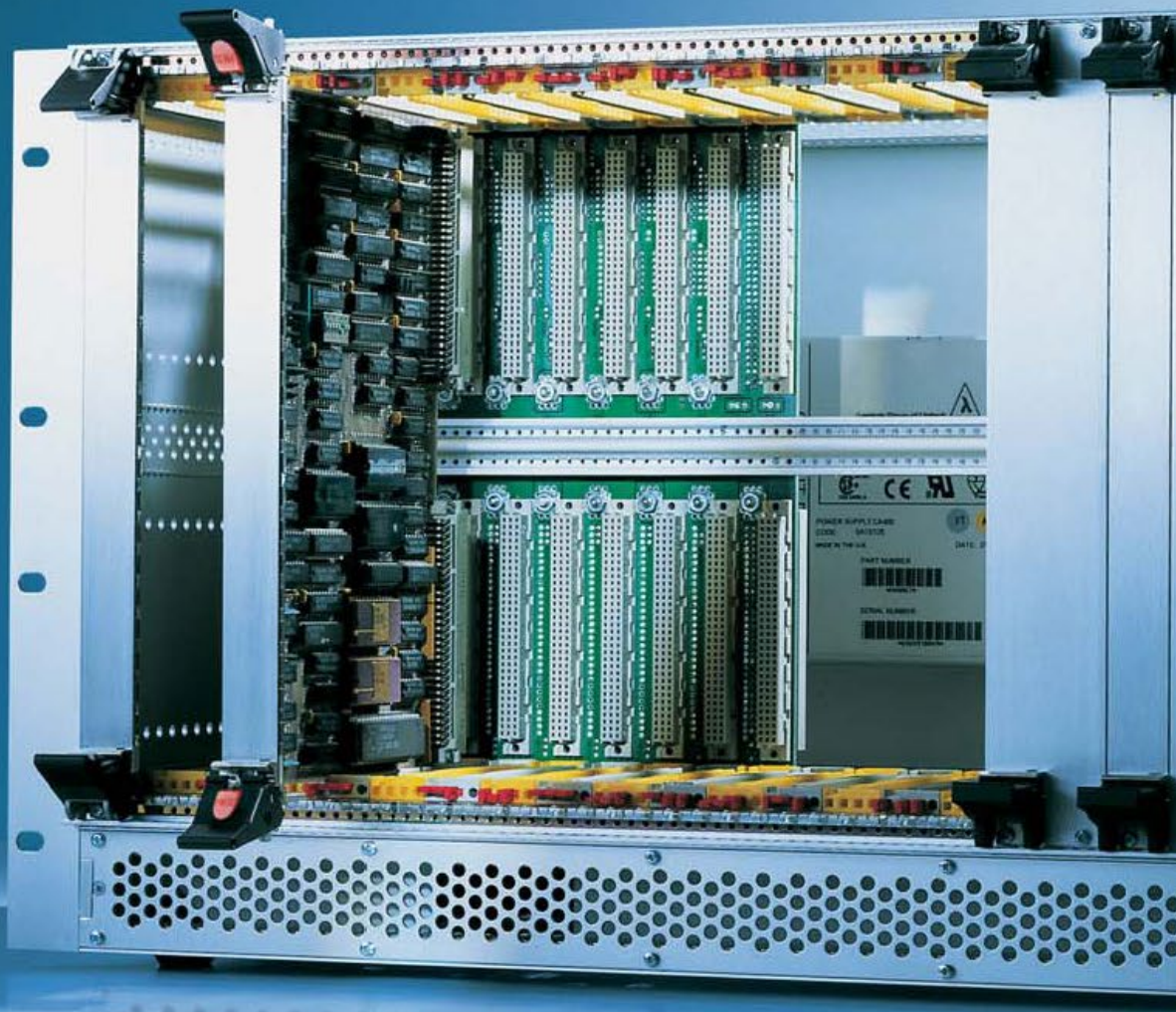
TECHNOLOGY EXPERTISE



Overview of standards

Designs for electronic systems (dimensions for 19-inch design)	
IEC 60297-3-100	Basic dimensions of front panels, subracks, rack-mount systems, racks and cabinets
IEC 60297-3-101	Subracks and assembly modules
IEC 60603-2	Connectors for printed circuits operating at frequencies below 3 MHz - Part 2: Component specification for quality-rated indirect connectors for printed circuits, 2.54 mm (0,1 in) pitch, with common mounting features (IEC 60603-2:1995 + A1:2000)
IEC 60297-3-102	Injector/extractor handle
IEC 60297-3-103	Keying and guide pin
IEC 60297-3-104	Connector dependent interface dimensions of subracks and assembly modules
IEC 60297-3-105	Dimensions and layout of 1 U high rack-mount systems
IEC 60297-3-106	Adaptation dimensions for subracks and rack-mount systems applicable with metric cabinets or racks in accordance with IEC 60917-2-1
IEC 60917	Modular order for the development of mechanical structures for electrical and electronic equipment practices - Part 1: Generic standard
