



Mounting and installation information for junction boxes

For any installation requirement in all kinds of
application areas



Contents

1. Installation in external areas, outdoors, in damp and wet areas and rooms	5
1.1. Basic principles	5
1.2. Protection against UV radiation	5
1.3. Protection against high temperatures	6
1.4. Protection against chemical influences	6
1.5. Protection against condensation	6
1.6. Protection against rain/snow (precipitation)	7
1.7. Protection against water build-up (frost)	7
1.8. Protection against plants and/or mould growth	7
2. Protection ratings according to IEC 60529 (VDE 0470-1)	8
3. Overview of the installation areas	10
3.1. Protection against direct contact (basic protection)	10
3.2. Rooms with bath tubs or showers according to DIN VDE 0100-701	10
3.3. Pools of swimming baths or other pools according to DIN VDE 0100-702	11
3.4. Agricultural or horticultural facilities according to DIN VDE 0100-705	12
3.5. Damp and wet areas, rooms and outdoor areas according to DIN VDE 0100-737	12
3.6. Photovoltaic systems according to DIN VDE 0100-712	13
3.7. Strain relief, cable systems VDE 0100-520	14
4. Junction boxes from OBO Bettermann	15
4.1. A series – the everyday hero	15
4.2. T series – the all-rounder	16
4.3. X series – the extreme athlete	17
4.4. Mx series – the robust one	18

Introduction

Junction boxes are used to connect cables and can be mounted in all kinds of areas. With regard to the ambient conditions, several factors and standardised specifications must be taken into account, in order to select the right junction box for the intended place of use. Thus, with installations in outdoor areas or in damp or wet environments, it is necessary to estimate exactly how strong the load from weathering or possibly damaging environmental influences is and which protective measures are necessary. The division into different protection ratings, also termed IP codes, provides information on how strongly a junction box is protected against contact and

the harmful ingress of water. By contrast, the so-called IK code represents the protection rating against mechanical loads. DIN VDE 0100 is an erection requirement and specifies which requirements a junction box must fulfil in specific installation areas. To guarantee a safe device installation, all these factors must be checked in individual cases and observed during the selection.



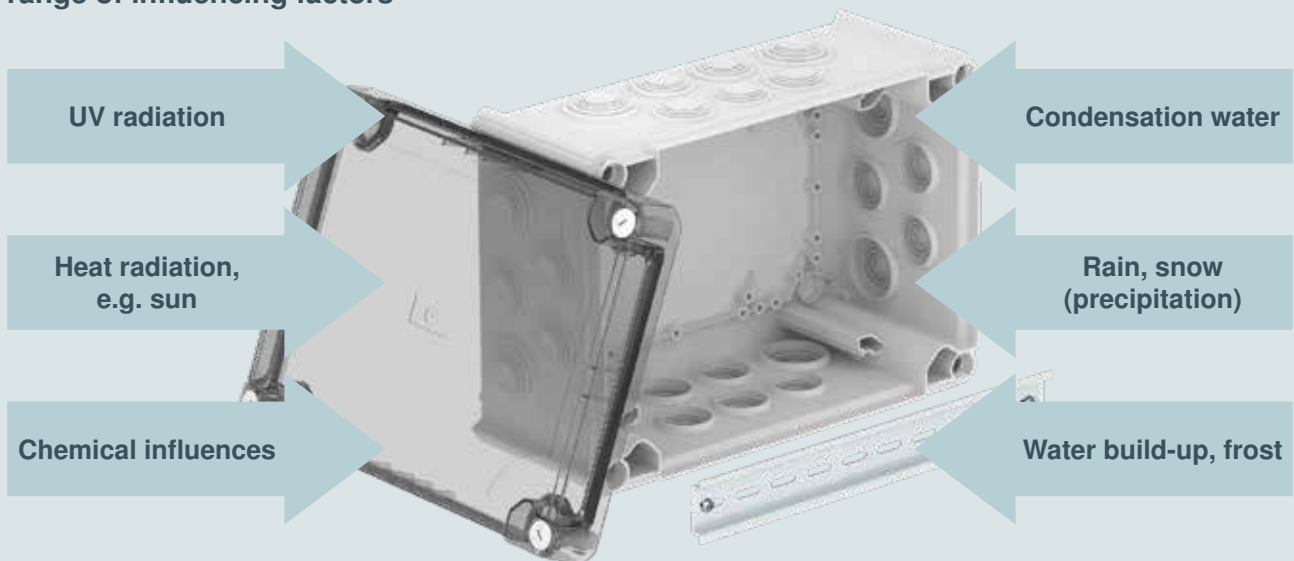
1. Installation in external areas, outdoors, in damp and wet areas and rooms

1.1. Basic principles

With all installation types, the user must always comply with the valid conditions, such as the erection requirements according to DIN VDE 0100-ff.

Depending on the local circumstances, the user may need to take additional or special measures as protection, to guarantee the safe function of junction boxes.

With outdoor installations, there is a wide range of influencing factors



1.2. Protection against UV radiation

UV radiation can cause major structural damage to various plastics. This damage may even lead to destruction. For these reasons, products made of the material polystyrene (PS) may not be used in outdoor areas.

