



'HOW TO' GUIDE FOR SPECIFYING A STRUCTURED CABLING INSTALLATION

PART 1 - REQUIREMENTS AND PREPARATION

Over a series of data sheets we provide guidelines on how to produce a specification for an IT cabling system that meets your organisation's needs and gives you value for money.

Part one covers the elements you should include and the information you should gather before starting work on the specification.

REQUIREMENTS

Assuming you need a conventional structured cabling system using RJ45 connectors, the completed specification should include details on all or some of the following:

- The Class or Category of cabling system e.g. Class D/Cat 5e, Class E/Cat 6 etc.
- The number and locations of outlets
- The location and type of telecommunications rooms and spaces
- Backbone cabling between telecommunications rooms and spaces
- Cabling pathways and containment
- Labelling systems and methods
- Patching facilities and patch cords
- Testing
- Administration system
- Minimum warranty period.

NO OBLIGATION CONSULTATION

Depending on your knowledge and the complexity of the requirement, expert assistance may be required to complete the specification.

Contact Black Box for a free consultation on your next project:
black-box.eu/freeconsultation

OTHER DATA SHEETS IN THE SERIES

- Part 2 - Selecting an ICT Cabling System
- Part 3 - Cable Pathways, Installation Techniques and Documentation
- Part 4 - Testing of Copper and Fibre Links



PREPARATION

Before starting work on a structured cabling specification, gather the following information if relevant:

- ◆ A plan (preferably) or dimensions of the areas to be cabled
- ◆ The number of staff requiring IT and/or voice services
- ◆ The services required per workstation, e.g. voice, data
- ◆ Business expansion plans
- ◆ Applications to be supported
- ◆ The highest network speed anticipated during the expected life of the cabling system
- ◆ Ethernet switches and other IT infrastructure hardware to be supported
- ◆ Printers and other peripherals to be supported
- ◆ Voice backbone / distribution requirements
- ◆ The maximum backbone bandwidth expected during the life of the cabling system
- ◆ Building management systems integration
- ◆ Telephone system details
- ◆ Location of Telecommunications Rooms (for edge networking hardware)
- ◆ Location of Equipment Rooms (for core networking hardware)
- ◆ Location of Entrance Facilities for incoming telecommunications lines
- ◆ Locations for cabinets or racks, or space in existing cabinets and racks
- ◆ Cable routes between floors, across floors and between buildings
- ◆ Existing earthing facilities
- ◆ The fire rating requirement of the cable
- ◆ Any known or potential hazards e.g. asbestos, exposed high voltages, etc.

'HOW TO' GUIDE FOR SPECIFYING A STRUCTURED CABLING INSTALLATION

PART 2 - SELECTING AN ICT CABLING SYSTEM

Over a series of data sheets we provide guidelines on how to produce a specification for an IT cabling system that meets your organisation's needs and gives you value for money.

Part two covers a review of industry standards, the types of cable available, and the capabilities of copper and fibre.

STANDARDS

Cabling systems are often specified using USA standards, e.g. Cat 5e or Cat 6. However, you should get assurance from your installer that your new cabling system will comply with your country's structured cabling standards. For the purpose of this document we are using BS EN (British Standard, European Norm) standards, namely:

- BS EN 50173 series for performance and components
- BS EN 50174 series for design, installation, operation and maintenance
- BS 6701 for installation, operation and maintenance
- BS EN 50310 for grounding and bonding
- BS EN 50346 for testing.

The standards specify a range of Classes or Categories of copper cabling systems, correctly referred to as balanced cabling systems. Amongst these are:

- Class D - Comparable with TIA Cat 5e, supporting Gigabit Ethernet (1000BASE-T)
- Class E - Comparable with TIA Cat 6, supporting Gigabit Ethernet (1000BASE-T) and 10Gigabit Ethernet (10GBASE-T) to a distance of 35m
- Class EA - Comparable with TIA Cat 6A, supporting 10 Gigabit Ethernet (10GBASE-T)
- Class F - Comparable with TIA Cat 7, supporting 10 Gigabit Ethernet (10GBASE-T)
- Class FA – Supporting 10 Gigabit Ethernet (10GBASE-T).

Choose a class that will meet your bandwidth requirements for the foreseeable future and that will fit within your budget. Bear in mind that higher class cabling is more expensive, and requires larger containment and pathways as the cables have a bigger diameter.

CHOICE OF CABLING MEDIUM

Bandwidth, lengths of cable runs, and environmental influences will determine your choice of cabling medium. In a typical enterprise installation, it is customary to use balanced twisted pair copper cables to service work areas although optical fibre cabling may be a better choice if security or electromagnetic interference are significant considerations.

