

# Copper Structured Cabling Types

## Copper Cabling Categories

### Category 5e



Since Cat5e superseded Cat5 in 1999, it has been the baseline structured cabling system. It is still adequate for basic installations, supporting 10BaseT, 100BaseT and 1000BaseT. However, it will not support 10GBaseT Ethernet and should therefore only be installed where there will be no requirement to support 10GBaseT during the lifetime of the cabling system. There is also doubt whether manufacturers will make the investment to develop a CPR Class Cca version of the Cat5e cable. So as that becomes a requirement, it is likely that Cat5e will no longer be an option for new installations.

### Category 6



Cat6 has been the enterprise cabling system of choice for many years. Although only designed to run the same Ethernet protocols as Cat5e, it is a higher performance system, supporting more than double the frequency and running to a tighter specification. This gives it significant performance headroom to support the faster protocols like 1000BaseT and is therefore considered more reliable than Cat5e.

A properly installed Cat6 system will potentially run 10GBaseT over lengths of up to between 30 and 45 metres. However, this is not guaranteed and may depend on the installation being 'tweaked' to pass. More than 95% of Cat5e and Cat6 installations in the UK are unshielded (U/UTP).

### Category 6a



Cat6a is designed to meet all the requirements of 10GBaseT over the full 100 metres channel length. It is therefore an attractive solution when there is a requirement for future proofing the installation for five or more years. It is especially suitable for data centres, where the higher bandwidths are likely to be used at the earliest opportunity and in backbone links of less than 100m. Cat6a cables also have less DC resistance than Cat5e/Cat6, so are more efficient for POE use.

To achieve the high performance, the Cat6a system is specified to run at frequencies of up to 500MHz, which imposes serious constraints on its design in terms of the cable size - it can be a hefty cable. For this reason, most manufacturers produce shielded solutions, where it is easier for the manufacturer to guarantee meeting the standards.

### Category 7/Category 7a



Cat7/7a is a high-performance system, specified to run at frequencies up to 600MHz (Cat7) and 1GHz (Cat7a). It is mandatory that Cat7 systems are shielded, with both the individual cables and the overall cables being screened (S/FTP).

Cat7 has been around since Cat6, but is only popular in some European countries, where shielded solutions are required to meet the local electromagnetic regulations. Cat7 and Cat7a fully support 10GBase-T. Cat7/7a uses non-standard connectors (i.e. not RJ45) either the Tera or GG45.

### Category 8



Cat8 supports high speed 25GBase-T and 40GBase-T standards over short distances. Aimed specifically for Data Centres, to link Servers to Access layer network switches, the standard supports 40Mbits/sec over a channel of 30m through 2 connectors, running over a shielded 2GHz 4-pair cable. The standard comes in two flavours allowing multiple connector types, the RJ45 (Cat8.1) and Cat7 derived Tera/GG45 (Cat8.2).

## Category Comparison Table

System Category			Cat5e	Cat6	Cat6a	Cat7	Cat7a	<sup>7</sup> Cat8
<b>Standards</b>	Year Ratified		1999	2002	2008	2002	2008	2016
	ISO/EN		Class D	Class E <sub>A</sub>	Class F	Class F	Class F <sub>A</sub>	Class I/II
	TIA		TIA-568-B.2	TIA-568-B.2-1	TIA-568-B.2-10	-	-	TIA-568-C.2-1
<b>Performance</b>	Max Frequency		100MHz	250MHz	500MHz	600MHz	1GHz	2GHz
	Fastest Ethernet		1Gbit	1Gbit	10Gbit	10Gbit	10Gbit	25/40Gbit
<b>Physical</b>	Cable		4-pair	4-pair	4-pair	4-pair	4-pair	4-pair
	Standard Connector		RJ-45	RJ-45	RJ-45	GG-45 or TERA	GG-45 or TERA	RJ-45 / GG-45 or TERA
	<sup>1</sup> Max Connections		4	4	4	4	4	4
	<sup>2</sup> Max channel length		100m	100m	100m	100m	100m	30m
<b>Ethernet Protocols Supported</b>	10Base-T		✓	✓	✓	✓	✓	✓
	100Base-T		✓	✓	✓	✓	✓	✓
	1000Base-T		✓	✓	✓	✓	✓	✓
	2.5GBase-T		<sup>3</sup> ✓	<sup>3</sup> ✓	✓	✓	✓	✓
	5GBase-T		-	<sup>3</sup> ✓	✓	✓	✓	✓
	10GBase-T		-	<sup>4</sup> Up to 55m	✓	✓	✓	✓
	10GBase-T		-	-	-	-	-	✓
<b>Backwards<sup>5</sup> Compatibility</b>			Cat5	Cat5-5e	Cat5-6	-	Cat7	Cat5-6a/ Cat7-7a
<b>Cable Size</b>	Diameter	UTP	5 mm	6 mm	8.5 mm	-	-	-
		Shield	6 mm	7 mm	7 mm	8 mm	8 mm	8 mm
	Tray Capacity <sup>6</sup> 150mm x 50mm	UTP	191	133	66	-	-	-
		Shield	133	97	97	75	75	75
<b>UK 2017</b>	Market Share by Volume		10%	40%	40%	<1%	<1%	-
	Ratio: UTP/Shield		98% / 2%	98% / 2%	25% / 75%	- / 100%	- / 100%	- / 100%
<b>Relative Installation Cost (approx)</b>			1.00	1.20	2.00	2.20	2.50	TBD

1. The number of connections excludes the two end points where the patch/fly lead plugs into the equipment.
2. A maximum channel length of 100m is usually stated as max permanent link length of 90m, with 10m for patch leads. Similarly for Cat 8, a max channel length of 30m translates to a permanent link length of 24m, with 6m for patch leads.
3. The 2.5GBase-T and 5GBase-T are new applications introduced in 2017, mainly to support the deployment of Wave 2 802.11ac wireless standards (which can use speeds more than 1Gbit/sec) over legacy Cat5e/Cat6 cabling. However, 2.5G/5G performance is not guaranteed by the standards which recommend that new 2.5/5GBase installations should use Cat6a cabling.
4. Cat6 may support 10GBaseT for lengths up to a maximum of between 30m and 55m, depending on installation factors.
5. A link of mixed components will perform to the standard of the lowest performance component.
6. Based on 50% fill as per the TIA-569 design guidelines.
7. 7ISO/IEC designate two Cat8 cabling variants to support 25/40Gbps. Cat8.1 (Class I) which uses RJ45 connectors and is backwards compatible with Cat5-6a and Cat8.2 (Class II) which uses Cat7/7a style connectors.