OBO Bettermann developed the junction boxes of the T and X series for these applications. These products are manufactured from materials offering a high level of resistance to UV radiation.



T series



X series



1.3. Protection against high temperatures

During operation, electrical devices require loss power. This factor must always be observed, whilst taking the ambient temperature and the installation type into account.

Switching device combinations are designed for ambient temperatures between $-25\text{ }^{\circ}\text{C}$ and $+35\text{ }^{\circ}\text{C}$ (over a maximum period of 24 hours). Brief heating up to $+40\text{ }^{\circ}\text{C}$ is not problematic. Even if OBO Bettermann junction boxes are suitable for temperatures of $-40\text{ }^{\circ}\text{C}$ to $+80\text{ }^{\circ}\text{C}$, the manufacturer's specifications and the specifications of the appropriate product safety standard must be checked for the installed devices.

Sunlight or other heat sources can lead to improper inner temperatures, which must be avoided at all costs. Otherwise, the safe function of the electrical resources may not be guaranteed.

According to VDE 0100-520, 522.1.2, cable systems, including their accessories, may only be operated at ambient temperatures corresponding to the product standard or the manufacturer's specifications and may not exceed the limit values.

1.4. Protection against chemical influences

Installations in areas with an increased concentration of pollutants in the area may see a restriction of suitability.

The X series from OBO Bettermann is resistant to mineral oils and various vegetable and animal fats.



1.5. Protection against condensation

The tighter the connection sockets or distributor boxes are closed, the greater the likelihood that condensation will occur.

This is particularly the case in places where strong temperature variations are to be expected. The formation of condensation water is increased or amplified by the loss of power of the electrical resources installed.

This can cause differing pressure conditions, which can lead to the housing sucking in air when there is a change in temperature. During a subsequent temperature increase, the moisture located in the air precipitates as water onto the cold surface of the housing, e.g. on the cover.

As soon as this effect has occurred multiple times, a considerable volume of water can collect in the housing. The higher the protection level of the housing, the higher the volume that can collect in the interior, as the water is no longer discharged. This means that the tightness may even have a negative impact and damage may occur.

According to DIN VDE 0100-520, measures must be taken to remove water, if water or condensation can occur within cable systems.

Depending on the type, OBO Bettermann's junction boxes of the various product groups can offer a break-out or condensation water opening to be pushed in. This is attached in such a way that possible condensation can flow out freely at any time, irrespective of whether the box is mounted horizontally or vertically. Alternatively, pressure compensation measures can be used, such as the OBO pressure compensation element.

1.6. Protection against rain/snow (precipitation)

The protection rating tests carried out according to IEC 60529 serve as comparative tests and to classify properties. These tests are limited to a few minutes and cannot imitate weather through precipitation or cleaning with a water jet. A general weather test cannot be defined due to differing local circumstances. For this reason, the erector requirements of the appropriate installation situation must always be taken into account.

According to DIN VDE 0100-520, 522.3.1, cable systems must always be selected in such a way that damage from condensation or the ingress of water cannot be caused. This means that condensation water openings should be available and the junction boxes in outdoor areas may only be installed with protection.

1.8. Protection against plants and/or mould growth

The plastics used for electrical installations are organic materials. For this reason, damage from plants, algae or mould should be taken into account.

According to DIN VDE 0100-520, 522.9.1, if experience has shown that plant and/or mould growth can cause damage, the cable systems must be selected accordingly or special protective measures must be provided.

Note: A routing type must be selected which allows a corresponding removal of such growth.

Conclusion:

Taking the above-mentioned parameters into account, protected installation of the junction boxes is essential and also described in detail in the erection standards. Only in this way can safe operation of the protection devices be guaranteed.

Installation only in protected external areas

Please note that, in the case of an installation such as under solar panels, the housings may not be located directly under the joints of the solar modules, or that the housings must additionally be covered with protective covers.

