



# Functional earthing explained

To ensure personal and equipment safety, the areas of shielding and earthing require careful planning and installation. How important is functional earthing? Weidmüller gives you the answers.

## How do the areas of earthing and shielding differ fundamentally?

Earthing and shielding are divided into personal safety and equipment function. Thus, earthing takes priority to protect life and limb, and is also known as the circuit protective conductor for this reason. Shielding, on the other hand, ensures error-free functioning of an electrical system and ensures that there is electromagnetic compatibility.

## What differences come from the electrical technical design and installation?

Shielding is not designed to transfer power, although leakage currents may flow along them. A PE conductor, on the other hand, must at least be able to briefly carry a high residual current (IEC 60947-7-2). The corresponding short-term ability to withstand a current in the PE termination must be 120 A/mm<sup>2</sup> for the connected cross-section.

## Is the earthing also relevant for ensuring the system operates properly as well as for protection of life and limb?

Yes, and here you can differentiate between two different sorts of earthing: protective earthing and functional earthing. Whilst protective earthing is designed to protect living beings from an electric shock in the event of a fault, functional earthing – as the name suggests – ensures that the functions and therefore the normal operation of the system is preserved.

## How exactly does this functional earthing work?

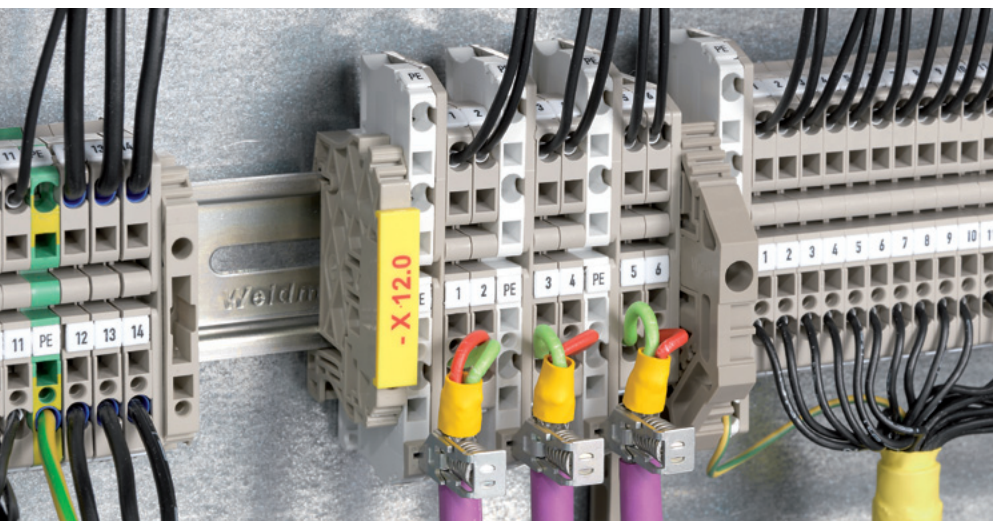
Functional earthing is basically equipotential bonding; this is the discharge of coupled transient currents that build up on screens, or a FE function in device parts for people with non-dangerous voltages. The same applies for couplings on the ground leads inside equipment. These, too, must be safely discharged.

## What must be considered when selecting suitable products?

If terminal blocks are used for functional earthing, the DIN VDE 0113 is split into FE and PE. PE terminals, with a protection function for life and limb, must be labelled yellow/green, they may also be used for functional earthing. For FE terminals, a colour differentiation may be applied and so white PE (FE) terminal blocks may be used but must be marked as earth. Even the symbolism has been expanded to illustrate functional earthing.

## What does Weidmüller offer in the area of functional earthing?

For systems where there is a requirement to show the distinction between protective and functional earthing, Weidmüller offers white PE (FE) terminal blocks in its W-series (with screw connections) and Z-series (tension clamp connections). These terminals are easily identified through their colouring and marking, showing that the circuits are exclusively there to functionally protect the electrical systems that are connected.