Class D (Cat 5e), Class E (Cat 6) and Class EA (Cat 6A) cables are available as unshielded (UTP) and shielded (e.g. STP, FTP). Class F and Class FA have an overall shield only and each pair is individually foil-shielded. Unshielded cable is suitable for some installations but shielded cable may be required if high levels of electromagnetic interference are present or if a high "tempest" rating is required for security purposes. Also, in the case of Class EA, the unshielded variant has a larger diameter so requires larger containment.

The following circumstances, commonly found in backbones, may make it necessary to select optical fibre cabling:

- If the length of a cable run is over 90m
- If each end of the cable terminates in different electrical earth zones. This is often the case if nodes are in different buildings – a non-metallic optical fibre cable is far less likely to conduct damaging electricity in the event of a lightning strike
- If the cable is routed externally. In this case sheaths need to be more rugged and weatherproof. This is more often available for optical fibre cables
- If the space in the cable containment is limited; a multi-core fibre can carry many times the volume of data cable
- If a high level of security is required; optical fibre is secure against unauthorized access.

SELECTING THE RIGHT OPTICAL FIBRE CABLE

The selection of OM1, OM2, OM3, OM4 or OS1/OS2 optical fibre cabling depends on the network application and the distance. OM1-OM4 cables are multimode whilst OS1 and OS2 cables are singlemode.

TEST REQUIREMENT	OM1 62.5 µm	OM2 50 µm	OM3 50 µm	OM4 50 µm	SINGLEMODE
Minimum reach at 1 Gb/s	275/550m* (850/1300nm)	550/550m* (850/1300nm)	800/550m* (850/1300nm)	1100/550m* (850/1300nm)	5000m* (1300nm)
Minimum reach at 10 Gb/s	33m*	82m*	300m* (850nm)	550m* (850nm)	10000m* (1300nm)
Minimum reach at 40 & 100 Gb/s	N/A	N/A	100m* (850nm)	125m* (850nm)	10km/40km* (1310/1550nm)

*Distances listed are industry minimums.

MECHANICAL PROTECTION AND PHYSICAL PROPERTIES

The selection of cable sheath material such as PVC, Low Smoke Zero Halogen (LSZH) or plenum rated, depends on the attitude to risk, local regulations and the requirements of other interested parties e.g. premises owners and insurance companies.

Optical fibre cables may need to be armoured and rodent-resistant to give protection in ducts or for direct burial.

LIFETIME COST EFFECTIVENESS

A cabling system represents the element of a network that has the longest life span so should be designed and installed with at the very least 10 years of useable life. To ensure consistent performance throughout the life of the system, the following should be considered:

- Warranty and performance guarantees from the component manufacturer
- Quality components proven to meet appropriate standards
- Manufacturer and supplier support
- The installers have relevant qualifications and training and their installation methods fully comply with country standards.

NO OBLIGATION CONSULTATION

Depending on your knowledge and the complexity of the requirement, expert assistance may be needed to complete the specification.

Contact Black Box for a free consultation on your next project:
black-box.eu/freeconsultation

OTHER DATA SHEETS IN THE SERIES

- Part 1 - Requirements and Preparation
- Part 3 - Cable Pathways, Installation Techniques and Documentation
- Part 4 - Testing of Copper and Fibre Links



'HOW TO' GUIDE FOR SPECIFYING A STRUCTURED CABLING INSTALLATION

PART 3 - CABLE PATHWAYS, INSTALLATION TECHNIQUES AND DOCUMENTATION

Over a series of data sheets we provide guidelines on how to produce a specification for an IT cabling system that meets your organisation's needs and gives you value for money.

Part three covers what you should consider when installing containment and cable, and lists the components which make up a well-documented cabling system.

CABLE PATHWAYS AND CONTAINMENT

Cable pathways can be located above ceilings, under floors, in risers between floors, underground or overhead between buildings. In most instances, the cabling will require dedicated containment such as trunking, conduit, cable tray, matting, cable basket or ducts.

The following should be considered:

- Designing pathways that keep cable lengths within limits
- Specifying the most suitable containment for the pathway
- Consider who has responsibility for the pathways and designing the containment system, e.g. architect, mechanical and electrical contractor or the cabling installer
- Capacity, allowing for future growth and to keep fill ratios within the requirements of the BS and EN standards
- Segregation from other services, particularly electricity supply cabling in accordance with your country's standards, in the case of the UK it is BS 6701 and BS EN 50174-2 series
- Suitability for standards conformity e.g. to allow correct bend radii for cables
- You have permission from the landowner for the installation of ducts
- Protection of the cable from water, heat, sunlight, physical damage and rodents.