Environmental conditions for designs as per IEC 60917, IEC 60297	
DIN EN 61587-1	Environmental requirements, test set-up, as well as safety aspects for empty enclosures, i.e. cabinets, racks, subracks and chassis under indoor and transport conditions
DIN EN 61587-2	Seismic tests for cabinets and racks
DIN EN 61587-3	Electromagnetic shielding performance tests for cabinets and subracks
VG 95373, part 15	Electromagnetic compatibility of equipment Part 15: Measuring method for coupling and shielding
Safety	
EN 62368-1	Equipment for audio/video, information and communication technology - Part 1: Safety requirements
Rail	
EN 50155	Electronic equipment used on rail vehicles
Fire protection	
EN 45545	Railroad applications - fire protection in rail vehicles

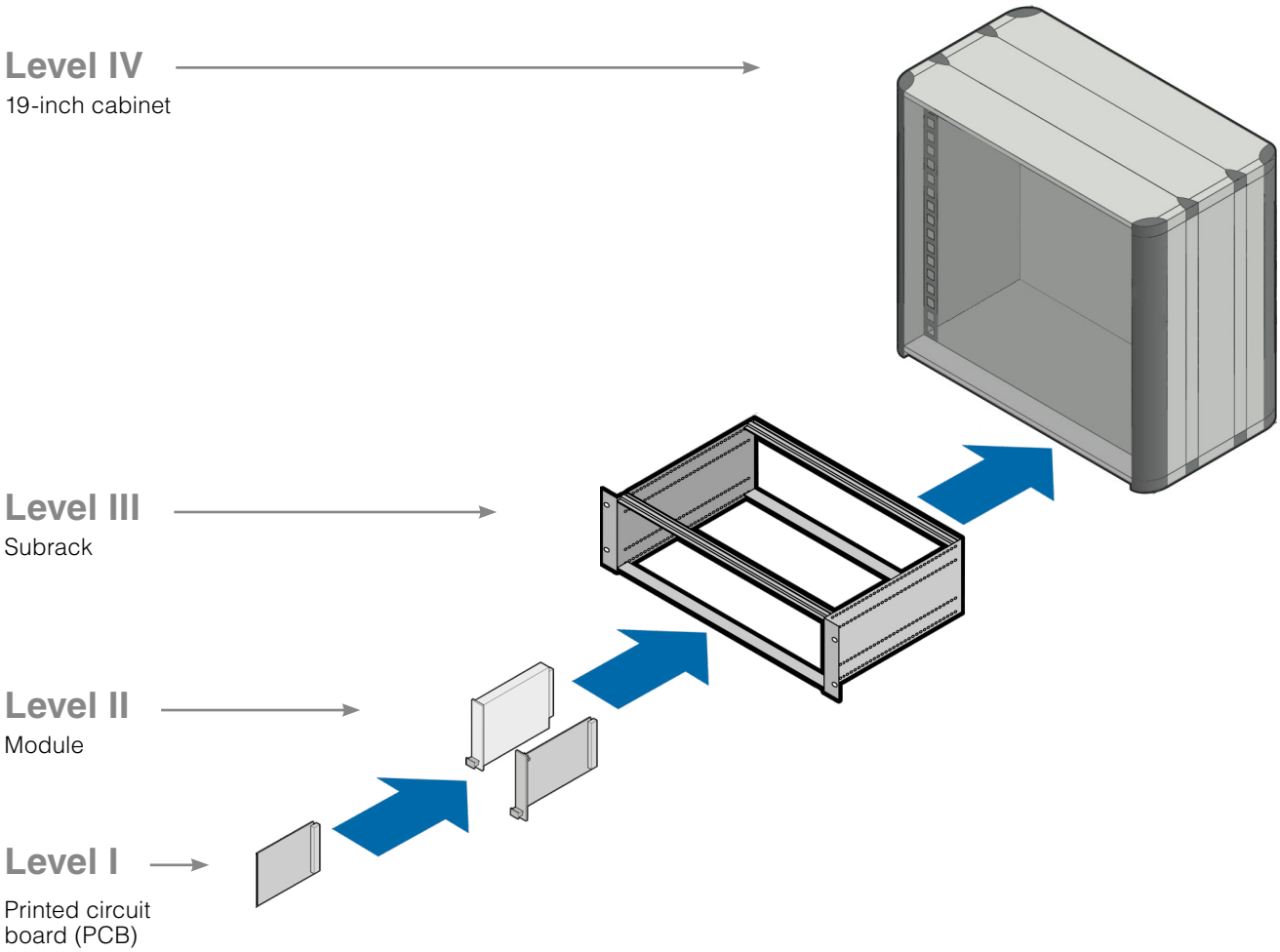
19-inch technology: dimensional coherence

The 19-inch packaging system is based on internationally applicable dimensional standards that describe the coordinated, modular system structure. The mechanical structure of the system is described in various parts of the series of standards IEC 60297.