1.7. Protection against water build-up (frost)

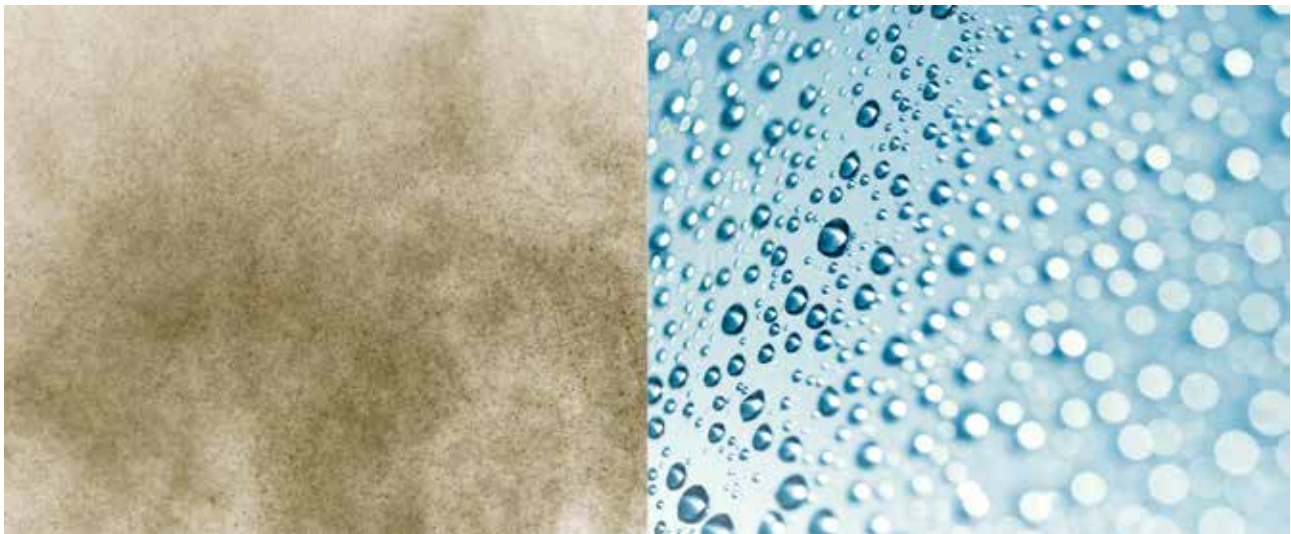
Frequently, with an installation that is not protected against precipitation, water will collect on surfaces and in recesses. If these cannot flow away unimpeded, then this will cause a build-up of water. In the case of low temperatures, this water can freeze and exert an improper mechanical load on the housing. This can lead to damage to the housings. Therefore, during installation, care should be taken that the housings are protected by a cover.

A cover may already exist due to structural circumstances, may be erected by the user or be created with additional components.

Additional information on outdoor installation and UV resistance:

The information on the protection rating and UV resistance is frequently seen as the only criterion for outdoor installation. In the case of outdoor installations, other factors, such as absolute temperature, frequency of temperature changes, humidity and particularly chemical influences, have a role to play. Besides influences through UV impacts, with outdoor installations it is damage from chemical influences, in particular, that are to be expected. Thus, outdoor areas of petrol stations, chemical plants, rubbish dumps, compressors, sewage works, etc. must be investigated particularly critically in advance.

2. Protection ratings according to IEC 60529 (VDE 470-1)



The IP protection rating specifies how far a component is protected against contact and foreign bodies and the ingress of water. The IP protection ratings are controlled by the standard DIN EN 60529 (VDE 0470 Part 1). The IP is always made up of two digits.

IP
65

The first digit designates the contact and foreign body protection. On the one hand, it specifies how far a housing prevents access to dangerous parts, by preventing or limiting the ingress of body parts or objects held by a person. On the other hand, it specifies how far the housing protects the installed resources against the ingress of solid foreign bodies.

The second digit specifies the protection against water. It specifies how far the resource is protected against incoming water and the resulting damage.

Protection rating against contact and the ingress of foreign bodies

First code digit	...against access to the dangerous parts	...against solid foreign bodies
0	Protected against access to dangerous parts with the back of the hand	Non-protected
1	Protected against access to hazardous parts with a finger	Protected against solid foreign bodies 50 mm diameter and larger
2	Protected against access to hazardous parts with a tool	Protected against solid foreign bodies 12.5 mm diameter and larger
3	Protected against access to hazardous parts with a wire	Protected against solid foreign bodies 2.5 mm diameter and larger
4	Protected against access to hazardous parts with a wire	Protected against solid foreign bodies 1.0 mm diameter and larger
5	Protected against access to hazardous parts with a wire	Dust-protected
6	Protected against access to hazardous parts with a wire	Dust-proof

Protection rating against the entry of water with a damaging impact

Second code digit	Short name	Definition
0	Non-protected	-
1	Protected against water droplets	Droplets falling vertically may have no damaging impact.
2	Protected against water drops when enclosure tilted to up to 15°	Vertically falling drops shall have no harmful effects when the enclosure is tilted at any angle up to 15° on either side of the vertical.
3	Protected against spray water	Water being sprayed at an angle of 60° on both sides of the vertical may not have any damaging impact.
4	Protected against spray water	Water spraying the housing from any direction may not have any damaging impact.
5	Protected against water jets	Jets of water pointing at the housing from any direction may not have any damaging impact.
6	Protected against strong water jets	Strong jets of water pointing at the housing from any direction may not have any damaging impact.
7	Protected against the effects of being temporarily immersed in water	If the housing is sometimes underwater under standard pressure and time conditions, then water may not enter in such volumes as would have a damaging impact.
8	Protected against the effects of being continuously immersed in water	Ingress of water in quantities causing harmful effects shall not be possible when the enclosure is continuously immersed in water under conditions which shall be agreed between manufacturer and user. However, the conditions are more difficult to fulfil than for number 7.

3. Overview of the installation areas

Various standard requirements must be fulfilled so that junction boxes can be installed in specific environments and that the internal installations do not present a safety risk.



Example: Living rooms, hotel rooms, attics, etc.

