



# CONTROL PANEL DESIGN

Our panel manufacturing facility caters for panels ranging from Form 1 to Form 4 including panels for use in hazardous areas. The panels are built from approved electrical panel design drawings, which detail all components in a parts list, cable schedules and sizes, terminal numbers, etc. All the drawings are produced using AutoCAD and are capable of being emailed in PDF or original format. A dimensional drawing of the internal and external panel enclosure with any display or identification labels, lights, etc., will be fully detailed. When appropriate the panel will include for the customers "Free Issue" control equipment and customers logo, and drawing/label identification or serial numbers. The panel design, manufacturing and testing procedures are fully covered to BS EN ISO 9000:2000.

RACE Integrated can provide a complete range of the following types of control panel enclosures.

## INTERNAL FORM OF SEPARATION

IEC 60439-1: 1999, Annex D, gives the following guidelines for the different separation types.

One or more of the following conditions can be obtained by dividing ASSEMBLIES by means of partitions or barriers (metallic or non-metallic) into separate compartments or enclosed protected spaces:

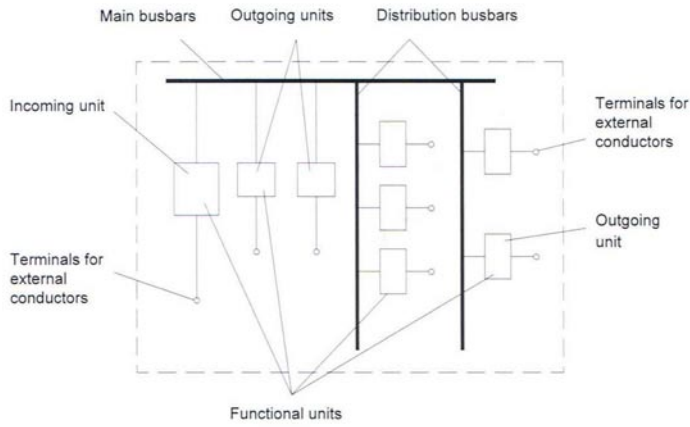
- Protection against contact with hazardous parts belonging to the adjacent functional units. The degree of protection shall be at least IPXXB.
- Protection against the passage of solid foreign bodies from one unit of an ASSEMBLY to an adjacent unit. The degree of protection shall be at least IP2X.

Unless otherwise stated by the manufacturer, both conditions shall apply.

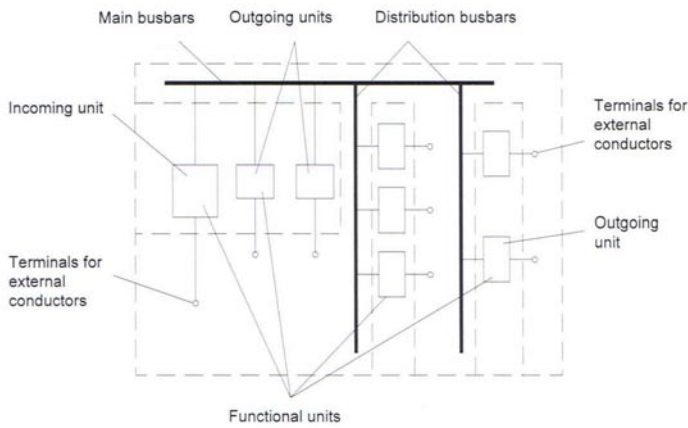
NOTE:

The degree of protection IP2X covers the degree of protection IPXXB

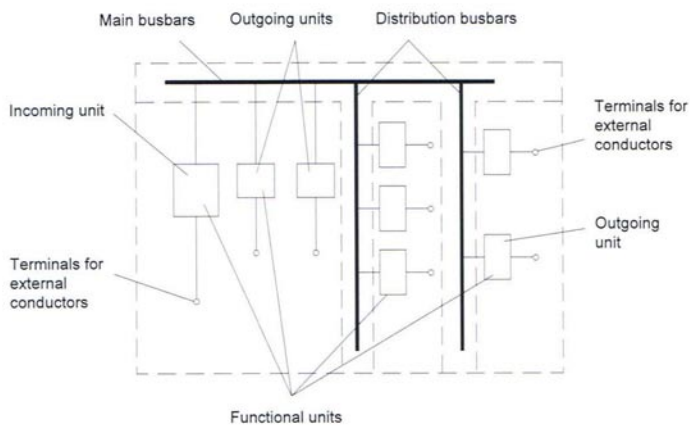
The following are typical forms of separation by partitions:



