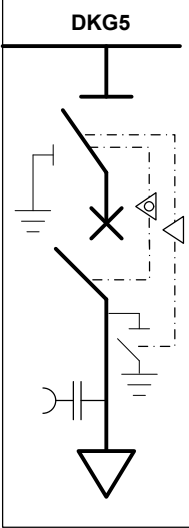
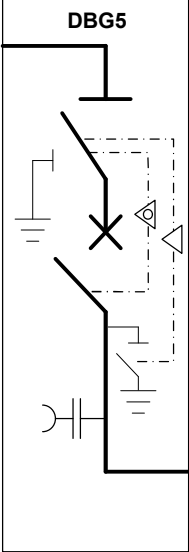
3.4 F.U. type D

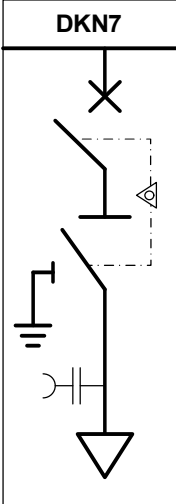
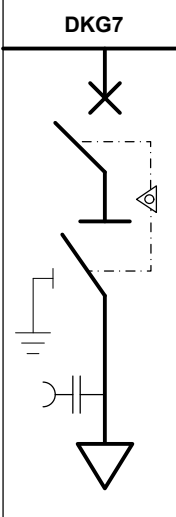
	<p>DKN1</p> <p>FU feeder with a circuit-breaker, a cable connection, a disconnector (or switch-disconnector) upstream the circuit-breaker, 2 earthing-switches (one upstream and one downstream the circuit-breaker) and a VDIS on the cable side.</p> <p>Both earthing-switches are operated independently.</p> <p>Both earthing-switches have the full short-circuit making capacity.</p> <p>The closing operation of the disconnector (or switch-disconnector) is interlocked with the position of both earthing-switches and reversely.</p> <p>The operation of the disconnector is interlocked with the position of the circuit-breaker.</p>
	<p>DKG1</p> <p>FU feeder with a circuit-breaker, a cable connection, a disconnector (or switch-disconnector) upstream the circuit-breaker, 2 earthing-switches (one upstream and one downstream the circuit-breaker) and a VDIS on the busbar side.</p> <p>Both earthing-switches are operated independently.</p> <p>The closing operation of the disconnector (or switch-disconnector) is interlocked with the position of both earthing-switches and reversely.</p> <p>The operation of the disconnector is interlocked with the position of the circuit-breaker.</p>
	<p>DBG1</p> <p>FU feeder with a circuit-breaker, with upper busbar section, a lower busbar connection, a disconnector (or switch-disconnector) upstream the circuit-breaker, 2 earthing-switches (one upstream and one downstream the circuit-breaker) and a VDIS on the lower busbar side.</p> <p>Both earthing-switches are operated independently.</p> <p>The closing operation of the disconnector (or switch-disconnector) is interlocked with the position of both earthing-switches and reversely.</p> <p>The operation of the disconnector is interlocked with the position of the circuit-breaker.</p>

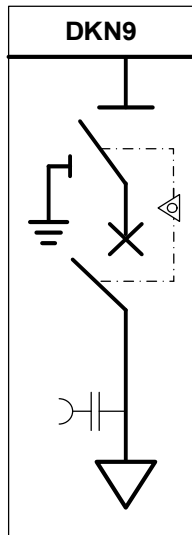
<p style="text-align: center;">DKN2</p> 	<p>DKN2</p> <p>FU feeder with a circuit-breaker, a cable connection, a disconnect (or switch-disconnector) upstream the circuit-breaker, earthing bolts upstream the circuit-breaker, an earthing-switch downstream the circuit-breaker and a VDIS on the cable side.</p> <p>The earthing-switch has the full short-circuit making capacity.</p> <p>The closing operation of the disconnect (or switch-disconnector) is interlocked with the position of the earthing-switch and reversely.</p> <p>The operation of the disconnect is interlocked with the position of the circuit-breaker.</p>
<p style="text-align: center;">DKG2</p> 	<p>DKG2</p> <p>FU feeder with a circuit-breaker, a cable connection, a disconnect (or switch-disconnector) upstream the circuit-breaker, earthing bolts upstream the circuit-breaker, an earthing-switch downstream the circuit-breaker and a VDIS on the cable side.</p> <p>The closing operation of the disconnect (or switch-disconnector) is interlocked with the position of the earthing-switch and reversely.</p> <p>The operation of the disconnect is interlocked with the position of the circuit-breaker.</p>

<p style="text-align: center;">DKN3</p>	<p>DKN3 FU feeder with a circuit-breaker, a cable connection, a disconnector (or switch-disconnector) upstream the circuit-breaker, an earthing-switch downstream the circuit-breaker and a VDIS on the cable side. The earthing-switch has the full short-circuit making capacity. The closing operation of the disconnector (or switch-disconnector) is interlocked with the position of the earthing-switch and reversely. The operation of the disconnector is interlocked with the position of the circuit-breaker. This FU is only allowed in GIS.</p>
<p style="text-align: center;">DKG3</p>	<p>DKG3 FU feeder with a circuit-breaker, a cable connection, a disconnector (or switch-disconnector) upstream the circuit-breaker, an earthing-switch downstream the circuit-breaker and a VDIS on the cable side. The closing operation of the disconnector (or switch-disconnector) is interlocked with the position of the earthing-switch and reversely. The operation of the disconnector is interlocked with the position of the circuit-breaker. This FU is only allowed in GIS.</p>

