

MCCB, SECTION BOARD & DISTRIBUTION BOARD

Technical Guide | Industrial & Commercial Installations

A practical technical overview of how MCCBs, section boards, distribution boards, submains and protective devices work together within industrial and commercial low-voltage distribution systems.

01 | TYPICAL DISTRIBUTION ARRANGEMENT

A commercial or industrial installation will normally distribute power in stages. The exact arrangement depends on the size and use of the site, but a typical system may follow the path below.

DNO / TRANSFORMER	→	MAIN LV SWITCHBOARD	→	SECTION BOARD	→	DISTRIBUTION BOARD / LOAD
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The main LV switchboard receives the incoming supply and distributes power to larger submains. Section boards can then provide multiple MCCB-protected outgoing ways, while downstream distribution boards supply smaller final circuits such as lighting, small power and local equipment.

02 | MCCBs - WHAT THEY DO

Moulded Case Circuit Breakers (MCCBs) combine circuit protection and switching in a compact device designed for higher-current applications. They are commonly used on incomers and outgoing submains feeding section boards, distribution boards, machinery and plant.

Depending on the MCCB and trip unit, protection can include overload and short-circuit functions with adjustable settings. Electronic trip units can provide greater adjustment and, on some equipment, additional metering, communication or protection functionality.

Key MCCB parameters include:

- Rated current and frame size
- Breaking capacity at the system voltage
- Trip-unit type and available protection settings
- Number of poles and neutral arrangement
- Compatibility with the assembly and manufacturer system
- Accessory requirements such as auxiliary contacts, shunt trips or undervoltage releases

03 | PROTECTIVE DEVICE COORDINATION

Protection should be coordinated so that cables and equipment are protected under overload and fault conditions. On installations with several levels of distribution, the relationship between upstream and downstream devices is particularly important.

Discrimination / selectivity aims to ensure that the protective device closest to a fault operates first where the design permits. This can help prevent a fault on one circuit from unnecessarily disconnecting a larger part of the site.

Cascading / back-up protection may be available within a manufacturer's tested system, allowing an upstream device to support the short-circuit performance of a downstream device. This should only be applied using appropriate manufacturer data.

04 | FAULT LEVEL & BREAKING CAPACITY

The prospective fault current at the point where equipment is installed must be considered. The selected protective device and assembly must be capable of safely dealing with the fault conditions applicable at that location.

Fault level can be particularly significant close to large transformers or main LV switchboards. It should not be assumed that a device suitable further downstream is automatically suitable at the origin of the installation.

05 | SECTION BOARDS

Section boards are used where several substantial outgoing circuits need to be distributed from one location. They are particularly common within factories, warehouses, production facilities, plant rooms and large commercial buildings.

A typical section board may comprise an isolator or MCCB incomer, busbar system, multiple MCCB outgoing ways, neutral and earth bars, metering and spare capacity. The arrangement should be selected to suit the load, fault level, cable sizes, installation environment and future requirements.

06 | DISTRIBUTION BOARDS

Distribution boards generally sit further downstream and distribute power to final circuits or smaller sub-distribution circuits. Depending on the application they may incorporate MCBs, RCBOs, RCDs, AFDDs, surge protection and metering.

For industrial and commercial applications, board selection should consider the number of ways, load characteristics, spare capacity, fault level, enclosure type, cable entry, neutral requirements and the protective devices required by the design.

07 | SUBMAIN CABLE DESIGN

A submain must be designed around both the connected load and the protective device. Large industrial installations may use multicore SWA cables or single-core cables installed on ladder, tray or other suitable containment.

Technical considerations typically include:

- Design current and maximum demand
- Cable current-carrying capacity after applicable correction factors
- Protective device rating and characteristics
- Voltage drop
- Earth fault loop impedance and automatic disconnection
- Prospective short-circuit current and cable fault withstand
- Parallel cable arrangements where required
- Neutral loading, harmonics and load characteristics
- Installation method, grouping and ambient conditions

08 | PARALLEL CABLES

Larger supplies may require two or more conductors per phase in parallel. Parallel conductors need careful design so current shares appropriately between the cables. Conductor material, size, length, installation method and termination arrangements should be consistent, and the physical layout should avoid creating unequal impedance between parallel paths.

