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Rack unit

A **rack unit** (abbreviated **U** or **RU**) is a unit of measure defined as $1\frac{3}{4}$ inches (44.45 mm).^{[1][2]} It is most frequently used as a measurement of the overall height of 19-inch and 23-inch rack frames, as well as the height of equipment that mounts in these frames, whereby the height of the frame or equipment is expressed as multiples of rack units. For example, a typical full-size rack cage is 42U high, while equipment is typically 1U, 2U, 3U, or 4U high.

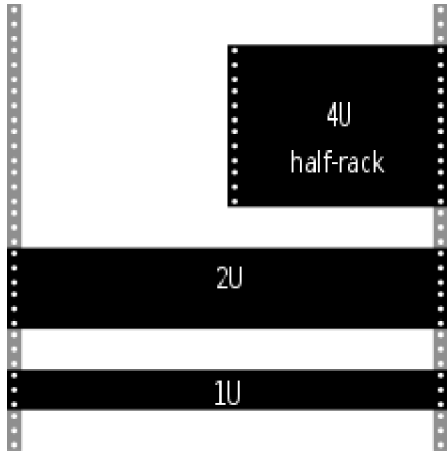
Definition

The rack unit size is based on a standard rack specification as defined in EIA-310. The Eurocard specifies a standard rack unit as the unit of height; it also defines a similar unit, horizontal pitch (HP), used to measure the width of rack-mounted equipment. The standard was adopted worldwide as *IEC 60297 Mechanical structures for electronic equipment – Dimensions of mechanical structures of the 482.6 mm (19 in) series*, and defines the sizes for rack, subrack (a shelf-like chassis in which cards can be inserted), and the pitch of printed circuit boards/cards providing physical compatibility of technological equipment, typically in telecommunications.

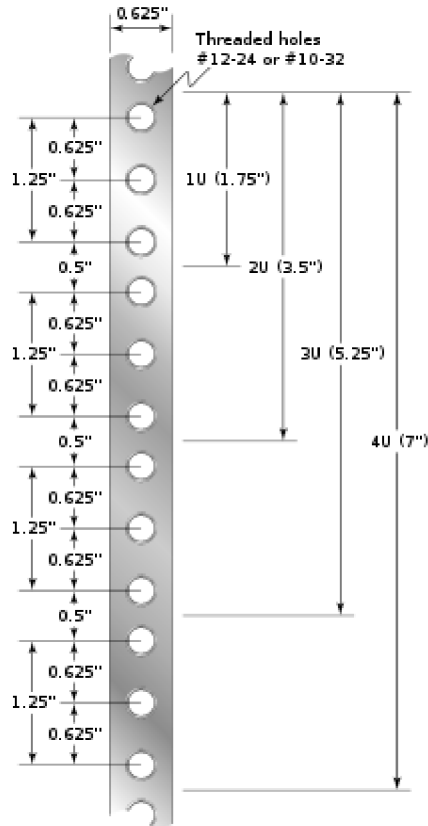
While a rack unit is defined as $1\frac{3}{4}$ inches (44.45 mm), a front panel or filler panel in a rack is not an exact multiple of this height. To allow space between adjacent rack-mounted components, a panel is $\frac{1}{32}$ inch (0.03125 in or 0.794 mm) less in height than the full number of rack units would imply. Thus, a 1U front panel would be $1\frac{23}{32}$ inch (1.71875 in or 43.66 mm) tall. If *n* is number of rack units, the ideal formula for panel height is $h = (1.75n - 0.031)$ for calculating in inches, and $h = (44.45n - 0.794)$ for calculating in millimetres. Manufacturing allows for dimensions with less precision.

The mounting-hole distance (as shown to the right) differs for 19-inch racks and 23-inch racks: The 19-inch racks uses uneven spacings (as shown to the right) while the 23-inch racks uses evenly spaced mounting holes. Although it is called a 19-inch rack unit, the actual mounting dimensions of a 19-inch rack unit are $18\frac{5}{16}$ inches (18.3125 in or 465.1 mm)^[3] wide, center to center.

The 19-inch rack format with rack-units of 1.75 inches (44.45 mm) was established as a standard by AT&T around 1922 in order to reduce the space required for repeater and termination equipment in a telephone company central office.^[4]



Rack with sample component sizes including an A/V half-rack unit



A typical section of rack rail, showing rack unit distribution

Configurations

A typical full size rack is 42U,^[5] which means it holds just over 6 feet (180 cm) of equipment, and a typical "half-height" rack is 18–22U, which is around 3 feet (91 cm) high.

Rack units are universally the same, but the type of thread^[6] can vary depending on the rack. Mounting rails can be No. 10-32 tapped (Unified Thread Standard), No. 12-24 tapped, metric M6 threaded or universal square holes. Universal square holes are becoming the most common as these allow the insertion of replaceable cage nuts for the type of thread needed. This prevents stripping of the threading on the rails and allows for more flexibility.