3.1. Protection against direct contact (basic protection)

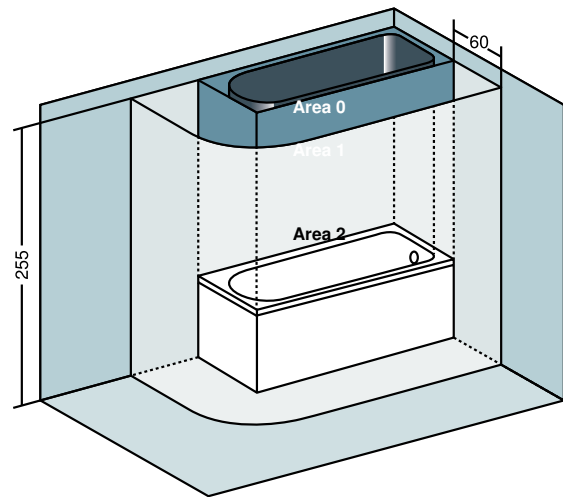
Protection according to the standard conditions according to DIN VDE 0100-410.

Active parts (alternating current voltages of more than 50 V and direct current voltages of more than 120 V) must be surrounded by wrapping or arranged behind covers with a protection rating of at least IP2X. Horizontal top surfaces of covers or wrapping, which are easily accessible, must correspond to at least the protection rating IP4X. Covers and wrapping must be securely fastened and have a sufficient resistance and lifespan, in order to maintain sufficient distance to active parts under the normally expected conditions of normal operation and taking the appropriate external influences into account. Covers may only be removed with tools.

All the products of OBO Bettermann fulfil these requirements.

3.2. Rooms with bathtubs or showers according to DIN VDE 0100-701

Rooms with bathtubs or showers are divided up into areas, in which only certain devices may be installed.



Areas in rooms with bathtub or shower

Important protection requirements:

The following switching devices, control devices and installation devices are permitted in the areas:

Area 0

No devices permitted.

Area 1

- Junction boxes and connection boxes for the supply of electrical consumables, which are permitted in Areas 0 and 1 according to 701.55;
- Accessories, including sockets, of circuits protected by low voltages using safety extra-low voltage (SELV 1) or protective extra-low voltage (PELV2) with a nominal voltage, which does not exceed AC 25 V or DC 60 V. The current source must be located outside Areas 0 and 1.

Area 2

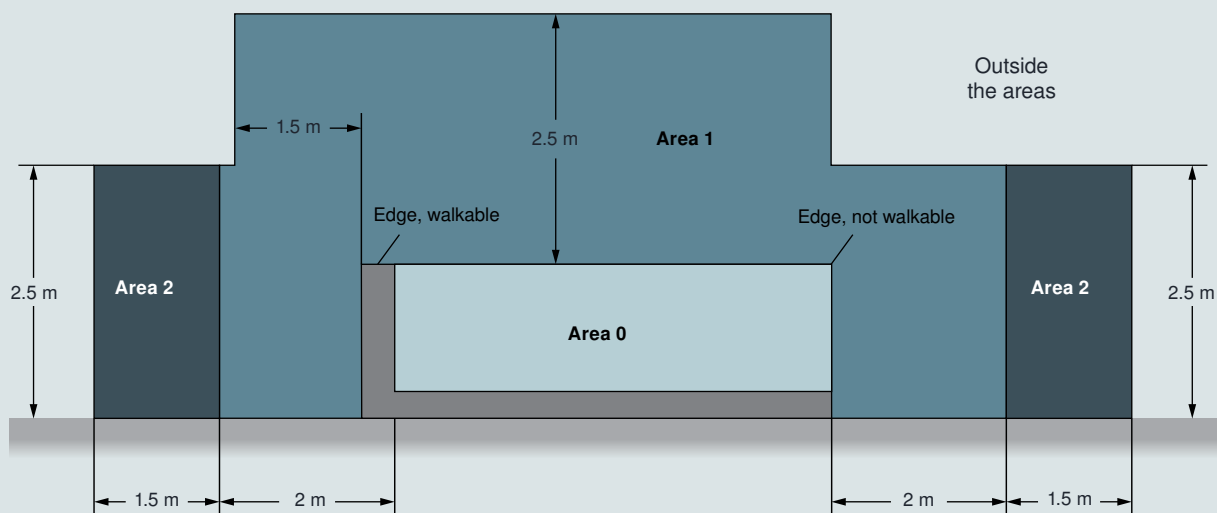
- Accessories, with the exception of sockets;
- Accessories, including sockets, of circuits protected by low voltages using safety extra-low voltage (SELV¹) or protective extra-low voltage (PELV²). The current source must be located outside Areas 0 and 1;
- Shaving socket units according to DIN EN 61558-2-5 (VDE 0570-2-5);
- Accessories, including sockets for signal and communication technology resources, of circuits protected by low voltages using safety extra-low voltage (SELV¹) or protective extra-low voltage (PELV²).