Application example: Shielding via functional earthing



Hager's installers are offered more functional reliability for communication systems thanks to Weidmüller's white FE (PE) terminals

## Functional earthing in practical applications

Be it power distribution, cable management and room connection systems, switch systems, building automation or security in domestic and commercial buildings – Hager offers innovative system solutions for electrical installations. Uwe Karmann, Multimedia Solutions and Residential Enclosures Product Manager, explained what role Functional Earthing plays for Hager.

### **WIN!** What significance do the areas of shielding and earthing have for you in general?

**Karmann:** They are extremely important. As a traditional manufacturer of distribution cabinets for residential and commercial buildings, we must always provide a sufficient number of terminals for adequate and proper protective equipotential bonding. Increasingly we are installing information technology equipment that meets the standard for structured building cabling, DIN EN 50173. Even in residential properties, the importance of shielding and electromagnetic compatibility has significantly increased. Here, amongst other things, we must consider standard DIN EN 50310 (VDE 0800 part 2-310). This lays down the requirements for earthing and equipotential bonding in buildings where there are installations for information technology. In low voltage systems, like meter cabinets for example, we can fit PE and N terminals in the connection area on integral system terminal block carriers. Here we must

consider the requirements of the standard series DIN VDE 0603 and DIN 43870.

### **WIN!** For what purpose do you install functional earthing? What functions do you protect with this?

**Karmann:** For Hager meter cabinets and built-in small distribution boards, you talk about functional earthing where IT cables and lines as well as shielded data lines and the associated IT equipment are used. To ensure trouble-free operation, functional equipotential bonding with a connection to the functional earth is required. To achieve trouble-free operation of all the electrical systems, we are of the opinion that there should be no PEN conductor from the building entry in the whole building. The separation into PE and N as well as the connection of all metallic building fittings to the protective equipotential bonding plays an important role in all of this.

There are different options for functional equipotential bonding. For our applications, it is there to ensure trouble-free operation of the data communications equipment. Usually TP Cat. 7 cabling is used in Germany for generic applications. This can be used to transmit signals for the internet, telephone, television or audio systems. These use different high frequencies (up to GHz) and can achieve data rates of 1000 MBit/s or more. The shielding for this cable is therefore split into a foil shield made of aluminium, and a copper braided shield. They are used to shield against high- and low-frequency disturbances.

In addition, these cables may not cause any additional disturbances inside the system

according to the EMC law. Therefore, according to standard DIN EN 50310 (VDE 0800 Part 2-310) this braided shield is to be connected to the equipotential bonding – it allows low impedance. This means that the protective earthing (green-yellow) must be different to this functional earthing and must also run separately. In domestic settings that require no TN-S system, we often find the classical TN-C system. Therefore the protective earth (PE) and the neutral conductor (N) should be separated as soon as possible. In double insulated meter cabinets or built-in distribution panels, we may not establish a conductive connection to the metal housing. Hager therefore deliberately offers the installer the possibility to construct the functional equipotential bonding with a white terminal, so that an optical and technical difference can be achieved from the protective earthing.

### **WIN!** In what ways have you run wiring?

**Karmann:** The installer is often faced with the challenge of installing an IT facility in existing buildings. This is normally star-wired and therefore favourable for a functional earthing. Where the cable lengths are large, high impedance (resistance) is created when combined with high operating frequencies. This means that the operating current is conducted poorly which can lead to disturbances. Therefore, an intermeshed equipotential bonding is preferable in principle. Here metallic building fittings can be used as well.

### **WIN!** How can Weidmüller help you in creating functional earthing?

**Karmann:** Weidmüller, according to our research, is the only manufacturer who can supply us with white FE (PE) terminals as a stock item in a timely manner. Weidmüller also has extensive experience in the areas of EMC and system safety and could assist us with this know-how. Our concerns about the functional safety of the communication-related equipment could therefore be removed because the additional terminal in the communication fields now enables installers to bring more safety into the system.