	<p>DKN4</p> <p>FU feeder with a circuit-breaker, a cable connection, a 3-positions disconnector (or switch-disconnector) upstream the circuit breaker, a 2nd earthing-switch downstream the circuit-breaker and, a VDIS plus earthing bolts on the cable side.</p> <p>Both earthing-switches are operated together by one common mechanism.</p> <p>The earthing-switch downstream the circuit-breaker has the full short-circuit making capacity.</p> <p>The earthing-switch upstream the circuit-breaker needs not to have a short-circuit-making capacity at the condition it always closes after the earthing-switch downstream the circuit-breaker.</p> <p>The closing operation of the disconnector (or switch-disconnector) is by design interlocked with the position of both earthing-switches and reversely.</p> <p>The operation of the disconnector is interlocked with the position of the circuit-breaker.</p>
	<p>DKG4</p> <p>FU feeder with a circuit-breaker, a cable connection, a 3-positions disconnector (or switch-disconnector) upstream the circuit breaker, a 2nd earthing-switch downstream the circuit-breaker and, a VDIS plus earthing bolts on the cable side.</p> <p>Both earthing-switches are operated together by one common mechanism.</p> <p>The closing operation of the disconnector (or switch-disconnector) is by design interlocked with the position of both earthing-switches and reversely.</p> <p>The operation of the disconnector is interlocked with the position of the circuit-breaker.</p>
	<p>DBG4</p> <p>FU feeder with a circuit-breaker, with upper busbar section, a lower busbar connection, a 3-positions disconnector (or switch-disconnector) upstream the circuit-breaker, a 2nd earthing-switch downstream the circuit-breaker and, a VDIS plus earthing bolts on the lower busbar side.</p> <p>Both earthing-switches are operated together by one common mechanism.</p> <p>The closing operation of the disconnector (or switch-disconnector) is by design interlocked with the position of both earthing-switches and reversely.</p> <p>The operation of the disconnector is interlocked with the position of the circuit-breaker.</p>

<p style="text-align: center;">DKN5</p> 	<p>DKN5</p> <p>FU feeder with a circuit-breaker, a cable connection, a 3-positions disconnector (or switch-disconnector) upstream the circuit-breaker, a 2nd earthing-switch downstream the circuit-breaker and a VDIS on the cable side.</p> <p>Both earthing-switches are operated independently.</p> <p>Both earthing-switches have the full short-circuit making capacity.</p> <p>The closing operation of the disconnector (or switch-disconnector) is interlocked with the position of both earthing-switches (by design for the one upstream the circuit-breaker) and reversely.</p> <p>The operation of the disconnector is interlocked with the position of the circuit-breaker.</p>
<p style="text-align: center;">DKG5</p> 	<p>DKG5</p> <p>FU feeder with a circuit-breaker, a cable connection, a 3-positions disconnector (or switch-disconnector) upstream the circuit-breaker on the busbar side, an earthing-switch downstream the circuit-breaker and a VDIS on the cable side.</p> <p>Both earthing-switches are operated independently.</p> <p>The closing operation of the disconnector (or switch-disconnector) is interlocked with the position of both earthing-switches (by design for the one upstream the circuit-breaker) and reversely.</p> <p>The operation of the disconnector is interlocked with the position of the circuit-breaker.</p>
<p style="text-align: center;">DBG5</p> 	<p>DBG5</p> <p>FU feeder with a circuit-breaker, with upper busbar section, a lower busbar connection, a 3-positions disconnector (or switch-disconnector) upstream the circuit-breaker, a 2nd earthing-switch downstream the circuit-breaker and a VDIS on the lower busbar side.</p> <p>Both earthing-switches are operated independently.</p> <p>The closing operation of the disconnector (or switch-disconnector) is interlocked with the position of both earthing-switches (by design for the one upstream the circuit-breaker) and reversely.</p> <p>The operation of the disconnector is interlocked with the position of the circuit-breaker.</p>

<p style="text-align: center;">DKN7</p> 	<p>DKN7 FU feeder with a circuit-breaker, a cable connection, a 3-positions disconnector (or switch-disconnector) downstream the circuit-breaker and a VDIS on the cable side. The earthing-switch has the full short-circuit making capacity. The closing operation of the disconnector (or switch-disconnector) is by design interlocked with the position of the earthing-switch and reversely. The operation of the disconnector is interlocked with the position of the circuit-breaker. This FU is only allowed in GIS.</p>
<p style="text-align: center;">DKG7</p> 	<p>DKG7 FU feeder with a circuit-breaker, a cable connection, a 3-positions disconnector (or switch-disconnector) downstream the circuit-breaker and a VDIS on the cable side. The closing operation of the disconnector (or switch-disconnector) is by design interlocked with the position of the earthing-switch and reversely. The operation of the disconnector is interlocked with the position of the circuit-breaker. This FU is only allowed in GIS.</p>



DKN9

FU feeder with a circuit-breaker, a cable connection, a 3-positions disconnecter (or switch-disconnector) upstream the circuit-breaker and a VDIS on the cable side.

Earthing of the cable side is carried out by closing the circuit-breaker and the earthing-switch. An auxiliary contact of the earthing-switch automatically deactivates the overcurrent protection and prevents remote controlled opening operation of the circuit-breaker as soon as the earthing-switch is closed (by interrupting the trip coil circuit).

The earthing operation of the cable side can operate the circuit-breaker and the earthing-switch together or sequentially.