Where single-core cables are used on AC systems, their arrangement and surrounding metallic containment must also be considered to manage magnetic effects and heating.

09 | EARTHING & PROTECTIVE CONDUCTORS

Every distribution circuit requires an appropriate fault-current return path. Depending on the cable and installation arrangement, this may use the cable armour, a separate protective conductor or another designed arrangement.

Protective conductor sizing can be established using the applicable tabulated method or by calculation where appropriate. The complete earth fault path and protective device characteristics must support the required automatic disconnection performance.

10 | VOLTAGE DROP

Voltage drop becomes increasingly important on long submains and high-current circuits. Excessive voltage drop can affect equipment performance and reduce the voltage available at downstream distribution boards and final circuits.

The designer should consider the submain together with the downstream circuits rather than using the entire available voltage-drop allowance at the first stage of distribution.

11 | CABLE TERMINATIONS

Large cable terminations require sufficient physical space and appropriate support. Correct glands, lugs, crimping systems, heat-shrink or identification, bend radii and terminal torque are important to produce a reliable connection.

Cables should be mechanically supported so their weight and bending forces are not transferred directly onto MCCB or busbar terminals.

12 | METERING & MONITORING

Section boards and larger distribution boards can incorporate electrical metering to provide visibility of energy consumption and load. Depending on the application, metering may use direct-connected meters or current transformers (CTs).

Sub-metering can be useful for monitoring individual production areas, machinery groups, tenants, departments or energy-saving projects. Networked meters can also support wider energy-management systems where required.

13 | SURGE PROTECTION

Surge protective devices (SPDs) may form part of the distribution design to limit transient overvoltages. Selection and positioning depend on the electrical installation, supply arrangement, equipment being protected and the applicable requirements of BS 7671.

Where multiple distribution levels exist, coordinated surge protection may be required rather than treating each board independently.

14 | THERMAL MANAGEMENT & CONNECTION INTEGRITY

High-current equipment can generate significant heat. Enclosures, busbars, protective devices and cable terminations must operate within their designed limits. Loose or poorly made connections can create localised heating and may lead to deterioration or failure.

Periodic inspection and thermal imaging can help identify abnormal heating in operational equipment, although thermal imaging does not replace the electrical inspection and maintenance required for the installation.

15 | PLANNING SHUTDOWNS & CHANGEOVERS

Distribution upgrades often involve equipment that supplies significant areas of an operational site. Replacement or modification therefore requires careful shutdown planning.

Before isolation, the circuits and operational impact should be established. Critical plant, IT systems, production equipment, fire and security systems, emergency lighting and other essential services may require specific arrangements during the shutdown.

16 | TECHNICAL INFORMATION TO GATHER

For a new section board, distribution board or MCCB installation, the following information is typically useful at design stage:

- Existing single-line diagram or distribution information
- Supply voltage, earthing arrangement and fault-current data
- Existing main switchboard details and available outgoing capacity
- Current and anticipated maximum demand
- Load type and starting characteristics of large equipment
- Required number and size of outgoing circuits
- Cable routes, lengths and installation methods
- Space restrictions and preferred cable entry
- Required metering, monitoring or control
- Future expansion requirements and shutdown constraints

17 | THE QUEST APPROACH

From LV Distribution to the Final Connection

QUEST Electrical delivers industrial and commercial distribution projects as complete electrical installations. This can include assessment of the existing supply, MCCB and protective-device selection, section boards, distribution boards, large submains, cable ladder and containment, machinery supplies, metering, testing and commissioning.

Considering the complete distribution path helps ensure the new equipment is appropriate for the existing infrastructure, connected loads and future requirements of the site.

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LV Switchgear | MCCBs | Section Boards | Distribution Boards | Submains | Containment | Testing & Commissioning

Technical note: This guide provides a general technical overview only. Final equipment selection, protection settings, cable sizing and installation arrangements must be based on project-specific design information, manufacturers' data and the applicable requirements for the installation.