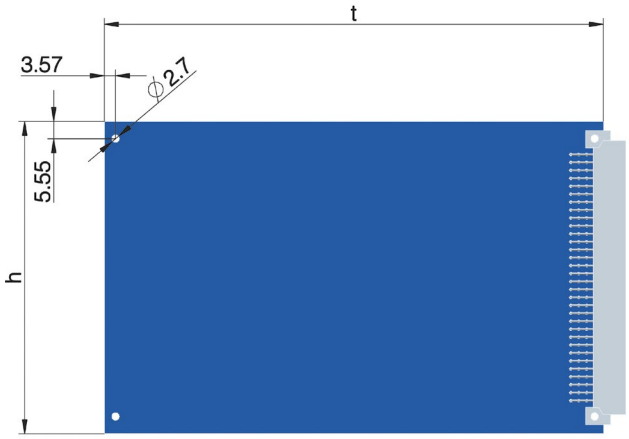
The objective of these provisions is to ensure that different devices and modules from all potential manufacturers can be combined and replaced without difficulty.

The 19-inch packaging system is now used in almost every area of industrial electronics:
Systems and machine construction, energy technology, transportation, aerospace technology, medical technology, Information and communication technology and measurement and testing technology

More specifically, the 19-inch packaging system can be divided into the following four levels:



Level 1: Printed circuit board



Subrack height	PCB height h + 0mm - 0.3 mm	PCB depth (mm) t +0 mm - 0.3 mm			
		100 mm	160 mm	220 mm	280 mm
3 U	100 mm	-	x	x	-
6 U	233.35 mm	-	x	x	-
9 U	366.70 mm	-	x	x	-

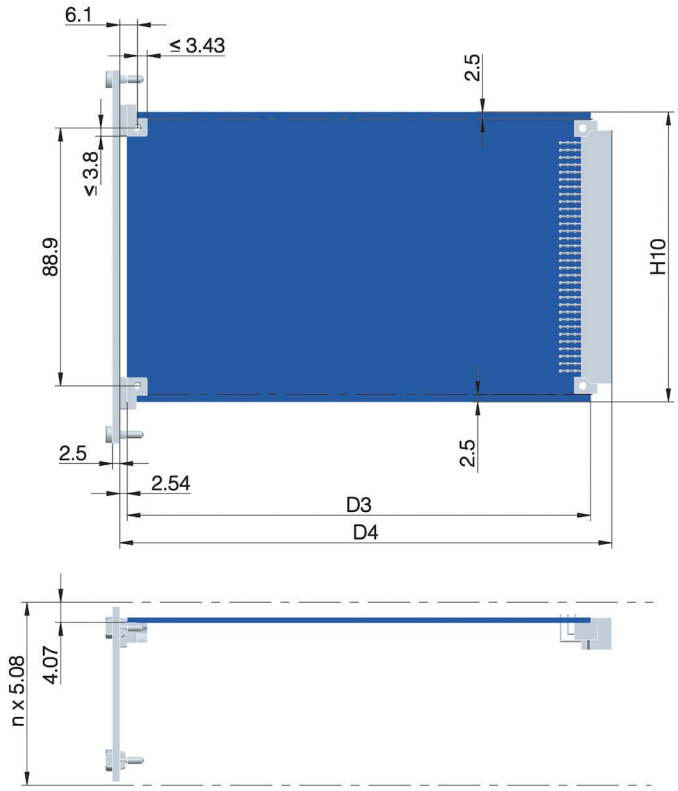
x most common dimensions

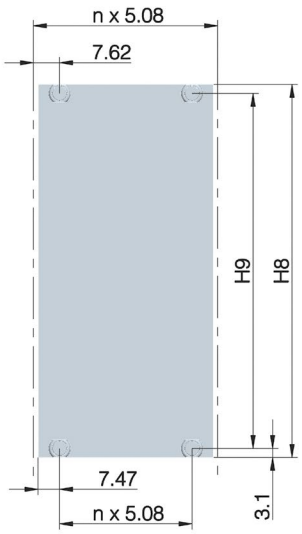
The PCB dimensions are defined on the basis of the eurocard format and are set forth in standard IEC 60297-3-101. Starting from a height of 100 mm and a depth of 160 mm as the basic dimensions, the height increases by multiples of one height unit (1 U = 44.45 mm) and the depth by multiples of 60 mm.

The table above shows the PCB formats most commonly used.