The earthing-switch has the full short-circuit making capacity.

The earthing-switch shall close after the circuit-breaker.

In the case of combined operation of the earthing-switch together with the circuit-breaker, the earthing operation shall be interlocked when the circuit-breaker is closed.

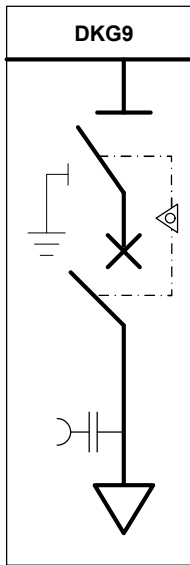
In the case of sequential operations of the circuit-breaker and of the earthing-switch, both closing and opening operations of the earthing-switch shall be interlocked when the circuit-breaker is opened.

The closing operation of the disconnecter (or switch-disconnector) is by design interlocked with the position of the earthing-switch and reversely.

The operation of the disconnecter is interlocked with the position of the circuit-breaker.

If the CTs are mounted on the bushings, to allow primary current injection, either there shall be no mechanical interlock preventing to operate the circuit breaker when the earthing-switch is closed, or this FU shall be equipped with auxiliary circuits/windings allowing to carry out a primary current injection through the CTs from outside the lower busbar compartment to test the complete protection without needing access and any earthing.

This FU is only allowed in GIS.



DKG9

FU feeder with a circuit-breaker, a cable connection, a 3-positions disconnecter (or switch-disconnector) upstream the circuit-breaker and a VDIS on the cable side.

Earthing of the cable side is carried out by closing the circuit-breaker and the earthing-switch. An auxiliary contact of the earthing-switch automatically deactivates the overcurrent protection and prevents remote controlled opening operation of the circuit-breaker as soon as the earthing-switch is closed (by interrupting the trip coil circuit).

The earthing operation of the cable side can operate the circuit-breaker and the earthing-switch together or sequentially.

The earthing-switch shall close after the circuit-breaker.

In the case of combined operation of the earthing-switch together with the circuit-breaker, the earthing operation shall be interlocked when the circuit-breaker is closed.

In the case of sequential operations of the circuit-breaker and of the earthing-switch, both closing and opening operations of the earthing-switch shall be interlocked when the circuit-breaker is opened.

The closing operation of the disconnecter (or switch-disconnector) is by design interlocked with the position of the earthing-switch and reversely.

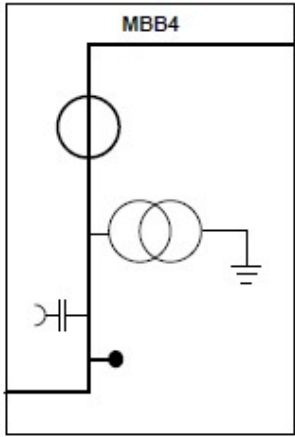
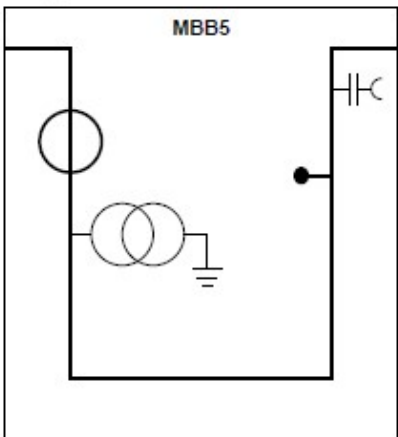
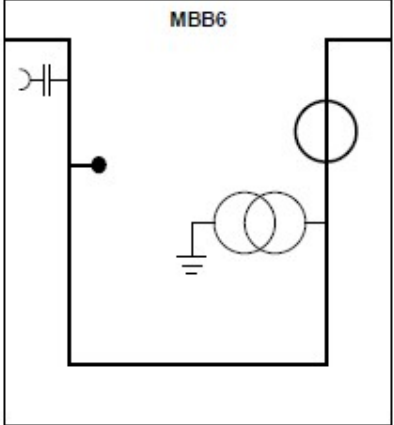
The operation of the disconnecter is interlocked with the position of the circuit-breaker.

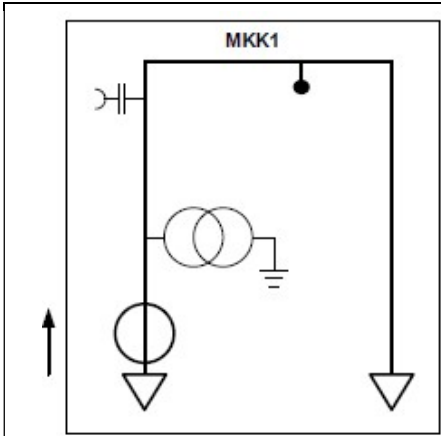
If the CTs are mounted on the bushings, to allow primary current injection, either there shall be no mechanical interlock preventing to operate the circuit breaker when the earthing-switch is closed, or this FU shall be equipped with auxiliary circuits/windings allowing to carry out a primary current injection through the CTs from outside the lower busbar compartment to test the complete protection without needing access and any earthing.

This FU is only allowed in GIS.