The electrical resources must have at least the following protection rating:

- In area 0: IPX7
- In area 1: IPX4
- In area 2: IPX4

This requirement does not apply to shaver socket units according to DIN EN 61558-2-5 (VDE 0570-2-5), which are erected in Area 2 and where direct spraying during showering is unlikely. Electrical resources which are subjected to water jets, e.g. for cleaning purposes in public baths, must correspond at least to protection rating IPX5 in Areas 1 and 2.

3.3. Pools of swimming baths or other pools according to DIN VDE 0100-702



Areas such as pools of swimming baths and other pools

Important protection requirements:

When using safety extra-low voltage (SELV¹), protection against direct contact must be guaranteed, irrespective of the nominal voltage level, through:

- Covers or wrapping with a protection rating of at least IPX2 or IPXXB (protected against finger access) or
- insulation, which can withstand a testing voltage of 500 VAC for at least one minute.

Pools of swimming baths and other pools are divided up into areas, in which only certain devices may be installed.

Junction/connection sockets may not be erected in Area 0. In Area 1, only junction/connections sockets for circuits with protection through low voltages with safety extra-low voltage (SELV¹) are permitted.

SELV = Safety extra low voltage
PELV = Protective extra low voltage

Electrical resources used in areas of pools of swimming baths and other pools must correspond at least to the following protection ratings:

Area	Outdoors, for cleaning work with spray water	Outdoors, without spray water	Indoors, for cleaning work with spray water	Indoors, without spray water
0	IPX5/IPX8	IPX8	IPX5/IPX8	IPX8
1	IPX5	IPX4	IPX5	IPX4
2	IPX5	IPX4	IPX5	IPX4

3.4. Agricultural or horticultural facilities according to DIN VDE 0100-705

In these areas, there are different requirements for the switch-off devices of the circuits, but also requirements for the materials used.

In final circuits with sockets, there must be an offset current protection device with a rated differential current = 30 mA.

In all other circuits, except those supplying distributors, there must be an offset current unit with a rated differential current = 300 mA.

With regard to the material used for the junction/connection sockets, before the installation it is necessary to check which chemical concentrations are present in the environment. This has a serious influence on the resistance of the products used.

Examples:

Stables, chicken coops, pigsties, breeding spaces, storage locations for straw, fertilisers and cereals, etc.

3.5. Damp and wet areas, rooms and outdoor areas according to DIN VDE 0100-737

Important protection requirements:

In damp and wet areas and rooms, electrical resources must at least be protected against water droplets (protection rating IPX1).

In areas and rooms, in which spray water is used and the resources are normally not sprayed directly for cleaning purposes, the resources must have at least spray water protection (protection rating IPX4). In areas and rooms in which spray water is used, resources that are directly subjected to the water jet must, with regard to water protection, have a protection rating suitable to being subjected to a water jet or have sufficient additional protection that does not impair perfect operation of a resource protected in such a manner.

Examples:

Canteens, unheated and unventilated cellars, laundries, refrigerators, greenhouses, laundrettes, etc.



Junction box in greenhouse



Protected outdoor area



Photovoltaic system

Open-air systems

Important protection requirements:

In protected outdoor areas, resources must at least be protected against water droplets (protection rating IPX1). In unprotected outdoor areas, resources must at least be protected against spray water (protection rating IPX3).

The requirements for protection through an automatic switch-off of the power supply are listed in DIN VDE 0100-470 (VDE 0100-470):1996-02 and, amongst other things, apply to

- outdoor sockets,
- sockets occasionally used to supply portable resources outdoors can be expected.

In addition, ventilation and/or drainage is essential!

Examples of unprotected outdoor installations:

Roads, paths and squares, thoroughways and gardens, construction locations, platforms, ramps and roofs, construction machines, petrol stations and buildings.

Examples of protected outdoor areas:

Systems on covered platforms, gateways and covered petrol stations, houses or buildings with a sufficient roof overhang/with additional weather protection.

3.6. Photovoltaic systems according to DIN VDE 0100-712

Important protection requirements:

The periphery of PV systems is primarily mounted outdoors. For this reason, there are the following important protection requirements:

- External influences that are to be expected, such as wind, ice formation, temperature and sunlight, must be taken into account.
- In PV systems, it is essential that the heat created by direct sunlight is dissipated.

All connection/junction boxes must be provided with a warning that active parts in the boxes could still be energised after the PV inverter is disconnected.

The requirements for switching off the PV system for maintenance work can be found in VDE 0100-712, Section 53.

In addition, ventilation and/or drainage is essential!



Strain relief clips



Cable glands

3.7. Strain relief, cable systems VDE 0100-520

Cable systems must be selected and erected in such a way that damage is avoided during the erection, operation and maintenance work. The tension on a cable should not exceed the values stated below. This is dependent on a maximum tensile strength of 1,000 N or a value agreed with the manufacturer.

- 50 N/mm² for non-flexible cables during routing.
- 15 N/mm² for flexible cables with maintained tensile loading and non-flexible cables during operation in permanently installed circuits.

When the above-mentioned values are exceeded, suitable measures must be taken. This can be implemented using a suitable, separated agent/product. This agent may not damage the cables.

