203: Electrical installations technology  
**Handout 11: Data communications**

**Learning outcome**

The learner will:

1. know wiring systems of electrical installations.

**Assessment criteria**

The learner can:

3.1 describe principles of operation of different **circuit types.**

**Range**

**Circuit types**: Lighting, power and heating, alarm and emergency systems, data communications, control circuits, ring final, radial.

**Data communications**

In this day and age, the use of computers is widespread, with many businesses, hospitals and schools having their own data networks linking all of their computers together to allow them to share data internally and externally via the internet.

Whilst the role of the electrician will not generally involve installing the computer and associated equipment (servers, data switches, etc), the electrician may well need to install the data cabling connecting this network together.

**Local Area Network (LAN)**

A LAN is installed within an organisation to link computers, servers and printers together, and to connect to other networks, including the internet. A basic arrangement is shown below:

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| 01 LAN.png |

Electricians are likely to be called on to install the cabling between the Ethernet hub and the users’ equipment (client and printer in the above example). The cables from the hub to the equipment will generally be installed in some form of cable containment system, eg trunking or cable basket. The cable will generally be terminated at a suitable socket (eg RG45) adjacent to the equipment, with the final connection made by an Ethernet patch lead plugged into the socket at one end and the equipment at the other.

The cable used has to meet very stringent requirements if it is to transfer data quickly and without loss of data, and not be prone to interference and cross‑talk.

Cables are categorised according to their maximum operating speeds, as detailed below.

* **Category 3**: supports frequencies up to 16MHz and was commonly used in the 1980s.
* **Category 4**: supports frequencies up to 20MHz but was quickly replaced by category 5.
* **Category 5**: supports frequencies up to 100MHz and is the most common type of cable in use today.
* **Category 6**: supports frequencies up to 250MHz; the augmented category 6 (Cat 6a) reaches speeds of 500MHz and is gaining increased usage.

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| The most common category installed is still Cat 5. This cable consists of four pairs of insulated conductors. Each pair is twisted together to reduce interference and cross‑talk, and the pitch of the twist is different for each pair. The diagram on the right shows a cable stripped and ready for termination.  The cables are either crimped or pressed into RJ45 plugs and sockets, as shown below: | 02 Cat 5 cable.png |
| RJ45 Socket.png | |

Here are a few installation points to note.

* Maximum length of cable should not exceed 100 metres. If longer runs are required, the use of active hardware, such as a repeater or a switch, is necessary.
* This allows for 90 metres of fixed cabling, two connectors and two patch leads of 5 metres – one at each end.
* Bending radius should be at least 4 times the overall diameter of the cable.

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| 04 RJ45 crimp tool.png | |
| **Fibre optic**  This is being used more frequently for high volume data transmission. An optical fibre cable is a cable containing one or more optical fibres. The latter consist of a core and a cladding layer, selected for total internal reflection. | 05 Fibre optic cable.png |

When a light source, usually a laser, is projected in one end, it is reflected off the borders between the core and the cladding, and will emerge from the other end with only a small level of reduction in the light strength. By rapidly switching on and off the light source, digital data in vast quantities can be transmitted over very long distances with minimal interference and data loss.

Advantages of fibre optic:

* very large data transfer rates
* no electromagnetic interference
* longer lengths of run without the need for repeaters
* better data security.

Disadvantages:

* high installation cost
* complicated installation procedure
* possible health risk during installation.

When stripping the cables, there is a possibility that a small shard of fibre optic cable could pierce the skin and enter the blood stream; it could then be carried around the body and possibly cause fatal damage within vital organs.

Care must be taken never to look down the end of the fibre optic cable. This is because if the laser is fired at one end of the cable, it could cause damage if it gets into the eyes when it comes out of the other end of the cable.