3.5 F.U. type M

<p>Diagram MBB1 shows a rectangular enclosure with a busbar at the top. The input is at the lower left side, and the output is at the upper right side. The circuit includes a metering CT, a VDIS, and three phase-to-earth metering VTs connected to ground.</p>	<p>MBB1 FU metering for billing with busbar input at lower left side and busbar output at upper right side. . The FU consist of:</p> <ul style="list-style-type: none"> - 3 metering CTs with terminal P1 connected to the input side - 3 phase-to-earth metering VTs connected downstream the CTs (on the P2 terminal side) - a VDIS on the output side - in case of AIS: 3 earthing bolts between the VTs and the output side plus 1 earthing bolt on the enclosure.
<p>Diagram MBB2 shows a rectangular enclosure with a busbar at the top. The input is at the lower right side, and the output is at the upper left side. The circuit includes a metering CT, a VDIS, and three phase-to-earth metering VTs connected to ground.</p>	<p>MBB2 FU metering for billing with busbar input at lower right side and busbar output at upper left side. The FU consist of:</p> <ul style="list-style-type: none"> - 3 metering CTs with terminal P1 connected to the input side - 3 phase-to-earth metering VTs connected downstream the CTs (on the P2 terminal side) - a VDIS on the output side - in case of AIS: 3 earthing bolts between the VTs and the output side plus 1 earthing bolt on the enclosure
<p>Diagram MBB3 shows a rectangular enclosure with a busbar at the top. The input is at the upper left side, and the output is at the lower right side. The circuit includes a metering CT, a VDIS, and three phase-to-earth metering VTs connected to ground.</p>	<p>MBB3 FU metering for billing with busbar input at upper left side and busbar output at lower right side. . The FU consist of:</p> <ul style="list-style-type: none"> - 3 metering CTs with terminal P1 connected to the input side - 3 phase-to-earth metering VTs connected downstream the CTs (on the P2 terminal side) - a VDIS on the output side - in case of AIS: 3 earthing bolts between the VTs and the output side plus 1 earthing bolt on the enclosure

	<p>MBB4 FU metering for billing with busbar input at upper right side and busbar output at lower left side.</p> <p>The FU consist of:</p> <ul style="list-style-type: none"> - 3 metering CTs with terminal P1 connected to the input side - 3 phase-to-earth metering VTs connected downstream the CTs (on the P2 terminal side) - a VDIS on the output side - in case of AIS: 3 earthing bolts between the VTs and the output side plus 1 earthing bolt on the enclosure
	<p>MBB5 FU metering for billing with busbar input at upper left side and busbar output at upper right side.</p> <p>The FU consist of:</p> <ul style="list-style-type: none"> - 3 metering CTs with terminal P1 connected to the input side - 3 phase-to-earth metering VTs connected downstream the CTs (on the P2 terminal side) - a VDIS on the output side - in case of AIS: 3 earthing bolts between the VTs and the output side plus 1 earthing bolt on the enclosure
	<p>MBB6 FU metering for billing with busbar input at upper right side and busbar output at upper left side.</p> <p>The FU consist of:</p> <ul style="list-style-type: none"> - 3 metering CTs with terminal P1 connected to the input side - 3 phase-to-earth metering VTs connected downstream the CTs (on the P2 terminal side) - a VDIS on the output side - in case of AIS: 3 earthing bolts between the VTs and the output side plus 1 earthing bolt on the enclosure

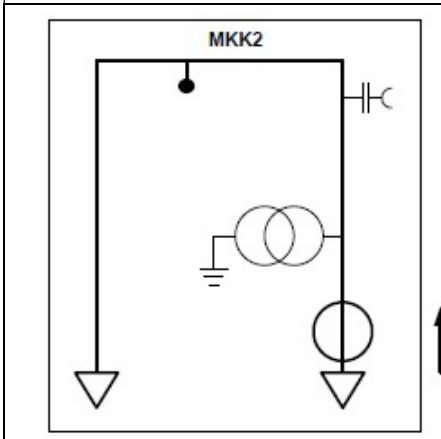


MKK1

FU metering for billing with cable input at lower left or front side and cable output at lower right or rear side.

The FU consist of:

- 3 metering CTs with terminal P1 connected to the input side
- 3 phase-to-earth metering VTs connected downstream the CTs (on the P2 terminal side)
- a VDIS on the output side
- in case of AIS: 3 earthing bolts between the VTs and the output side plus 1 earthing bolt on the enclosure



MKK2

FU metering for billing with cable input at lower right or rear side and cable output at upper left or front side.

The FU consist of:

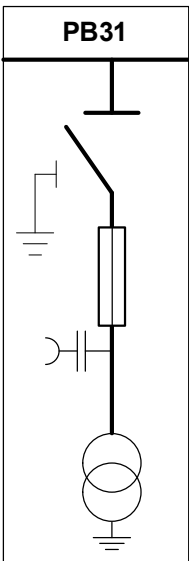
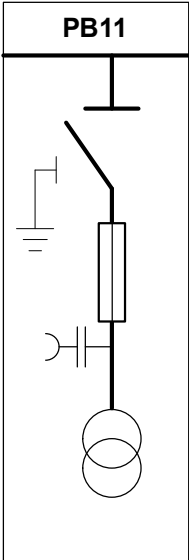
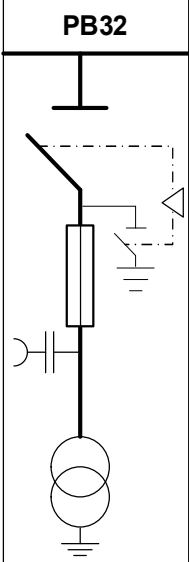
- 3 metering CTs with terminal P1 connected to the input side
- 3 phase-to-earth metering VTs connected downstream the CTs (on the P2 terminal side)
- a VDIS on the output side
- in case of AIS: 3 earthing bolts between the VTs and the output side plus 1 earthing bolt on the enclosure