PCBs are generally 1.6 mm thick. Different, higher values must be coordinated between the user and the manufacturer to arrange suitable guide rails. Standard subrack depths are arranged in accordance with PCB depths of 160 mm, 220 mm and 280 mm.

Level 2: Module

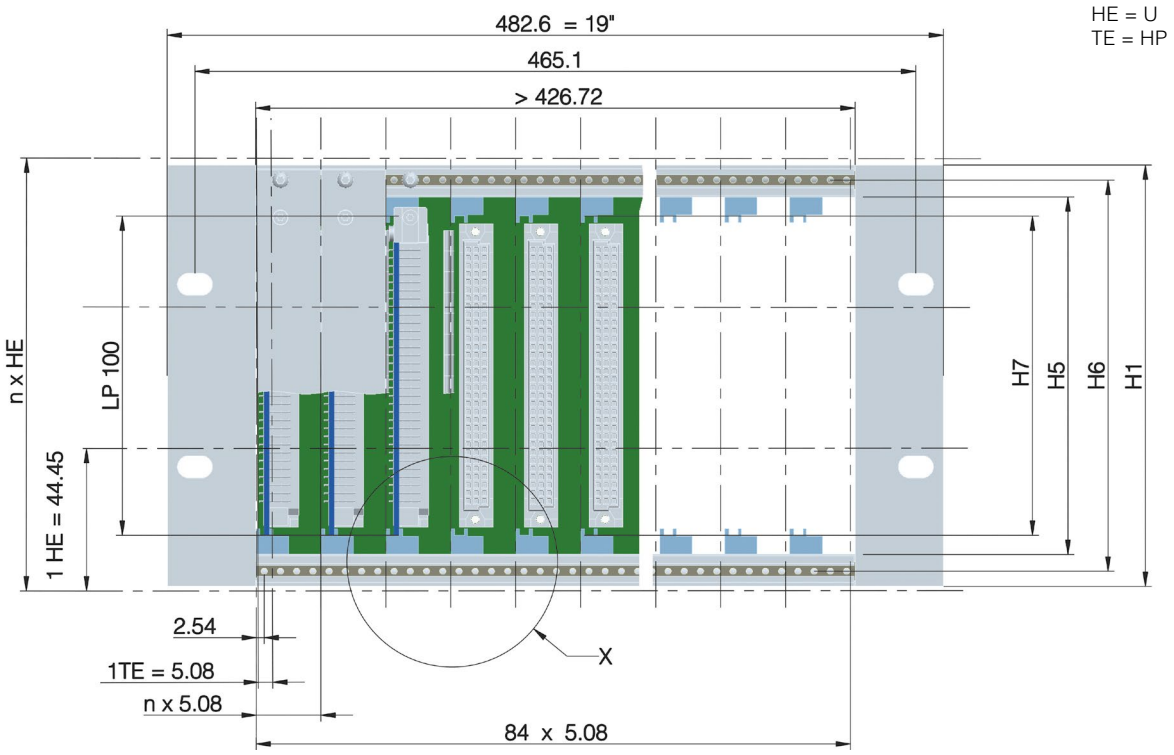




The IEC 60297-3-101 standard also describes the dimensions of the entire module and associated front panel, together with the screw fixing points. The following table shows the most common dimensions. D1 represents the depth of the subrack.The other values are shown in the figures.

Height H (in mm)				Depth D (in mm)			
Height units	3 U	6 U	9 U	Depth units			
H8 ± 0.15	128.55	261.90	395.25	D1 ± 0.5	175.60	235.60	295.60
H9 ± 0.2	122.50	255.85	389.20	D3 – 0.3	160.00	180.00	220.00
H10 +0 -0.3	100.00	233.35	366.70	D4 ± 0.4	169.93	229.93	289.93