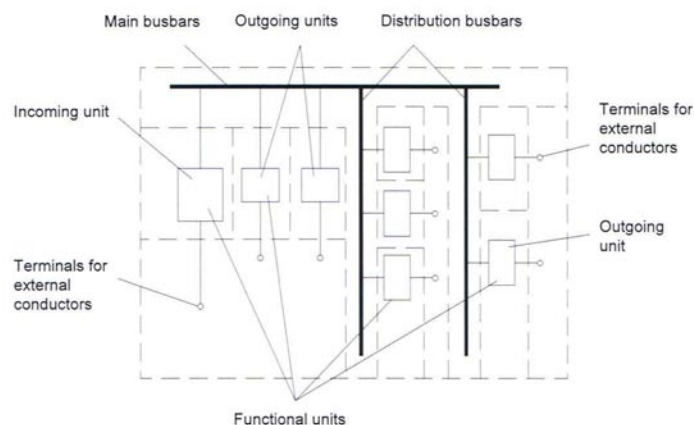
**FORM 1**  
No separation



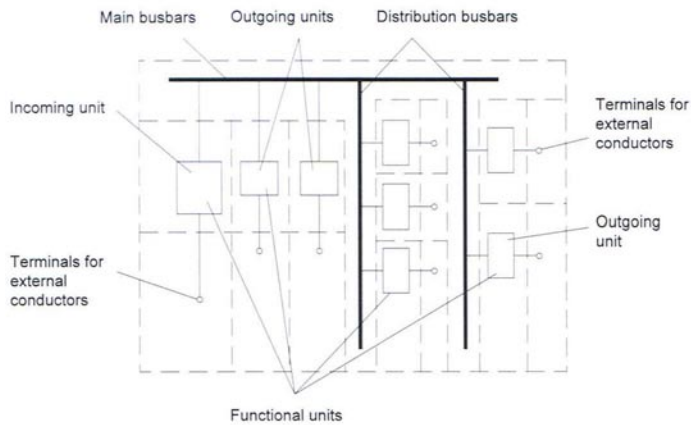
**FORM 2A**  
Separation of busbars from the functional units. The terminals for external conductors do not need to be separated from the busbars.



**FORM 2B**  
Separation of busbars from the functional units. The terminals for external conductors are separated from the busbars.

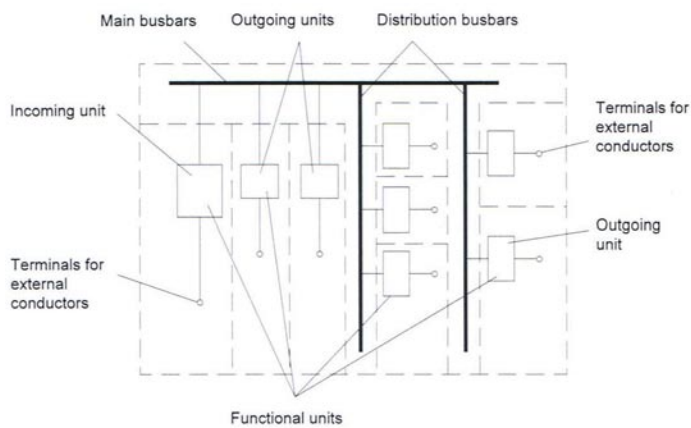


**FORM 3A**  
Separation of busbars from the functional units and separation of all functional units from one another. Separation of the terminals for external conductors from the units, but not from each other. The terminals for external conductors do not need to be separated from the busbars.



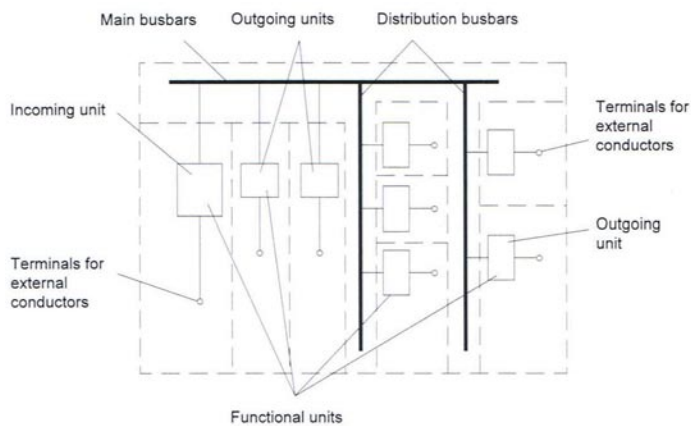
### FORM 3B

Separation of busbars from the functional units and separation of all functional units from one another. Separation of the terminals for external conductors from the units, but not from each other. The terminals for external conductors are separated from the busbars.



