RJ45 CONNECTOR WIRING

A common question asked at Canford is 'What is the colour code for connecting RJ45 connectors?' No doubt this arises because there are more than one! Here we offer some clarification of the various 'standards'.

In order to determine the code to use, one first has to decide what the connection will be doing. Usually the connectors are likely to be used for computer networking, although there are other applications, so here we assume the installation of IT infrastructure.

Firstly some background. The network interface of a modern PC uses a pair (or pairs) to send data and a pair (or pairs) to receive data. (The exact details vary, but let us keep it simple!). Thus the 'receive' input on the network card must be passed data from the 'transmit' output of another device. The various standard bodies have agreed that the internal connection in a hub or switch will be wired in such a way as to facilitate this simply by connecting the PC to the hub with 'straight' or pin-to-pin connections. So if the equipment conforms to this standard, a straight forward pin-to-pin connection is all that is required.

Patch Panels and Wall Plates

Consider cables installed from a patch panel to a wall or floor outlet. If they are to be used for an ethernet LAN, then category 5 or above cable is likely to be used, which consists of four twisted pairs. Not all of these are used in all networks, but it is normal to terminate all the pairs ready for future upgrades. There are two colour codes commonly referred to as EIA/TIA 568A and EIA/TIA 568B. The following applies to 10MHz and 100MHz ethernet wiring, specifically 10 Base-T and 100 Base-T systems.

EIA/TIA 568A

Pin	Signal	Wire colour	Pair
1	Transmit +	White with green stripe	(pair 3+)
2	Transmit -	Green	(pair 3-)
3	Receive+	White with orange stripe	(pair 2+)
4	Unused	Blue	(pair 1-)
5	Unused	White with blue stripe	(pair 1+)
6	Receive-	Orange	(pair 2-)
7	Unused	White with brown stripe	(pair 4+)
8	Unused	Brown	(pair 4-)

EIA/TIA 568B

Pin	Signal	Wire Colour	Pair
1	Transmit +	White with orange stripe	(pair 2+)
2	Transmit -	Orange	(pair 2-)
3	Receive+	White with green stripe	(pair 3+)
4	Unused	Blue	(pair 1-)
5	Unused	White with blue stripe	(pair 1+)
6	Receive-	Green	(pair 3-)
7	Unused	White with brown stripe	(pair 4+)
8	Unused	Brown	(pair 4-)

Note that these are colour codes. They do not denote anything particularly special. The only difference is the colour of the pair used for the receive connection to the PC, and all the pairs in CAT5 cable are identical in everything except colour and the position in the lay-up. So, effectively, both colour codes will produce the same effect if the colour code is the same at both ends of the cable run.

So which to use? So long as the connections are the same at both end of the cable, all will be fine. Choose the scheme which matches the equipment already installed. If starting from scratch, some patch bays will have punch-down terminals arranged to suit one scheme or another, so inspect them first! Failing that, EIA/TIA 568B is the more commonly used colour-code in the UK and US. EIA/TIA 568A is common in Europe.

After the above it will be obvious that a patch cord from the wall to the PC can also be wired with either standard, so long as both ends are the same.

Direct Connection

The eagle-eyed reader will have now noticed that a straight wired connection between two PCs will result in the transmit output of one PC being connected to the transmit output of the other PC. This is not good. Here we need a 'crossover' cable. Inspection of the two cabling schemes will reveal that a cable made up with the 568A scheme at one end and the 568B scheme at the other looks like this:

Pin	Signal	Wire colour	Pair	Signal	Pin
1	Transmit +	White with green stripe	(pair 3+)	Receive+	3
2	Transmit -	Green	(pair 3-)	Receive-	6
3	Receive+	White with orange stripe	(pair 2+)	Transmit +	1
4	Unused	Blue	(pair 1-)	Unused	4
5	Unused	White with blue stripe	(pair 1+)	Unused	5
6	Receive-	Orange	(pair 2-)	Transmit -	2
7	Unused	White with brown Stripe	(pair 4+)	Unused	7
8	Unused	Brown	(pair 4-)	Unused	8

....And has magically swapped the pairs so that transmit connects to receive in both directions. We have a cross-over cable! Gigabit ethernet, 1000 Base-T, wiring uses the remaining two pairs of the cable to send bidirectional data, not requiring a cross-over.

Hub to Hub

The same problem arises when cascading hubs and switches, although many modern devices have an 'uplink' port or a port with a cross-over switch, so that this connection can be accomplished using a 'straight cable'.