Level 3: Subrack



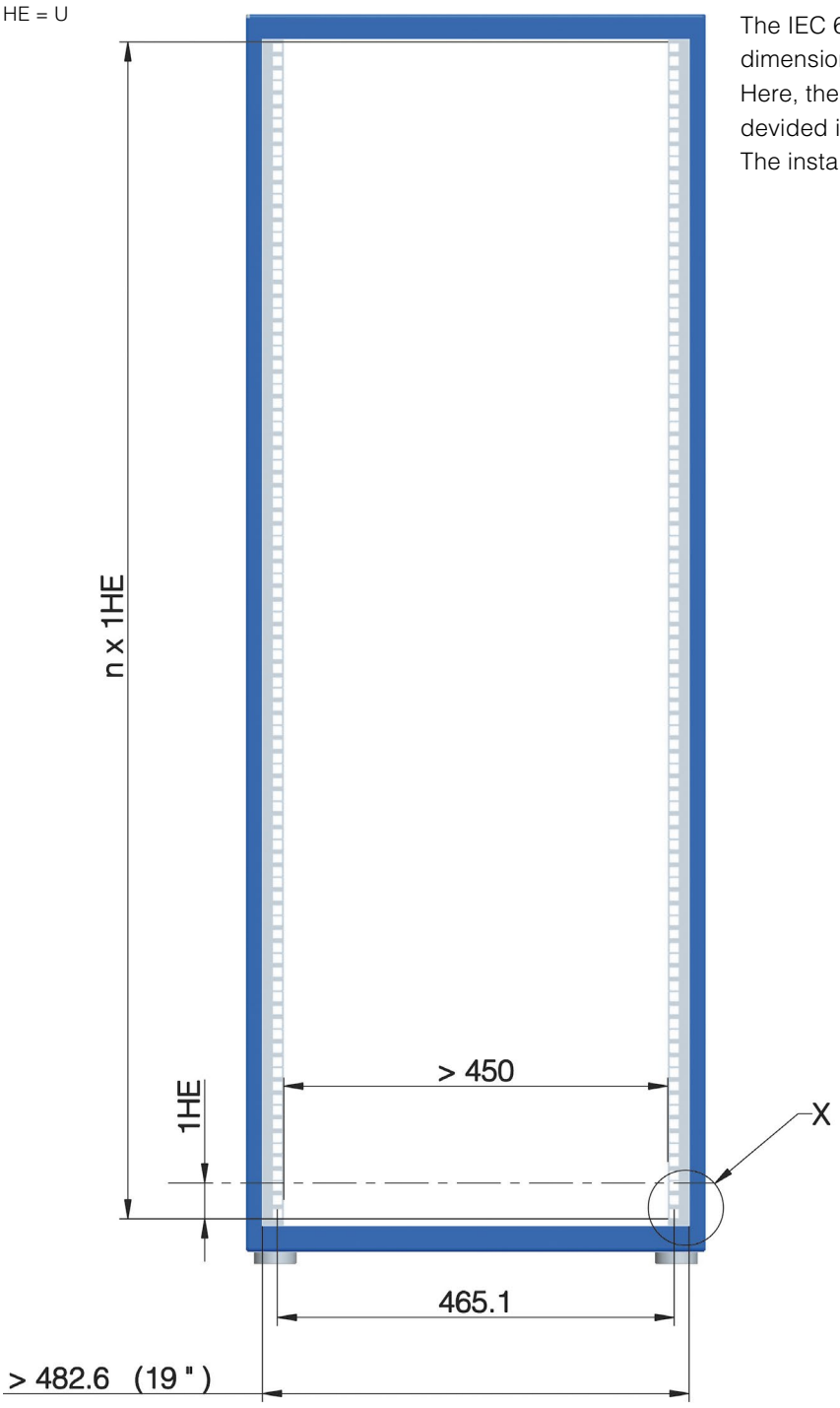
Width	84 HP (19-inch)	42 HP (1/2 19-inch)	21 HP (1/4 19-inch)
Card cage	426.72 mm	213.36 mm	106.68 mm
Flange	465.10 mm	251.70 mm	145.00 mm
Enclosure	482.60 mm	269.10 mm	162.40 mm

DIN EN 60297-3-101 provides a figure of 482.6 mm (19 inches) for the width of the subrack front. In practice, widths derived from this, such as 1/2 19-inch or 1/4 19-inch, are also common (see chart).

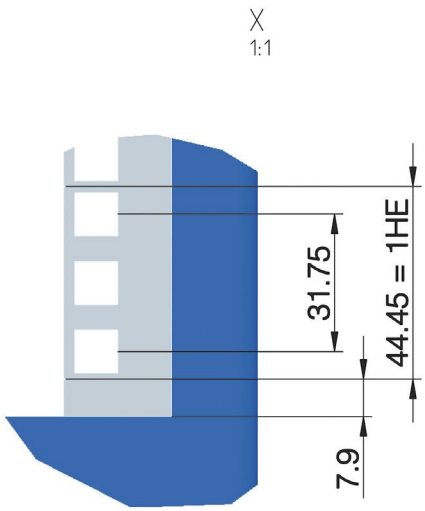
The maximum subrack height is given as a multiple of one height unit (1 U), or 44.45 mm. This ensures that the subrack height is coordinated with the height of the plug-in units used. Typical sizes are 3 U, 6 U and 9 U (refer to table).

The installation space for the modules is divided into horizontal pitch units (HP) of 5.08 mm (0.2 inch), or 84 HP for a subrack width of 19 inches.