For junction boxes, this specification can take place using various measures. On the one hand, through the use of a suitable cable gland, which is directly inserted into the box, and, on the other, through the use of suitable strain relief clips, which are mounted outside the box.

4. Junction boxes from OBO Bettermann

4.1. A series – the everyday hero



The A series family is one of our well-known classic brands. Made of halogen-free thermoplastic, they offer a simple solution to simple applications. The elastic material is particularly easy to use and, thanks to the external fastening and clamshell, the boxes are mounted quickly and simply. The cutting tool supplied in the packaging also allows proper opening of the pre-marked cable entries of the required size in the side walls.

The practical sizes in 3 colours are matched to the applications. The smallest of the family, the A6, is even at home in inspection lamps and roller blind boxes. Its big brother can be found in lofts and basements – a real everyday hero!



Areas of application:

- Lofts and cellars in private housing
- Private garages and carports
- Inspection lights and roller blind boxes

4.2. T series – the all-rounder



If you want a little more, the junction boxes, made from high-quality materials with sensible wall thicknesses, are particularly stable and thus perfectly equipped to handle greater loads. Thanks to the UV-stabilised plastic and the IP66 protection rating, they can also withstand weathering conditions in indoor areas and, under certain circumstances, those in outdoor areas as well.

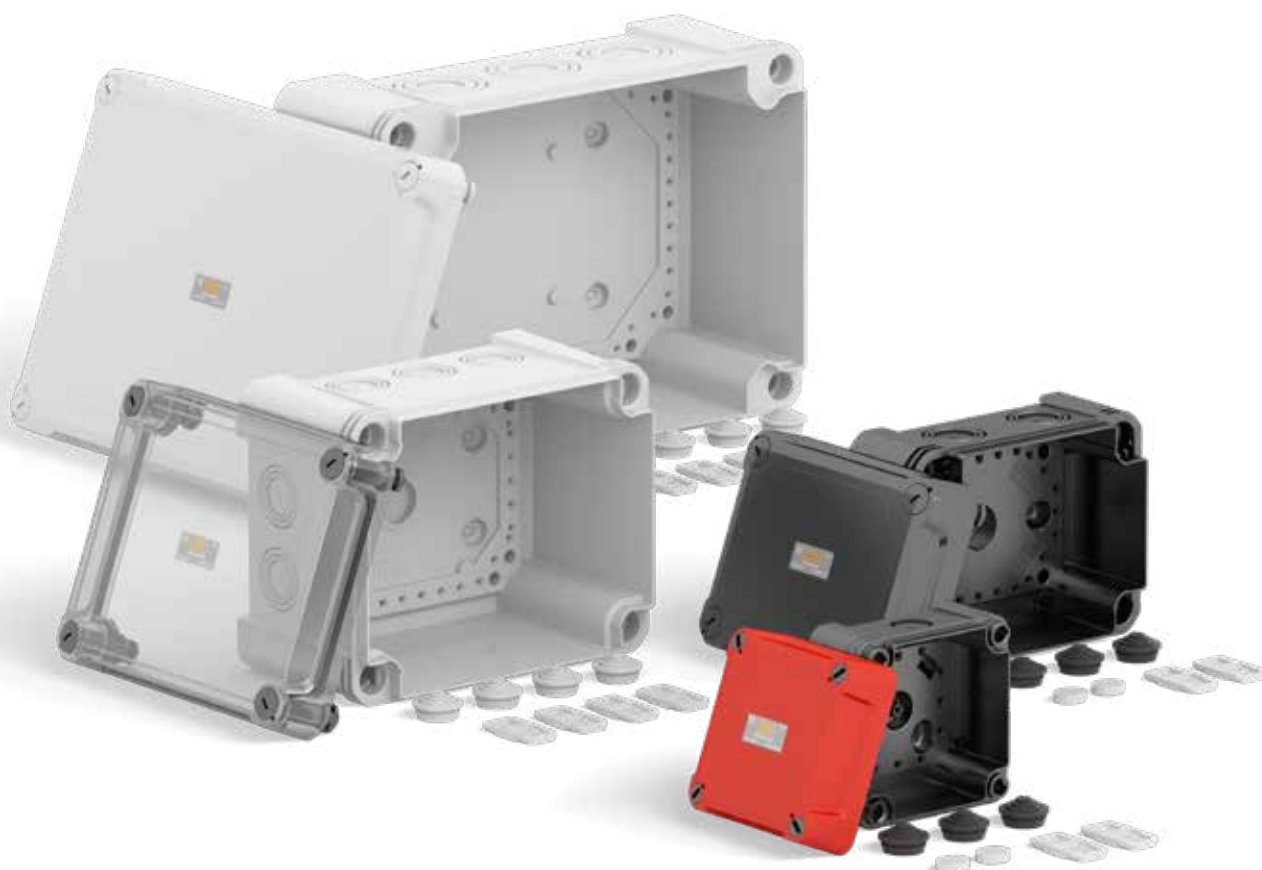
The T series is characterised by its intelligent construction and practical details, because it is as versatile as the requirements placed on it. No matter whether dealing with flexible wiring compartments of different shapes and sizes, the colour differentiation of circuits, checking of electrical components or use in the maintenance of electrical function – our all-rounders always have the right answer.