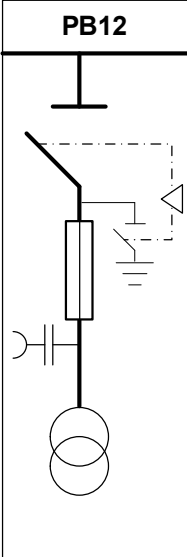
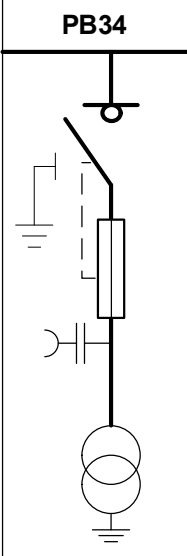
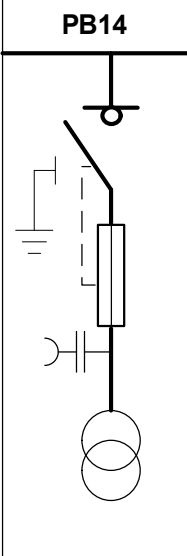
	<p>MBK1 FU metering for billing with busbar input at upper left side and cable output at lower side. The FU consist of:</p> <ul style="list-style-type: none"> - 3 metering CTs with terminal P1 connected to the input side - 3 phase-to-earth metering VTs connected downstream the CTs (on the P2 terminal side) - a VDIS on the output side - in case of AIS: 3 earthing bolts between the VTs and the output side plus 1 earthing bolt on the enclosure.
	<p>MBK2 FU metering for billing with busbar input at upper right side and cable output at lower side. The FU consist of:</p> <ul style="list-style-type: none"> - 3 metering CTs with terminal P1 connected to the input side - 3 phase-to-earth metering VTs connected downstream the CTs (on the P2 terminal side) - a VDIS on the output side - in case of AIS: 3 earthing bolts between the VTs and the output side plus 1 earthing bolt on the enclosure.
	<p>MBK3 FU metering for billing with busbar input at lower left side and cable output at lower right side. The FU consist of:</p> <ul style="list-style-type: none"> - 3 metering CTs with terminal P1 connected to the input side - 3 phase-to-earth metering VTs connected downstream the CTs (on the P2 terminal side) - a VDIS on the output side - in case of AIS: 3 earthing bolts between the VTs and the output side plus 1 earthing bolt on the enclosure.
	<p>MBK4 FU metering for billing with busbar input at lower right side and cable output at lower left side. The FU consist of:</p> <ul style="list-style-type: none"> - 3 metering CTs with terminal P1 connected to the input side - 3 phase-to-earth metering VTs connected downstream the CTs (on the P2 terminal side) - a VDIS on the output side - in case of AIS: 3 earthing bolts between the VTs and the output side plus 1 earthing bolt on the enclosure.

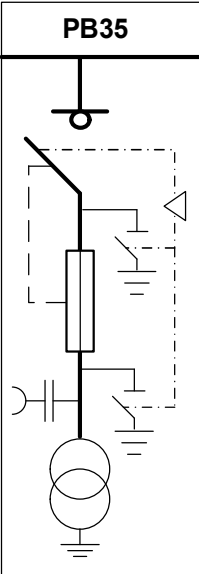
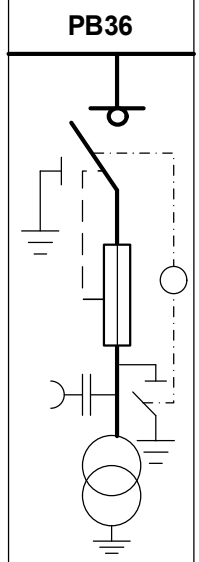
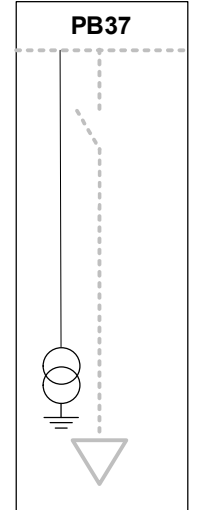
	<p>MKB1 FU metering for billing with cable input at lower side and busbar output at upper left side. The FU consist of:</p> <ul style="list-style-type: none"> - 3 metering CTs with terminal P1 connected to the input side - 3 phase-to-earth metering VTs connected downstream the CTs (on the P2 terminal side) - a VDIS on the output side - in case of AIS: 3 earthing bolts between the VTs and the output side plus 1 earthing bolt on the enclosure.
	<p>MKB2 FU metering for billing with cable input at lower side and busbar output at upper right side. The FU consist of:</p> <ul style="list-style-type: none"> - 3 metering CTs with terminal P1 connected to the input side - 3 phase-to-earth metering VTs connected downstream the CTs (on the P2 terminal side) - a VDIS on the output side - in case of AIS: 3 earthing bolts between the VTs and the output side plus 1 earthing bolt on the enclosure.
	<p>MKB3 FU metering for billing with cable input at lower left side and busbar output at lower right side. The FU consist of:</p> <ul style="list-style-type: none"> - 3 metering CTs with terminal P1 connected to the input side - 3 phase-to-earth metering VTs connected downstream the CTs (on the P2 terminal side) - a VDIS on the output side - in case of AIS: 3 earthing bolts between the VTs and the output side plus 1 earthing bolt on the enclosure.
	<p>MKB4 FU metering for billing with cable input at lower right side and busbar output at lower left side. The FU consist of:</p> <ul style="list-style-type: none"> - 3 metering CTs with terminal P1 connected to the input side - 3 phase-to-earth metering VTs connected downstream the CTs (on the P2 terminal side) - a VDIS on the output side - in case of AIS: 3 earthing bolts between the VTs and the output side plus 1 earthing bolt on the enclosure