INSTALLATION TECHNIQUES

Suitably qualified installers, complying with relevant standards should be selected to undertake the cabling work. Qualifications would include evidence of the cable manufacturer's training or training undertaken at a specialised training establishment and supported by a recognized certification.

The installation should adhere to standards, including, where applicable:

- ◆ BS 6701
- ◆ BS EN 7671 (IEE) Wiring Regulations - 17th Edition
- ◆ BS EN 50174 series of standards
- ◆ BS EN 50310
- ◆ BS EN 50346

A good installer will not:

- ◆ Exceed the minimum bend radii for cables
- ◆ Exceed the maximum pulling force for cables
- ◆ Crush cable (e.g. by over tightening cable ties)
- ◆ Strip too much cable sheath at termination points
- ◆ Install cables where they could be damaged
- ◆ Untwist too much of each cable pair
- ◆ Use incorrect tools or fixing techniques.

A good installer will:

- ◆ Work safely
- ◆ Adhere to the necessary standards
- ◆ Always follow the manufacturer's guidelines.

LABELLING, RECORDS AND DOCUMENTATION

If your cabling system is well documented, any implementation, moves, additions or changes will be made simpler and problems more quickly diagnosed. You should develop a full administration scheme, complying with BS 6701 or your own country's standards.

The level of detail will depend on the size and nature of your network and will include the following:

Labelling and records:

- Identifiers
- Labels
- Records
- Reports
- Drawings
- Work Orders (documenting all moves, additions and changes).

Documentation should contain some or all of the following:

- Topology diagram (schematic layout)
- Floor plans routes
- Equipment room layout
- Outlet locations
- Patching closet location
- Equipment termination location
- Telecommunications or equipment room layout
- Cabinet layout
- Patching / cross connect records
- Test schedules / results
- Identification of test equipment used
- Certificate of conformity.

NO OBLIGATION CONSULTATION

Depending on your knowledge and the complexity of the requirement, expert assistance may be needed to complete the specification.

Contact Black Box for a free consultation on your next project:
black-box.eu/freconsultation



OTHER DATA SHEETS IN THE SERIES

- Part 1 - Requirements and Preparation
- Part 2 - Selecting an ICT Cabling System
- Part 4 - Testing of Copper and Fibre Links



'HOW TO' GUIDE FOR SPECIFYING A STRUCTURED CABLING INSTALLATION

PART 4 - TESTING OF COPPER AND FIBRE LINKS

Over a series of data sheets we provide guidelines on how to produce a specification for an IT cabling system that meets your organisation's needs and gives you value for money.

Part four covers the different methods of testing data cabling, and evaluates the importance of a warranty.

TESTING OF BALANCED COPPER LINKS

The specification should state how the cabling system is to be tested and to what standard.

There are three forms of testing:

- **Certification** – Tests all parameters required by ratified standards and provides a certificate for each channel or permanent link
- **Qualification** – Only tests the cabling to work for particular applications or network standards
- **Verification** – Tests only the most essential parameters.

Black Box Network Services recommends certification testing for every channel or permanent link. This should prove cost effective in the long term. It is a condition of most manufacturers' warranties that the cabling system is 100% certified. The permanent link is the link from the distribution panels and the outlets whilst the channel also includes the patch core and equipment cables.

For every installation, where either certification or qualification testing is undertaken, complete individual test reports (or certificates where appropriate) configured in accordance with the agreed standard, should be included with the installation documentation. The format and material on which these reports are to be presented should form part of the contract.

CERTIFICATION TESTING OF BALANCED CABLING

Certification is carried out with a standards-compliant tester with the required accuracy for the Class or Category of cabling installed. You should state that the cabling system be certified to the BS EN 50173 series of standards, or your own country's standards. By definition, certification testing includes qualification testing.

QUALIFICATION TESTING OF BALANCED CABLING

Where a manufacturer warranty is not offered, qualification is a less stringent alternative to certification.

- ◆ Uses less accurate test equipment to compare installed cabling performance with the requirements of specific applications
- ◆ Can only provide results for existing application standards
- ◆ Cannot provide any form of 'future proofing' as it deals only with existing applications
- ◆ Is limited to the 'Channel' test model, i.e. includes the equipment, patch and work area type cords.