Areas of application:

- Warehouses, sports halls and car parks
- Protected exterior areas, e.g. under roof overhangs
- Escape route lighting for the maintenance of electrical function

4.3. X series – the extreme athlete



Professionals are at work here: The junction boxes are high-quality and robust. With its impact resistance of IK09, the X series can withstand the strongest mechanical loads. Our "extreme athletes" are also dust and waterproof, as well as UV-resistant. This is why they are the right choice for challenging industrial applications and extreme weathering conditions in exterior areas.

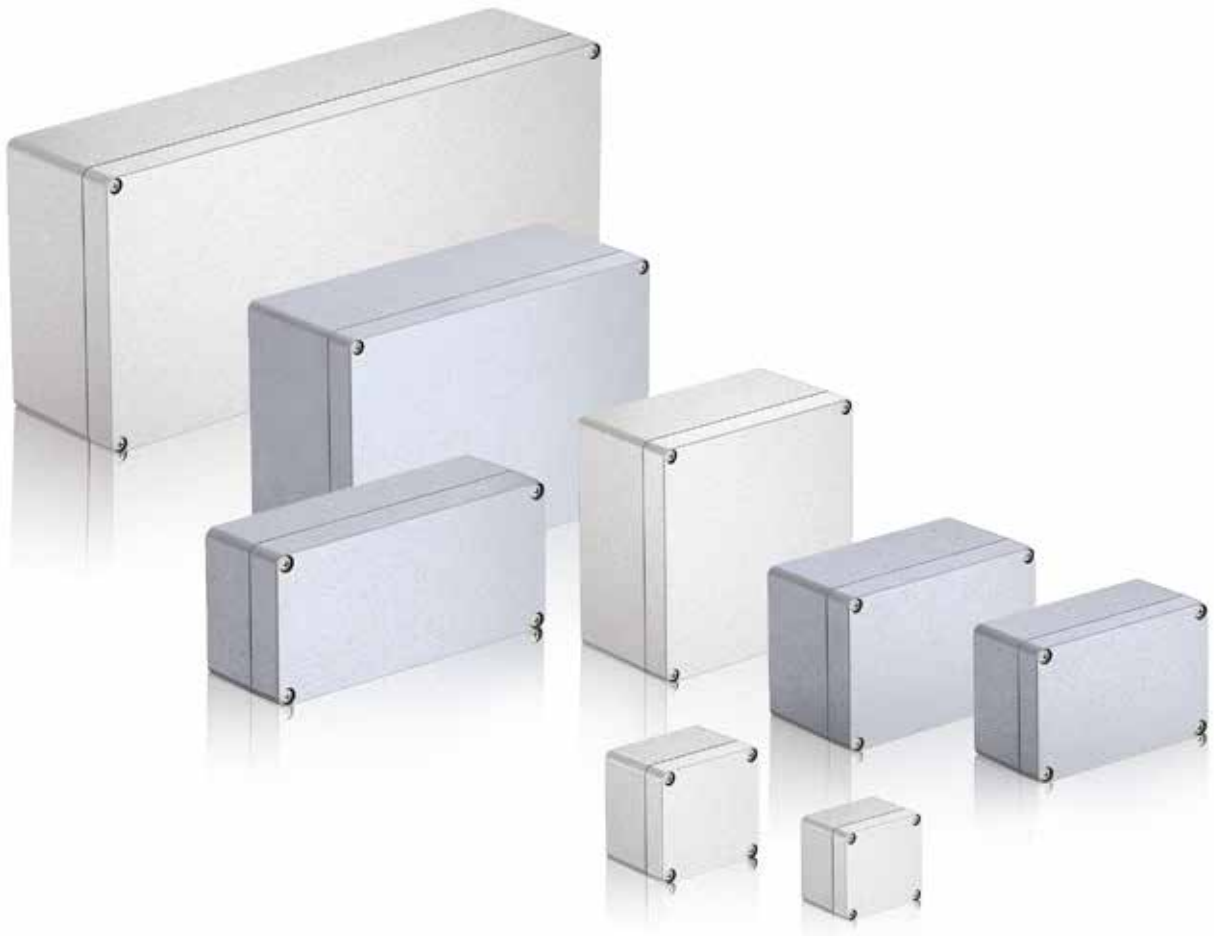
The well-thought-out and functional design gives the X series a particularly high wiring compartment and offers a wide range of mounting options for installations in any environment. The wide-ranging and practical equipment rounds off the range of services, making the X series ready for all kinds of applications.