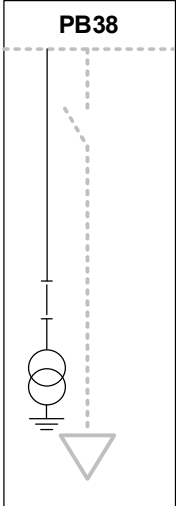
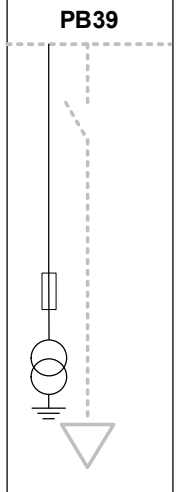
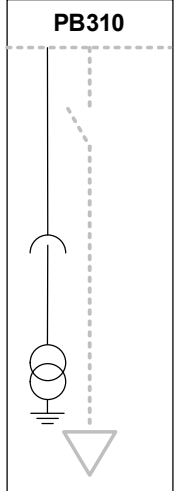
3.6 F.U. type P

A voltage metering function P can be a standalone Functional Unit or a secondary function integrated in a functional unit with another main function.

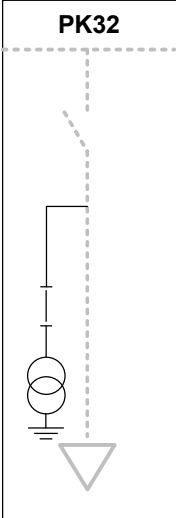
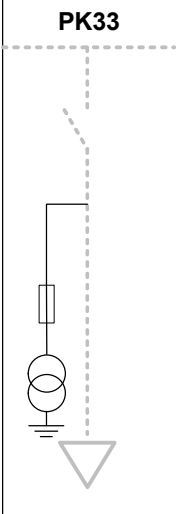
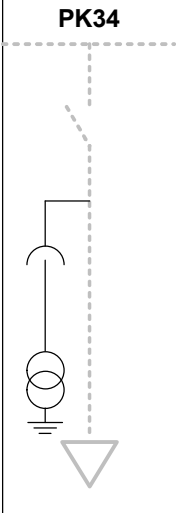
 <p style="text-align: center;">PB31</p>	<p>PB31 FU busbar voltage metering with 3 phase-to-earth metering voltage transformers protected by fuses, connected to the busbar through a 3-positions disconnector (or switch-disconnector) and with a VDIS just above the transformer connections. The earthing-switch has no short-circuit making capacity. The closing operation of the disconnector (or switch-disconnector) is by design interlocked with the position of the earthing-switch and reversely.</p>
 <p style="text-align: center;">PB11</p>	<p>PB11 FU auxiliary power supply with 1 phase-to-phase voltage transformer protected by fuses, connected to the busbar through a 3-positions disconnector(or switch- disconnector) and with a VDIS just above the transformer connection. The earthing-switch has no short-circuit making capacity. The closing operation of the disconnector (or switch-disconnector) is by design interlocked with the position of the earthing-switch and reversely. This FU is only allowed in AIS.</p>
 <p style="text-align: center;">PB32</p>	<p>PB32 FU busbar voltage metering with 3 phase-to-earth metering voltage transformers protected by fuses, connected to the busbar through a disconnector (or switch-disconnector), with an earthing-switch just above the fuses and a VDIS just above the transformer connections. The earthing-switch has no short-circuit making capacity. The closing operation of the disconnector (or switch-disconnector) is interlocked with the position of the earthing-switch and reversely. This FU is only allowed in AIS.</p>

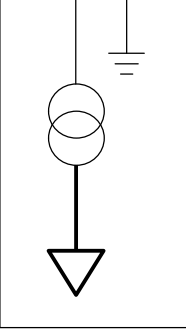
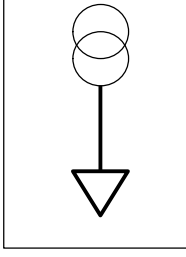
<p style="text-align: center;">PB12</p> 	<p>PB12</p> <p>FU auxiliary power supply with one phase-to-phase voltage transformer protected by fuses, connected to the busbar through a disconnector (or switch-disconnector), with an earthing-switch just above the fuses and a VDIS just above the transformer connection.</p> <p>The earthing-switch has no short-circuit making capacity.</p> <p>The closing operation of the disconnector (or switch-disconnector) is interlocked with the position of the earthing-switch and reversely.</p> <p>This FU is only allowed in AIS.</p>
<p style="text-align: center;">PB34</p> 	<p>PB34</p> <p>FU busbar voltage metering with 3 phase-to-earth metering voltage transformers, connected to the busbar through a 3-positions switch-fuse combination and with a VDIS just above the transformer connections.</p> <p>The earthing-switch has no short-circuit making capacity.</p> <p>The closing operation of the switch-disconnector is by design interlocked with the position of the earthing-switch and reversely.</p>
<p style="text-align: center;">PB14</p> 	<p>PB14</p> <p>FU auxiliary power supply with one phase-to-phase voltage transformer, connected to the busbar through a 3-positions switch--fuse combination and with a VDIS just above the transformer connection.</p> <p>The earthing-switch has no short-circuit making capacity.</p> <p>The closing operation of the switch-disconnector is by design interlocked with the position of the earthing-switch and reversely.</p> <p>This FU is only allowed in AIS.</p>