VERIFICATION TESTING OF BALANCED CABLING

This will eliminate common installation errors but will not guarantee that the cabling system will support the network or bandwidth requirements. It provides:

- ◆ Minimum test and inspection for copper cabling
- ◆ A visual inspection of the terminations
- ◆ Wire-mapping test to confirm there are no open circuits, short circuits or crossed wires, including the cable screen if present. It will also confirm that telecommunication outlets and patch panels are identified and labelled correctly.

Plus, optionally:

- ◆ Cable length
- ◆ Test to ensure there are no split pairs.

TESTING OF OPTICAL FIBRE CABLING

For optical fibre cabling, certification and qualification are essentially the same thing. There is not an acceptable less accurate alternative to the Loss/Length test set.

Certification / Qualification of Optical Fibre Cabling

Provides:

- Polarity proofing by use of a visible light source
- Link length
- End-to-end power loss at the transmission wavelengths identified in the selected standard
- Calculation of power loss budget in accordance with the selected standard, allowing for the total number of connections and splices within the link
- Stringent adherence to the test method defined in the selected standard
- A final check for end-face cleanliness after certification, and cleaned as required with the correct materials.

Verification of Optical Fibre Cabling

Provides:

- A visual inspection of terminations and splices
- Inspection for dirt and scratches using appropriate inspection microscopes, and where necessary cleaned with correct materials
- Optical fibre loss measurements using a light source and power meter to calculate loss budgets.

Plus, optionally:

- OTDR measurements to determine length and locate damage and poor connections.

ELECTRICAL INSTALLATION

Installation of electrical wiring is not within the scope of this document but any related work, such as earthing and bonding, should comply with your own country's standards.

MAINTENANCE AND SERVICES

BS EN 50174-1 states that "Repair and maintenance are generally captured by the contract between the cabling owner and the cabling maintainer". Additional consideration should be made to ensure:

- A suitable maintainer (i.e. installations company/service provider) is identified where desired
- Records are updated to reflect moves and changes
- Alterations upgrades and enhancements are carried out in accordance with existing warranties, topology and standards
- Emergency support is considered.

WARRANTY

Most cabling systems come with a warranty that covers the materials and installation for fifteen years or more (Black Box Network Services can offer a lifetime warranty). Some warrant that the cabling system will support specific applications whilst others guarantee to conform to a particular standard. These warranties are valuable and reassure you that the manufacturer has confidence in the cabling system. However, the warranties do not usually specify a response time or a fix time.

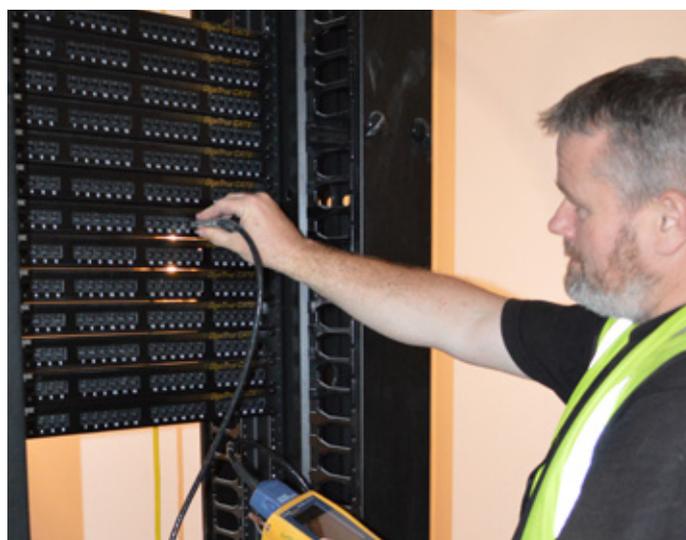
A few installers offer an enhanced warranty providing, for example, a timed response to a fault call. Cabling is often a critical part of your network so this type of warranty is beneficial for business continuity. There may be an extra charge and conditions attached to these enhanced warranties, which would be fully covered with a Service Level Agreement (SLA) for a cabling infrastructure.

For more information or a consultation on a cabling project contact Black Box Network Services.

NO OBLIGATION CONSULTATION

Depending on your knowledge and the complexity of the requirement, expert assistance may be needed to complete the specification.

Contact Black Box for a free consultation on your next project: black-box.eu/freeconsultation



OTHER DATA SHEETS IN THE SERIES

Part 1 - Requirements and Preparation

Part 2 - Selecting an ICT Cabling System

Part 3 - Cable Pathways, Installation Techniques and Documentation