### FORM 4A

Separation of busbars from the functional units and separation of all functional units from one another, including the terminals for external conductors which are an integral part of the functional unit. Terminals for external conductors are in the same compartment as the associated functional unit.



### FORM 4B

Separation of busbars from the functional units and separation of all functional units from one another, including the terminals for external conductors which are an integral part of the functional unit. Terminals for external conductors are not in the same compartment as the associated functional unit, but in individual, separate, enclosed protected spaces or compartments.

The form of separation and higher degrees of protection shall be subject to an agreement between the manufacturer and the user.

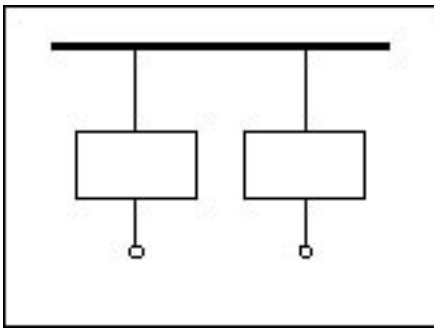
### The UK National annex to BS EN 60439-1: 1999

The internal separation of assemblies by barriers or partitions is specified in 7.7, and is subject to agreement between the manufacturer and the user.

Table NA1 gives additional information regarding different types of construction, based on typical practice in the United Kingdom. Other types of construction are not precluded, and it is not essential to adopt any of the listed types in order to comply with the requirements of this British Standard. However, in order to achieve agreement between manufacturers and users, it is recommended to adopt any of the listed types of construction.

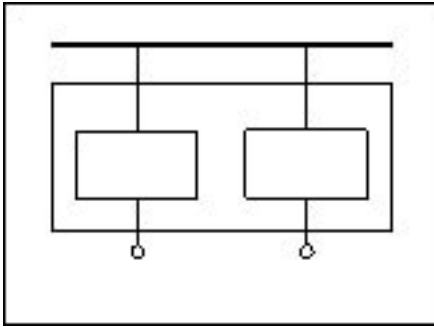
**Table NA.1 Forms of separation**

<b>Main criteria</b>	<b>Sub-criteria</b>	<b>Form</b>	<b>Type of construction</b>
No separation		Form 1	
Separation of busbars from the functional units.	Terminals for external conductors not separated from busbars.	Form 2a	
	Terminals for external conductors separated from busbars.	Form 2b	Type 1 Busbar separation is achieved by insulated covering e.g. sleeving, wrapping or coatings.
			Type 2 Busbar separation is by metallic or non-metallic rigid barriers or partitions.
Separation of busbars from the functional units and separation of all functional units from one another. Separation of the terminals for external conductors from the functional units, but not from each other.	Terminals for external conductors not separated from busbars.	Form 3a	
	Terminals for external conductors separated from busbars.	Form 3b	Type 1 Busbar separation is achieved by insulated coverings, e.g. sleeving, wrapping or coatings.
			Type 2 Busbar separation is by metallic or non-metallic rigid barriers or partitions.
Separation of busbars from the functional units and separation of all functional units from one another, including the terminals for external conductors which are an integral part of the functional unit.	Terminals for external conductors in same compartment as associated functional unit.	Form 4a	Type 1 Busbar separation is achieved by insulated coverings, e.g. sleeving, wrapping or coatings. Cables may be glanded elsewhere.
			Type 2 Busbar separation is by metallic or non-metallic rigid barriers or partitions. Cables may be glanded elsewhere.
			Type 3 Busbar separation is by metallic or non-metallic rigid barriers or partitions. The termination of each functional unit has its own integral glanding facility.
	Terminals for external conductors not in same compartment as the associated functional unit, but in individual, separate, enclosed protected spaces or compartments.	Form 4b	Type 4 Busbar separation is achieved by insulated coverings, e.g. sleeving, wrapping or coatings. Cables may be glanded elsewhere.
			Type 5 Busbar separation is by metallic or non-metallic rigid barriers or partitions. Terminals may be separated by insulated coverings and glanded in common cabling chamber(s).
			Type 6 All separation requirements are by metallic or non-metallic rigid barriers or partitions. Cables are glanded in common cabling chamber(s).
			Type 7 All separation requirements are by metallic or non-metallic rigid barriers or partitions. The termination for each functional unit has its own integral glanding facility.