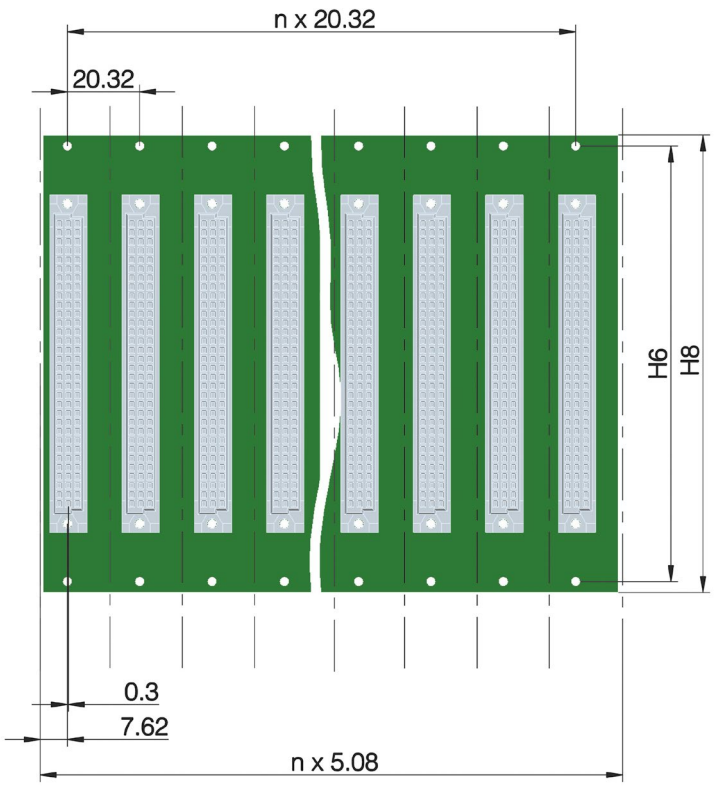
Level 4: 19-inch cabinet



The IEC 60297-3-100 standard describes the basic dimensions of the 19-inch cabinet.
Here, the available space to fit the subracks is also devided into multiples of 1 U.
The installation space must be at least 450 mm wide.

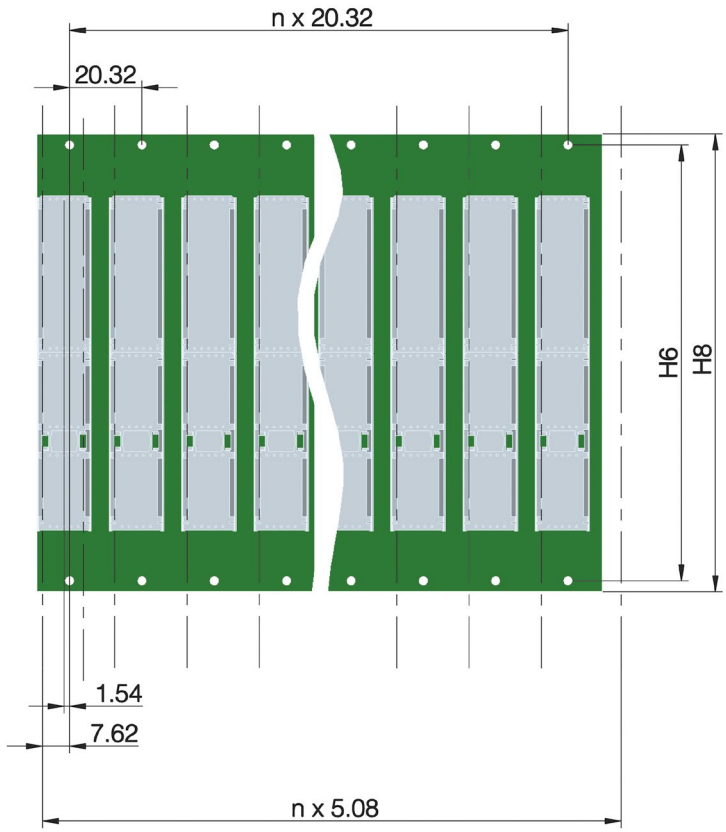


Backplane



Backplane with plug connector as per
DIN 41612/IEC 60603-2 and IEC 61076-4-113

Typical application: VME/VME64 systems



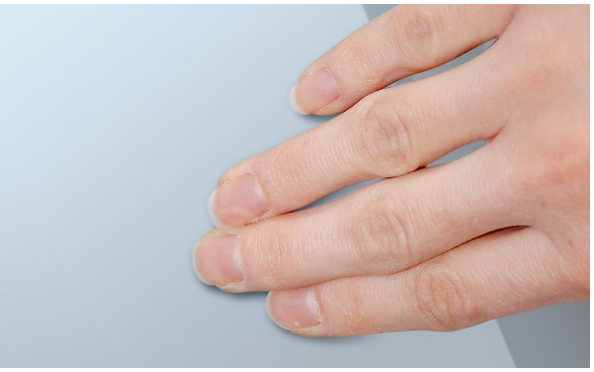
Backplane with plug connector as per
IEC 61076-4-101

Typical application: CPCI systems

The IEC 60297-3-104 standard describes the dimensions of the backplanes for the most common height variations (refer to table).