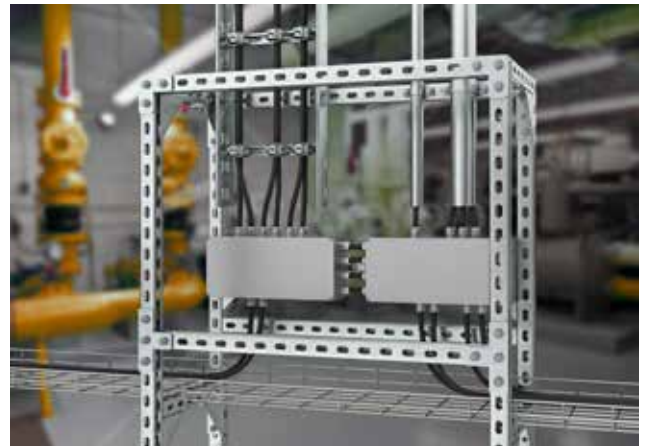
Areas of application:

- Industrial applications
- Unprotected exterior areas, e.g. on surveillance cameras
- Greenhouses and workshops

4.4. Mx series – the robust one

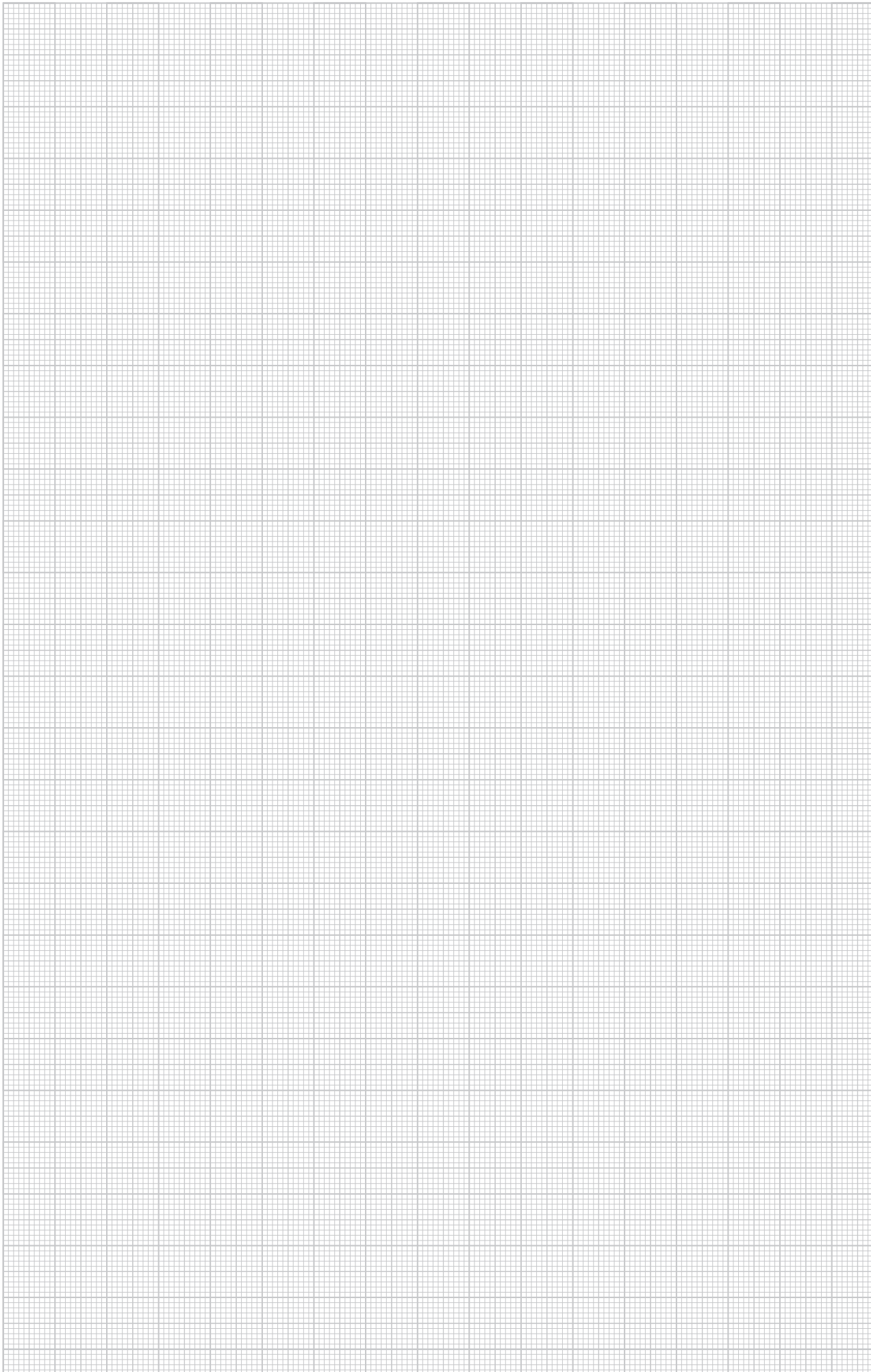


Our aluminium empty housings were designed for use under the toughest conditions and provide optimum protection of the installation. The metal housing of the Mx series withstands extremely high and low temperatures, as well as large temperature differences. High impact loads in an industrial surrounding, vandalism or rock falls are not able to harm the housing. Furthermore, the Mx series offers perfect EMC protection and is ideally secured against the entry of dust and water in line with protection rating IP 66.



Areas of application:

- Mechanical engineering and automation technology
- Industrial, port and ship construction
- Agriculture



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Building Connections