<p style="text-align: center;">PB35</p> 	<p>PB35 FU busbar voltage metering with 3 phase-to-earth metering voltage transformers, connected to the busbar through a switch—fuse combination, with an earthing-switch just above the fuses, an earthing-switch below the fuses and a VDIS just above the transformer connections. Both earthing-switches are operated together by one common mechanism. Both earthing-switches have no short-circuit making capacity. The closing operation of the switch-disconnector is interlocked with the position of the earthing-switches and reversely. This FU is only allowed in AIS.</p>
<p style="text-align: center;">PB36</p> 	<p>PB36 FU busbar voltage metering with 3 phase-to-earth metering voltage transformers, connected to the busbar through a 3-positions switch-fuse combination, an earthing-switch below the fuses and a VDIS just above the transformer connections. Both earthing-switches are operated together by one common mechanism. Both earthing-switches have no short-circuit making capacity. The closing operation of the switch-disconnector is by design interlocked with the position of the earthing-switches and reversely.</p>
<p style="text-align: center;">PB37</p> 	<p>PB37 Busbar voltage metering function with 3 phase-to-earth metering voltage transformers connected to the busbar by means of bolted connections. This function may only exist as a secondary function in/on a FU with another type of main function. It is only allowed in AIS.</p>

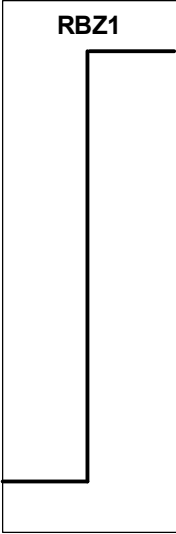
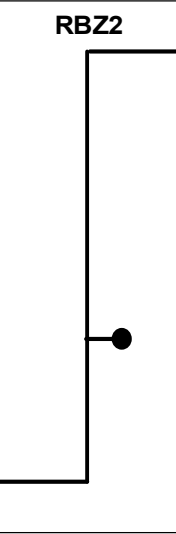
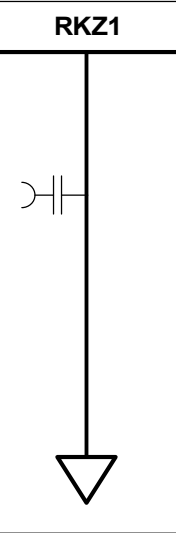
<p style="text-align: center;">PB38</p> 	<p>PB38 Busbar voltage metering function with 3 phase-to-earth metering voltage transformers connected to the busbar by means of removable conductors. This function may only exist as a secondary function in/on a FU with another type of main function. It is only allowed in AIS.</p>
<p style="text-align: center;">PB39</p> 	<p>PB39 Busbar voltage metering function with 3 phase-to-earth metering voltage transformers connected to the busbar by means of fuses. This function may only exist as a secondary function in/on a FU with another type of main function. It is only allowed in AIS.</p>
<p style="text-align: center;">PB310</p> 	<p>PB310 Busbar voltage metering Function with 3 phase-to-earth metering voltage transformers plugged into the busbar. The transformers are individually enclosed in an earthed metal enclosure. This function may only exist as a secondary function in/on a FU with another type of main function. If it is placed over another FU, the protection degree IP2X-D shall be ensured, eventually by means of an additional metal enclosure if necessary. It is only allowed in GIS.</p>

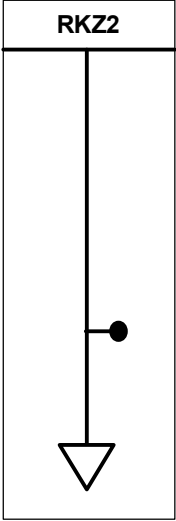
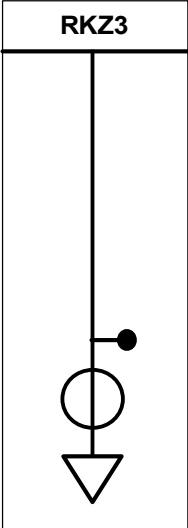
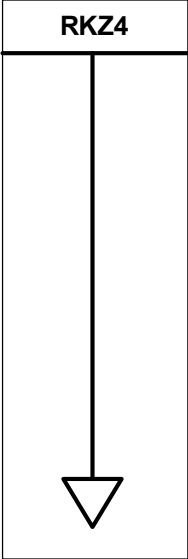
	<p>PB314</p> <p>FU voltage metering with 3 phase-to-earth metering voltage transformers protected by fuses, connected to the busbar through a switch-disconnector, with 2 earthing-switches (one just above and one below the fuses) and a VDIS just above the transformer connections.</p> <p>Both earthing-switches are operated together by one common mechanism.</p> <p>Both earthing-switches have no short-circuit making capacity.</p> <p>The closing operation of the switch-disconnector is interlocked with the position of the earthing-switches and reversely.</p> <p>This FU is only allowed in AIS.</p>
	<p>PB114</p> <p>FU auxiliary power supply with one phase-to-phase voltage transformer protected by fuses, connected to the busbar through a switch-disconnector, with 2 earthing-switches (one just above and one below the fuses) and a VDIS just above the transformer connection.</p> <p>Both earthing-switches are operated together by one common mechanism.</p> <p>Both earthing-switches have no short-circuit making capacity.</p> <p>The closing operation of the switch-disconnector is interlocked with the position of the earthing-switches and reversely.</p> <p>This FU is only allowed in AIS.</p>
	<p>PK31</p> <p>Cable voltage metering function with 3 phase-to-earth metering voltage transformers connected to the main circuit on the cable side by means of bolted connections.</p> <p>This function may only exist as a secondary function in a FU with another type of main function.</p> <p>It is only allowed in AIS.</p> <p>It is only allowed in FUs KKUx or DKUx downstream the general protection of a DSU installation.</p>