Height units	3 U	6 U	9 U
H6 ± 0.2	122.50 mm	255.85 mm	389.20 mm
H8 ± 0.15	128.55 mm	261.90 mm	395.25 mm

IP protection levels – chassis protection classes (IP code)



1st IP number

	Protection against solid objects
0	No protection
1	Protected against solid objects over 50 mm in diameter
2	Protected against solid objects over 12.5 mm in diameter
3	Protected against solid objects over 2.5 mm in diameter
4	Protected against solid objects over 1.0 mm in diameter
5	Protected against dust (limited ingress, no harmful deposit)
6	Totally protected against dust

	Protection against contact
0	No protection
1	Protected against contact with back of hand
2	Protected against contact with fingers
3	Protected against tools
4	Protected against wires
5	Complete protection against contact
6	Complete protection against contact

2nd IP number

	Protection against liquid
0	No protection
1	Protected against vertically falling drops of water, e.g. condensation
2	Protected against direct sprays of water up to 15 degrees from vertical
3	Protected against sprays up to 60 degrees from vertical
4	Protected against water sprayed from all directions
5	Protected against low-pressure jets of water from all directions
6	Protected against strong jets of water
7	Protected against the effects of short-term submersion
8	Protected against long periods of submersion

Examples of typical protection classes used in industry:

IP20 - For a touch-proof device that is mounted, for example, on a DIN rail or mounting plate in a control cabinet.

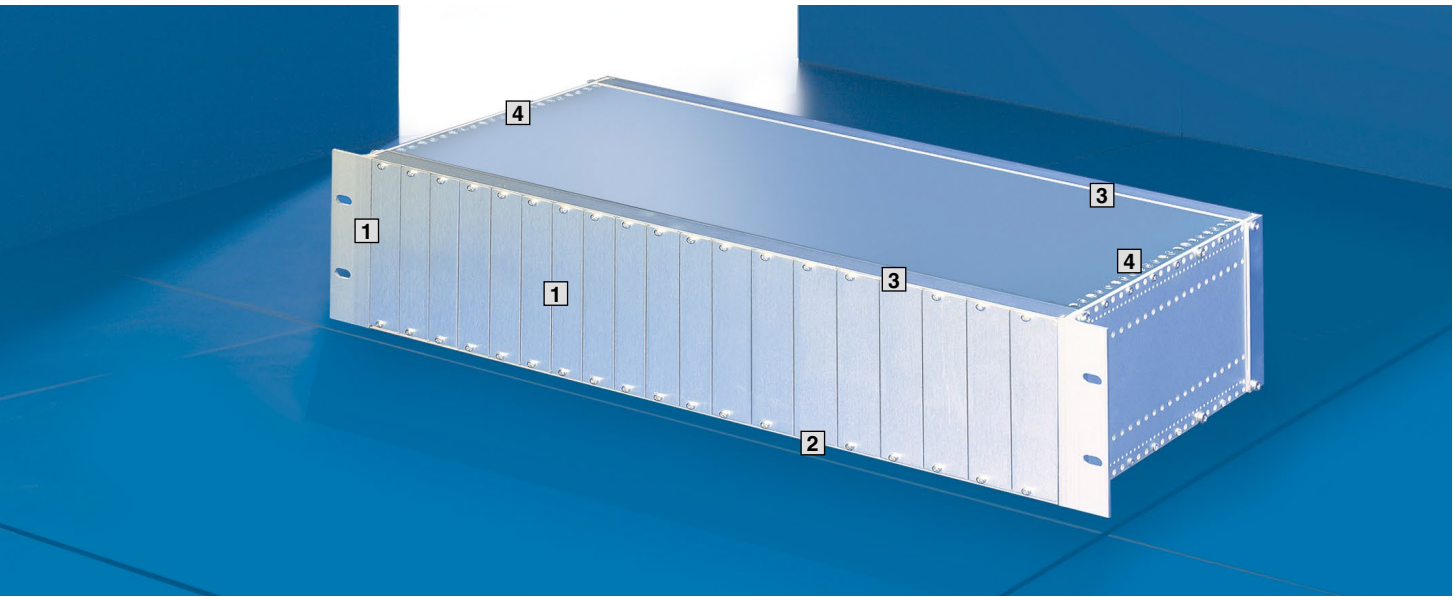
IP54 - For a splash-proof device, which is placed outside the control cabinet, e.g. a table-top device.

IP67 - For a waterproof device which can be used for permanent outdoor use, e.g. a control cabinet.

IP68 - For a waterproof device which can be used under water e.g. a watch or a current smartphone.