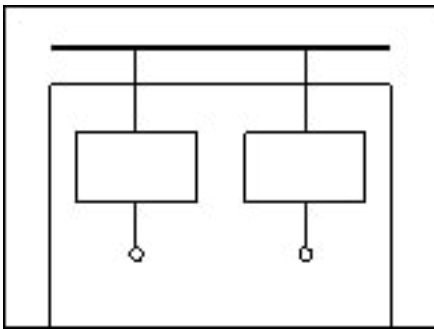
Form 1

No internal separation.



Form 2a

Separation of busbars from the functional units.  
**Terminal NOT separated from busbars.**

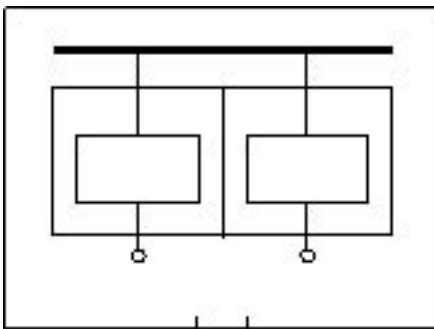


Form 2b - Types 1 & 2

Separation of busbars from the functional units.  
**Terminals separated from busbars.**

**Type 1:** Busbar separation by insulated coverings e.g. sleeving, wrapping or coatings.

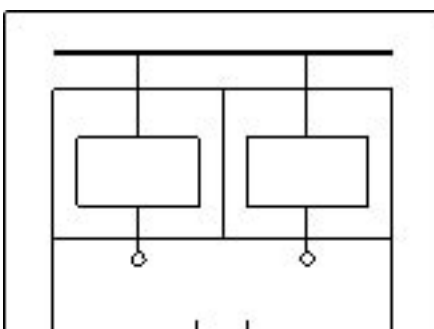
**Type 2:** Busbar separations by metallic or non metallic rigid barriers or partitions.



Form 3a

Separation of busbars from the functional units.  
 Separation of functional units from one another.  
 Separation of terminals from functional units but not from each other.

**Terminals NOT separated from busbars.**



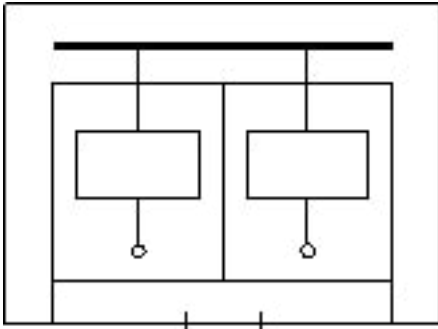
Form 3b - Types 1 & 2

Separation of busbars from the functional units.  
 Separation of functional units from one another.  
 Separation of terminals from functional units but not from each other.

**Terminals separated from busbars.**

**Type 1:** Busbar separation by insulated coverings e.g. sleeving, wrapping or coatings.

**Type 2:** Busbar separations by metallic or non-metallic rigid barriers or partitions.



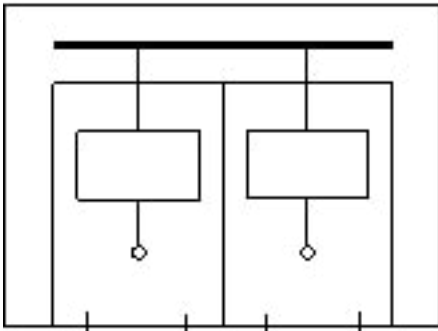
Form 4a - Types 1 & 2

Separation of busbars from the functional units.  
 Separation of functional units from one another.  
 Separation of terminals of functional units.

**Terminals in same compartment as functional units.**

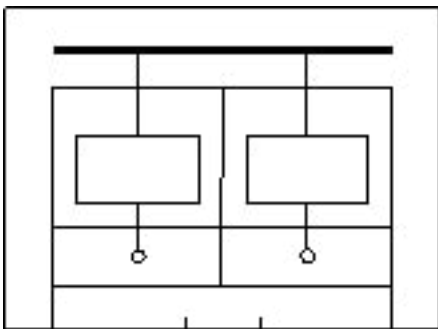
**Type 1:** Busbar separation by insulated coverings e.g. sleeving, wrapping or coatings. Cables glanded elsewhere.

**Type 2:** Busbar separations by metallic or non metallic rigid barriers or partitions. Cables glanded elsewhere.



Form 4a - Type 3

**Type 3:** All separation by metallic or non-metallic rigid barriers or partitions. The terminals for each functional unit have their own integral glanding facility.