<p style="text-align: center;">PK32</p> 	<p>PK32 Cable voltage metering function with 3 phase-to-earth metering voltage transformers connected to the main circuit on the cable side by means of removable conductors. This function may only exist as a secondary function in a FU with another type of main function. It is only allowed in AIS.</p>
<p style="text-align: center;">PK33</p> 	<p>PK33 Cable voltage metering function with 3 phase-to-earth metering voltage transformers connected to the main circuit on the cable side by means of fuses. This function may only exist as a secondary function in a FU with another type of main function. It is only allowed in AIS.</p>
<p style="text-align: center;">PK34</p> 	<p>PK34 Cable voltage metering function with 3 phase-to-earth metering voltage transformers plugged into the main circuit on the cable side. The transformers are individually enclosed in an earthed metal enclosure. This function may only exist as a secondary function in a FU with another type of main function. It is only allowed in GIS. It is only allowed in FUs KKUx or DKUx downstream the general protection of a DSU installation.</p>

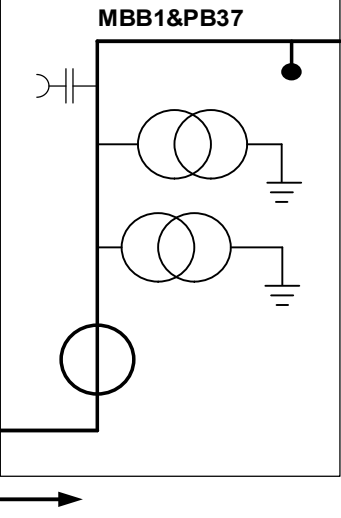
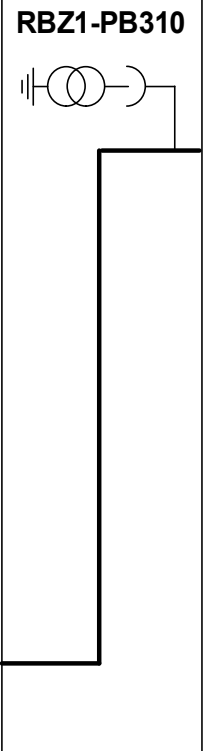
<p style="text-align: center;">PK38</p> 	<p>PK38 FU voltage metering with 3 metal-enclosed phase-to-earth voltage transformers each with an outer cone for a screened plug cable connection. This FU is only allowed to be connected downstream a dedicated switch-fuse combination.</p>
<p style="text-align: center;">PK11</p> 	<p>PK11 FU voltage transformer with 1 air-insulated phase-to-phase voltage transformer with terminals for air-insulated cable connection. This FU is only allowed to be connected downstream a dedicated switch-fuse combination.</p>

3.7 F.U. type R

	<p>RBZ1 FU busbar riser.</p> <p>A standalone FU is only allowed:</p> <ul style="list-style-type: none">• in GIS technology.• in AIS in combination with a function/FU allowing earthing of the accessible circuit.
	<p>RBZ2 FU busbar riser with earthing bolts on the each phase and on the enclosure.</p>
	<p>RKZ1 FU cable riser with a VDIS.</p> <p>A standalone FU is only allowed:</p> <ul style="list-style-type: none">• in GIS• in AIS only in combination with a function allowing earthing of the accessible circuit.

	<p>RKZ2 FU cable riser with earthing bolts on each phase as well as on the enclosure.</p>
	<p>RKZ3 FU cable riser with current transformers and with earthing bolts on each phase as well as on the enclosure.</p>
	<p>RKZ4 FU cable riser. A standalone FU alone is allowed:</p> <ul style="list-style-type: none"> • in GIS • in AIS only in combination with a function allowing earthing of the accessible circuit.

3.8 Combinations of FUs

<p>MBB1&PB37</p>  <p>The diagram shows a circuit with an input terminal on the left. A line goes up and then right to a terminal with a solid dot. Below this, there are two parallel branches, each containing a transformer symbol (two overlapping circles) connected to a ground symbol. Below these is a single transformer symbol. A line goes down from the bottom of the transformer symbols, then left, then down, then left, and finally right to an arrow pointing to the right.</p>	<p>MBB1 & PB37</p> <p>In case of a second set of 3 phase-to-earth VTs is installed in a FU metering, the extra code "& PB37" must be added behind the main code Mxxx.</p>
<p>RBZ1-PB310</p>  <p>The diagram shows a circuit with an input terminal on the left. A line goes up and then right to a transformer symbol (two overlapping circles). From the right side of the transformer, a line goes right, then down, then left, then down, then left, and finally right to an arrow pointing to the right.</p>	<p>RBZ1 - PB310</p> <p>This combination is only allowed in GIS, and only downstream a general protection of a DSU installation.</p>

C2/119

Part 2

Coding of FUs intended for use in DSU installations directly connected to a DSO substation and in installations for DSO a substation

(Under study)

The (new) coding of FUS intended for use in DSU installations directly connected to a DSO substation and intended for use in installations for a DSO substation is currently under study.