PROTECTION REQUIREMENTS

Electromagnetic compatibility (EMC)



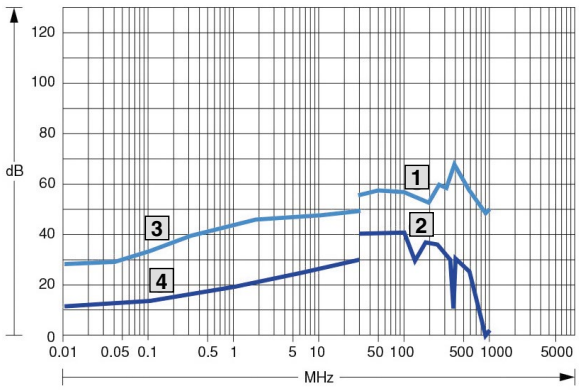
1 EMC gaskets, vertical
2 EMC gaskets, horizontal
3 EMC gaskets for cover plates
4 Mounting blocks

EMC (electromagnetic compatibility) refers to the ability of an electrical device to function properly in its electromagnetic environment without influencing this environment more than is admissible. These requirements were taken into account when developing the HEITEC subracks.
They are made entirely from metal and coated with a conductive surface finish.
Stainless steel EMC gaskets ensure a conductive connection between the separate parts.

Testing of measurements of the shielding effectiveness of empty chassis is based on DIN EN 61587-3 or military standards, e.g. MIL STD 285 (US) or VG 95373 Part 15 (GER).

International EMC standards are published mainly by IEC (International Electrotechnical Commission) and CISPR (International Special Committee on Radio Interference).

Key series of EMC standards with global importance: IEC 61000.



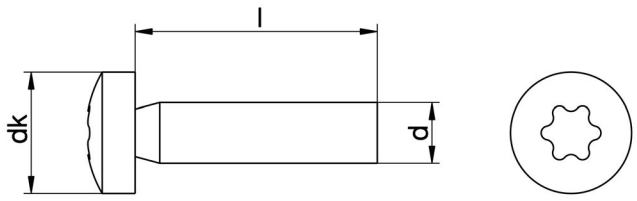
MHz = frequency
dB = HF attenuation
1 E-Field = electric field (V/m) EMC chassis
2 E-Field standard chassis
3 H-Field = magnetic field (A/m) EMC chassis
4 H-Field standard chassis

The diagram above shows the extent to which EMC shielding influences the attenuation of the electromagnetic field. The attenuation of a standard chassis with no suitable EMC components is thus much lower than that of a HeiPac Vario EMC subrack.

Of particular interest is the shielding factor provided by the attenuation.

HF attenuation (dB)	Shielding (%)
6	50
20	90
40	99
60	99.9

Screws



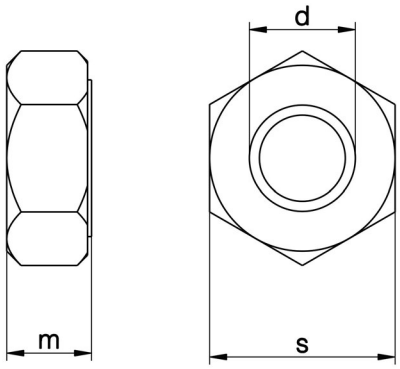
Screws are used to achieve a tight connection between two or more components. They form part of a screw gear consisting of two standardised, paired components. Friction on the wedge-shaped thread under load prevents the screws from coming loose.

Examples

Hexagonal head screw	ISO 4017 - M12 x 100 - A4 - 50 - H
Screw plug	DIN 910 - M24 x 2.5 - St
Panhead screw	ISO 4762 - M10 x 65 - 9.8

- Designation
- Reference standard, e.g. ISO, DIN, EN
- Dimensions and other ratings, e.g.
  - M → Metric thread
  - 24 → Nominal diameter d
  - 100 → Shank length l
- Strength class, e.g. 9.8, 12.9, A2 - 50
  - Material, e.g. St steel
- Drive, e.g.
  - H → Phillips
  - Z → Pozidriv
  - T → Torx

Nuts



Nuts are the counterpart to the screws. They have a standardised inside thread that matches the thread of the screw. The prismatic outside contour is shaped to accommodate a wrench, which is used to tighten the nut. In terms of dimensions, the height of a nut is approximately half the width across the flats.

Examples

Hexagonal nut	ISO 4032 - M10 - St
Castellated nut	DIN 935 - M4 x 1 - St
Hexagonal nut	EN 1661 - M12 - 8

- Designation
- Reference standard, e.g. ISO, DIN, EN
- Dimensions and other ratings, e.g.
  - M → Metric thread
  - 10 → Nominal diameter d
  - 1 → Thread pitch for fine threads
- Strength class, e.g 8, 12
  - Material, e.g. St steel