Form 4b - Types 4, 5 & 6

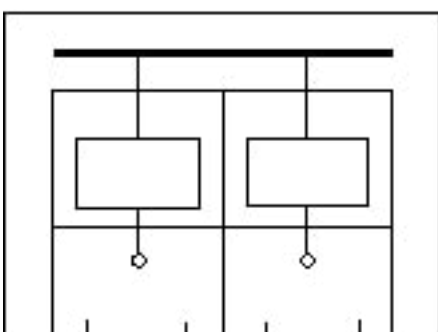
Separation of busbars from the functional units.  
 Separation of functional units from one another.  
 Separation of terminals of functional units.

**Terminals NOT in same compartment as functional unit.**

**Type 4:** Busbar separation by insulated coverings e.g. sleeving, wrapping or coatings. Cables glanded elsewhere.

**Type 5:** Busbar separations by metallic or non metallic rigid barriers or partitions. Terminals separated by insulated coverings. Cables glanded in common cabling chamber.

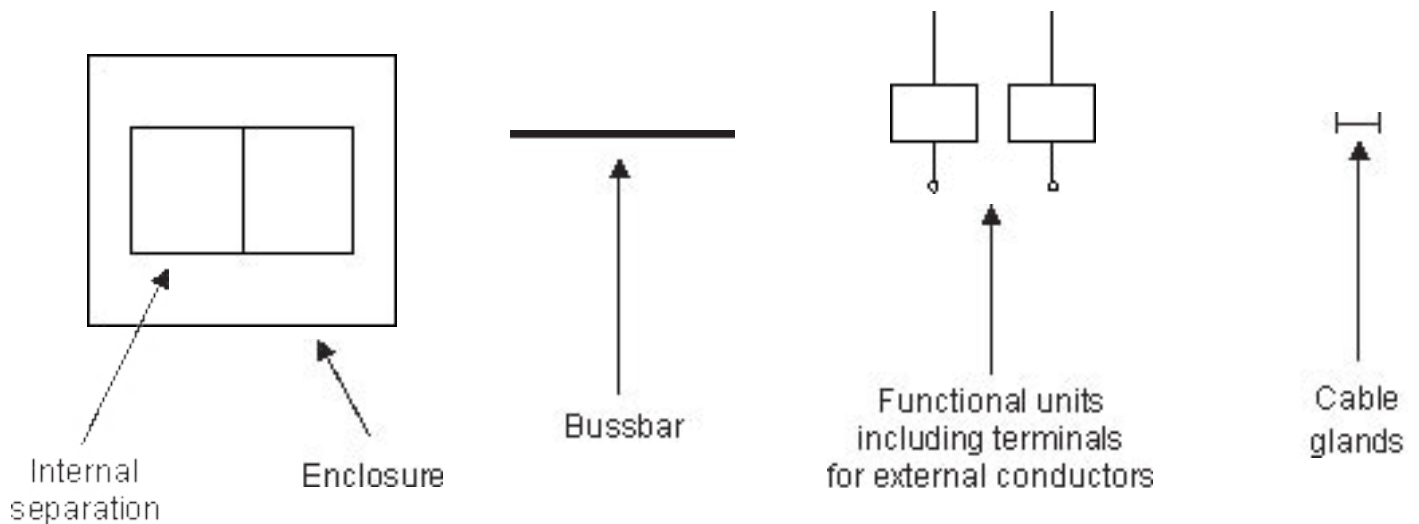
**Type 6:** All separation by metallic or non-metallic rigid barriers or partitions. Cables glanded in common cabling chamber.



Form 4b - Type 7

**Type 7:** All separation by metallic or non-metallic rigid barriers or partitions. The terminals for each functional unit have their own integral glanding facility.

## Symbol keys



## DEGREES OF PROTECTION

IEC 60529 describes the test conditions for the IP 54 protection as laid down in Sub-clause 7.5 (first characteristic numeral) and Sub-clause 8.4 (second characteristic numeral).

The following extract from the Standard gives an idea, but for more detailed information, please see this.

### DEGREE OF PROTECTION

First characteristic numeral	Short description	Second characteristic numeral	Short description
0	Non-protected	0	Non-protected
1	Protected against solid objects greater than 50 mm	1	Protected against dripping water
2	Protected against solid objects greater than 12 mm	2	Protected against dripping water when tilted up to 15°
3	Protected against solid objects greater than 2.5 mm	3	Protected against spraying water
4	Protected against solid objects greater than 1 mm	4	Protected against splashing water
5	Dust-protected	5	Protected against water jets
6	Dust-tight	6	Protected against heavy sea