Conversion table [\[show\]](#)

Rack unit	inches	mm
1U	1.75	44.45
2U	3.5	88.9
3U	5.25	133.35
4U	7	177.8
5U	8.75	222.25
6U	10.5	266.7
7U	12.25	311.15
8U	14	355.6
9U	15.75	400.05
10U	17.5	444.5
11U	19.25	488.95
12U	21	533.4
13U	22.75	577.85
14U	24.5	622.3
15U	26.25	666.75
16U	28	711.2
17U	29.75	755.65
18U	31.5	800.1
19U	33.25	844.55
20U	35	889
21U	36.75	933.45
22U	38.5	977.9
23U	40.25	1022.35
24U	42	1066.8
25U	43.75	1111.25
26U	45.5	1155.7
27U	47.25	1200.15
28U	49	1244.6
29U	50.75	1289.05
30U	52.5	1333.5
31U	54.25	1377.95
32U	56	1422.4
33U	57.75	1466.85
34U	59.5	1511.3
35U	61.25	1555.75

36U	63	1600.2
37U	64.75	1644.65
38U	66.5	1689.1
39U	68.25	1733.55
40U	70	1778
41U	71.75	1822.45
42U	73.5	1866.9

Half-rack configurations

Whereas there is no formal specification for "half rack", the term *half-rack* can have different separate meanings: It can describe equipment that fits in a certain number of rack units, but occupy only *half the width* of a 19-inch rack (9.5 inches (241.30 mm)). These are commonly used when a piece of equipment does not require full rack width, but may require more than 1U of height. For example, a "4U half-rack" DVCAM deck occupies 4U (7 in) height × 9.5 in width, and in theory, two 4U half-rack decks could be mounted side by side and occupy the 4U space. It can also describe a unit that is 1U high and *half the depth* of a 4-post rack (such as a network switch, router, KVM switch, or server), such that two units can be mounted in 1U of space (one mounted at the front of the rack and one at the rear). When used to describe the rack enclosure itself, the term "half-rack" typically means a rack enclosure that is *half the height* (22U tall). There is also a "half rack width" size being used in IT applications where a device conforms to a smaller than 9.5-inch width so that these "half rack width" appliances may be used in a chassis system that fits the traditional 19-inch rack space, but allows for these 8.4-inch-wide "half rack width" appliances to be inserted and removed easily without tools or the need to remove adjacent hardware. This "half rack width" concept is popular in applications where IT equipment is being used by military who are unable to use traditional 1U full-depth IT appliances due to their large size.

See also

- [Enclosure \(electrical\)](#)
- [List of unusual units of measurement](#)

References

1. *IEC 60297-3-108:2014. Mechanical structures for electronic equipment - Dimensions of mechanical structures of the 482,6 mm (19 in) series - Part 3-108: Dimensions of R-type subracks and plug-in units*, International Electrotechnical Commission
2. West, Jill; Dean, Tamara; Andrews, Jean (2015). ["Structured Cabling and Networking Elements"](https://books.google.com/books?id=KjadBAAQBAJ&pg=PA169) (<https://books.google.com/books?id=KjadBAAQBAJ&pg=PA169>). *Network+ Guide to Networks* (Seventh ed.). Boston, MA: Engage Learning. p. 169. ISBN 9781305480865. Retrieved 9 December 2019. "Racks are measured in rack units (RU or U) with the industry standard being 42U tall — about 6 feet."
3. ["Define: EIA-310 - The Server Rack FAQ"](http://www.server-racks.com/eia-310.html) (<http://www.server-racks.com/eia-310.html>).
4. Demarest, Charles S. (July 1923). ["Telephone Equipment for Long Cable Circuits"](https://archive.org/details/bstj2-3-112) (<https://archive.org/details/bstj2-3-112>). *Bell System Technical Journal*. Vol. 2, no. 3. New York: American Telephone and Telegraph Company. pp. 112–140. Retrieved 9 December 2019.

5. "42U Rack Dimensions - 42U" (<http://www.42u.com/42U-cabinets.htm>). 20 March 2012.
6. "Rack Mount Screws – Small Yet Important Details in Server Rack Design" (<https://web.archive.org/web/20151222125022/http://blog.rackmountsolutions.net/server-rack/rack-mount-screws-and-fasteners-in-server-rack-design/>). 14 October 2013. Archived from the original (<http://blog.rackmountsolutions.net/server-rack/rack-mount-screws-and-fasteners-in-server-rack-design>) on 22 December 2015. Retrieved 28 August 2015.

External links

- Abstract of EIA-310 standard (<http://aero-defense.ihs.com/document/abstract/SBSSIBAAAAAAAAAA>) at [Electronic Industries Alliance](#) website
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